DETERMINANTS OF EATING BEHAVIORS OF US ARMY ROTC CADETS IN MIDWESTERN UNIVERSITIES

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ABSTRACT

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Young adults 18-25 years of age, the largest demographic of the military, experience a high burden of obesity and eating disorders (ED) despite an emphasis on physical fitness, body composition, and operational readiness. Etiologic models for obesity and ED suggest body dissatisfaction (BD), dieting, negative affect (NA), and affect regulation represent potentially shared pathways. However, no studies have examined these factors and their shared pathways in military personnel, including ROTC cadets. The overarching aim of this dissertation research was to investigate if ED symptoms were associated with body mass index (BMI), an indicator of obesity, and to describe potential correlates of their development. Three specific aims of this research focus on: 1) the prevalence and correlates of ED risk classification and symptoms in ROTC cadets, 2) the association between ED symptoms and BMI, and their potentially shared mechanisms, psychological inflexibility related to BD and dieting, and 3) the gaps in knowledge about eating behaviors and mediators of eating behaviors within the ROTC context and from perspective of ROTC cadets.

In 2018, US Army ROTC cadets (n=205) were recruited from two Midwestern universities and completed questionnaires about demographics, military-specific eating behaviors and mediators of eating behaviors, ED symptoms, and anthropometric measures. Chi-square, multivariable logistic regression, and multiple linear regression were performed in determining the rate of ED risk classification and correlates of ED risk classification and symptoms (Aim 1). Two measures of psychological inflexibility related to BD and dieting, in

addition to the data for Aim 1, were used in mediation path analysis to examine the association of ED symptoms to BMI, and the indirect effects as mediated by psychological inflexibility related to BD and dieting (Aim 2). A purposively selected sample of eighteen cadets participated in one-on-one, semi-structured telephone interviews on eating behaviors and their mediators in the context of ROTC (Aim 3). Interviews were analyzed using thematic analysis to identify the most important themes and determinants related to eating behaviors in ROTC cadets.

We found that ED symptoms and ED risk classification are prevalent in a sample of US Army ROTC cadets (10.1% of sample). Correlates associated with greater likelihood of ED risk classification and elevated ED symptoms were: sex, dieting, and military contextual factors such as attempting dieting and weight loss to meet body composition standards, and peers' comments on weight. Total ED symptoms scores were positively associated with BMI and partially mediated by psychological inflexibility related to BD and dieting. Cadets discussed perceived determinants of eating behaviors which included traditional determinants (e.g. time, money, nutrition knowledge) and ROTC-context specific determinants (e.g. preparation for body composition assessments and body image perceptions), which contributed to unhealthy weight control behaviors (dieting) and negative body image perceptions (BD) for some cadets. In conclusion, the prevalent correlates for eating disorder symptoms and risk in the sample of US Army ROTC cadets in this study were factors related to the enforcement of body composition standards and body image perceptions in the military context which may contribute to the development of dieting, BD, and NA. Longitudinal and/or intervention studies on this important topic may benefit our understanding of how ED symptoms and obesity develop over time and how targeting dieting, BD, NA, and affect regulation may be leveraged to mitigate ED and obesity to promote physical fitness, operational readiness and health in military personnel.

I dedicate this work to the courageous individuals who follow a higher calling to serve. Without their loyalty, commitment, and sacrifice, I wouldn't have a place to serve their needs. You inspire me to serve, learn, and do the hard work.

I also dedicate this to my family, who first instilled in me a passion for hard work, learning, and nutrition. To my father, who tirelessly worked endless hours so that we would have the opportunity to pursue our dreams and a better life, and especially my mother, whose endless love, encouragement, and ultimate battle with cancer motivated me to seek a higher purpose to care for and to serve others. Siempre en mi corazon, mami.

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Dr. Song, thank you for taking me under your wing almost 10 years ago. Thank you for inspiring to consider research as a possible career, and for being willing to undertake a project of this scope in such a short time frame. Your support and belief in me has allowed me to grow not only as a researcher, but as an educator, leader, and human being. The love and passion you have for your students and for research knowns no bounds. I hope to carry on your legacy with me now and always.

Finally, thank you to my family, including my husband, who was volunteered to be a research assistant, and my son Osten, both who have shown me love and patience as we navigated this immense journey together. I hope I have instilled in you the courage and passion to pursue your dreams.

PREFACE

The views expressed in this dissertation are those of the author and do not reflect the views or official policy of the Department of the Army, the Department of Defense, or the US Government.

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CHAPTER 1 – Introduction

A. Background

Obesity and eating disorders are two public health concerns that are related to body weight and eating behaviors in US young adults (18-25 years) (Eisenberg, Nicklett, Roeder, & Kirz, 2011; Racette, Deusinger, Strube, Highstein, & Deusinger, 2008). The typical age of onset for eating disorders is 18-21 years, with these conditions highly prevalent in young adults, according to longitudinal and nationally-representative data (Hudson, Hiripi, Pope, & Kessler, 2007a; Stice, Marti, & Rohde, 2013b). For example, 13.5% of females and 3.6% of males met eating disorder risk criteria in a sample of US college students (Eisenberg et al., 2011). Similarly, the prevalence of overweight and obesity in US young adults is also high, ranging from 12.7-22.4% for overweight and 7.1-12.1% for obesity (American College Health Association, 2009; Flegal, Kruszon-Moran, Carroll, Fryar, & Ogden, 2016; Mokdad et al., 1999). Both eating disorders and obesity, however, have seldom been treated or investigated together (Neumark-Sztainer, 2009; Neumark-Sztainer, Wall, Story, & Perry, 2003; Sánchez-Carracedo, Neumark-Sztainer, & López-Guimera, 2012).

Neumark-Sztainer et al. (2002) have suggested that eating disorders and obesity are likely associated, and may represent two ends of the spectrum of *weight-related disorders*, rather than two separate conditions (Haines & Neumark-Sztainer, 2006; Neumark-Sztainer, Story, Hannan, Perry, & Irving, 2002). Evidence supporting the notion of weight-related disorders includes the fact that eating disorders and obesity tend to co-occur (Flament et al., 2015; Neumark-Sztainer et al., 2002), crossover (Fairburn et al., 1998; Lebow, Sim, & Kransdorf, 2015; Neumark-Sztainer et al., 2006c), share risk factors (Haines, Kleinman, Rifas-Shiman, Field, & Austin, 2010; Loth,

Wall, Larson, & Neumark-Sztainer, 2015; Neumark-Sztainer et al., 2007; Stice, Presnell, Shaw, & Rohde, 2005b) and tend to be difficult to treat (Agras, 2001; Balantekin et al., 2017; Pi-Sunyer, 2002). Cross-sectional and longitudinal studies in adolescents indicate that overweight and obese youth are more likely to engage in binge eating and unhealthy weight control behaviors such as vomiting, or taking diet pills, diuretics, or laxatives, compared to non-overweight adolescents (Neumark-Sztainer et al., 2002), and also have higher rates of meeting eating disorder criteria (Flament et al., 2015). Studies have shown that 30-40% of young adults with eating disorders were overweight as children (Fairburn et al., 1998; Lebow et al., 2015), and that dieting and unhealthy weight control behaviors resulted in greater weight gain over time (Neumark-Sztainer et al., 2006c). Longitudinal studies have identified dieting, unhealthy weight control behaviors, and body dissatisfaction as risk factors for both obesity and eating disorders (Loth, MacLehose, Bucchianeri, Crow, & Neumark-Sztainer, 2014; Quick, Wall, Larson, Haines, & Neumark-Sztainer, 2013; Stice, Marti, Spoor, Presnell, & Shaw, 2008; Stice et al., 2005b). Finally, the presence of eating disorders can make obesity more difficult to treat (Balantekin et al., 2017). Given that obesity and eating disorders share many features, including similar pathways to onset, there is a need to concurrently examine these conditions to identify shared risk factors and mechanisms, in order to develop interventions that simultaneously address both conditions.

The high prevalence of eating disorders and obesity in young adults is important to the military because service members 18-25 of years of age comprise the largest demographic (43.8%) of the military services (Department of Defense, 2015). Military service members in this age range also experience high rates of overweight and obesity (40.7% and 7.9%, respectively) (Reyes-Guzman, Bray, Forman-Hoffman, & Williams, 2015), and eating disorder risk (19% for

females and 2% for males) (Beekley et al., 2009; Lauder & Campbell, 2001; Lauder, Williams, Campbell, Davis, & Sherman, 1999). Furthermore, service members are also exposed to military cultural and contextual factors which may potentially exacerbate the shared risk factors of dieting, unhealthy weight control behaviors, and body dissatisfaction. For example, military service members are mandated to adhere to physical fitness, military appearance, and body composition standards as part of their employment with the Department of Defense (Department of the Army, 2013; US Department of Defense, 2002). These standards were put in place to advance the military goals of promoting physical fitness, military appearance, health, and operational readiness (Department of the Army, 2013; Friedl, 2012). However, there is concern that a stringent adherence to military physical fitness and body composition standards through the enforcement of semi-annual weight and body fat screenings may be driving service members to experience body dissatisfaction, that results in a greater prevalence of dieting and unhealthy weight control behaviors, such as fasting, use of diet pills/laxatives/diuretics, excessive exercise, and even bingeing and self-vomiting, which may have adverse effects on operational readiness, health, physical fitness, and body composition (Bodell, Forney, Keel, Gutierrez, & Joiner, 2014; Tanofsky-Kraff et al., 2013).

Currently, service members are evaluated for military appearance and body composition at least semi-annually (Department of the Army, 2013; US Department of Defense, 2002). Failure to meet published appearance and body composition standards may result in administrative and punitive consequences, including disciplinary counseling, administrative bars to reenlistment and other favorable actions, enrollment in service-specific weight management programs, remedial physical training programs, and discharge from the service for failure to meet standards (Department of the Army, 2013; US Department of Defense, 2002). There is also

limited data on the efficacy and effectiveness of the remedial weight management programs on assisting servicemembers in the achievement of body composition standards (Murray, Aboul-Enein, Bernstein, & Kruk, 2017; Sanderson, Clemes, & Biddle, 2011). Some authors even suggest that participation in these programs potentially increase the presence of body dissatisfaction, dieting, unhealthy weight control behaviors, and increased eating disorder risk in service members (Lauder & Campbell, 2001; McNulty, 2001; Peterson, Talcott, Kelleher, & Smith, 1995; Piche, Stankorb, & Salgueiro, 2014). Many of these studies were conducted over 10 years ago, and no studies explored whether and how eating disorders contribute to risk for obesity in military populations. Therefore, there is a need to examine the prevalence of eating disorder risk, including potential risk factors such as dieting, unhealthy weight control behaviors, body dissatisfaction, and other correlates, and how these might contribute to elevated eating disorder risk in military populations.

Military appearance standards were enacted to promote nutrition and fitness habits that lead to operational readiness, physical performance, and health (Department of the Army, 2013; Friedl, 2012; US Department of Defense, 2002). However, even with occupational requirements for military appearance, military rates of overweight and obesity parallel those observed in civilian populations (Reyes-Guzman et al., 2015; Smith et al., 2012). Despite the expected role of military appearance standards to positively influence eating behaviors in military service members, the opposite effect has been observed. This is not surprising given that etiologic models developed from prospective studies in civilian young adults suggest that dieting and body dissatisfaction play a crucial role in the onset of both eating disorders and obesity (Haines et al., 2010; Loth et al., 2014; Neumark-Sztainer et al., 2007; Stice, 2001; Stice et al., 2005b). Yet, other studies suggest that the presence of dieting and body dissatisfaction alone is not sufficient

to result in the development of eating disorders and obesity (Duarte, Ferreira, Pinto-Gouveia, Trindade, & Martinho, 2017; Duarte, Ferreira, Trindade, & Pinto-Gouveia, 2016; Masuda, Hill, Tully, & Garcia, 2015; Sandoz, Wilson, Merwin, & Kellum, 2013). Instead, studies suggest that one aspect of emotion regulation termed psychological inflexibility, or how one responds to difficult thoughts and emotions (such as body dissatisfaction), may help explain how eating disorders are associated with obesity (Duarte et al., 2017; Duarte et al., 2016; Masuda et al., 2015; Sandoz et al., 2013). These studies propose that psychological inflexibility related to body dissatisfaction and dieting represent potential mechanisms linking eating disorders and obesity by how individuals respond to difficult thoughts about dieting and body dissatisfaction (Duarte et al., 2017; Duarte et al., 2016; Masuda et al., 2015; Sandoz et al., 2013). However, there are no current military studies that have studied the association between eating disorders and obesity, and how these two conditions might be linked, in military populations of young adults, including US Army ROTC cadets.

B. Statement of the Problem

There is evidence that eating disorders and obesity are prevalent in young adult populations. Evidence also suggests that these two conditions are linked through dieting, unhealthy weight control behaviors, and body dissatisfaction, at least in civilian populations (Haines & Neumark-Sztainer, 2006). Although the largest demographic of military service members is comprised of young adults 18-25 years of age, including ROTC cadets, limited numbers of studies have examined the prevalence of eating disorders and obesity in this subgroup. One study that examined the prevalence of eating disorder risk in female ROTC cadets did not include potential correlates (Lauder & Campbell, 2001). Another study that investigated the risk of obesity in ROTC cadets included only a small number of males (n=13) (Crombie, Liu,

Ormsbee, & Ilich, 2012). To date, no studies have reported on both eating disorders and obesity in military populations, nor their psychological or behavioral correlates. Preliminary evidence seems to suggest that enforcement of body composition standards in the military may be associated with unhealthy weight control behaviors, a risk factor for eating disorders (Carlton, Manos, & Van Slyke, 2005; Lauder et al., 1999; McNulty, 1997a, 1997b, 2001; Rose, Moore, Mahnke, Christensen, & Askew, 1993; Sweeney & Bonnabeau, 1990).

Etiologic models of eating disorder development suggest a role of body dissatisfaction, dieting, and negative affect in the onset of eating disorder symptoms (Stice, 1994, 2001; Stice, Shaw, & Nemeroff, 1998). Body dissatisfaction, dieting, and negative affect are also implicated in weight gain and the onset of obesity (Goldschmidt, Lavender, Hipwell, Stepp, & Keenan, 2017; Goldschmidt, Wall, Choo, Becker, & Neumark-Sztainer, 2016; Goldschmidt, Wall, Loth, Le Grange, & Neumark-Sztainer, 2012; Neumark-Sztainer et al., 2006c; Neumark-Sztainer, Wall, Story, & Standish, 2012; Stice et al., 2005b). Affect regulation appears to be one mechanism linking body dissatisfaction, dieting, and negative affect, to eating disorder symptoms, such as binge eating and purging behaviors, as well as weight gain and obesity onset (Dakanalis et al., 2014; Gianini, White, & Masheb, 2013; Goldschmidt et al., 2017; Harrison et al., 2016; Lavender & Anderson, 2010; Lillis, Hayes, & Levin, 2011; Sim & Zeman, 2005; Sulkowski, Dempsey, & Dempsey, 2011; Whiteside et al., 2007).

Two specific facets of affect regulation, psychological inflexibility related to body dissatisfaction and dieting, represent potential mechanisms linking eating disorders and obesity. Most studies have focused on understanding the risk factors for eating disorders or obesity, without consideration to their potential shared association. Examining their potential shared association through psychological inflexibility related to body dissatisfaction and dieting may

help elucidate how and why eating disorders and obesity are related. Furthermore, qualitatively describing dieting and body dissatisfaction in military populations may help to expose how and why they occur in military-related populations. This quantitative and qualitative investigation will allow further examination into how eating disorders and obesity conditions are associated in order to develop shared mitigation strategies, such as prevention and treatment efforts, that address both conditions without further exacerbating either condition.

C. Aims and Research Questions

1. Aim 1: Prevalence and correlates of eating disorder symptoms in US Army ROTC cadets in two Midwestern universities.

To examine the prevalence and correlates of eating disorder risk classification and eating disorder symptoms in a sample of male and female ROTC cadets. This aim is guided by the following research questions:

1. What is the rate of meeting eating disorder risk classification cut-off scores in a sample and population of US Army ROTC cadets at two Midwestern universities?
2. Which biological, sociocultural, psychological/etiological, and behavioral characteristics are associated with the likelihood of meeting eating disorder risk classification cut-off scores?
3. Which biological, sociocultural, psychological/etiological, and behavioral characteristics are associated with elevated eating disorder symptoms?

2. Aim 2: Association between eating disorder symptoms and weight status in US Army ROTC cadets in two Midwestern universities.

To examine the association between eating disorder symptoms and an indicator of obesity, body mass index. In addition, to examine if two shared pathways, psychological inflexibility related to

body dissatisfaction and dieting, mediate the association between eating disorder symptoms and body mass index. This aim was guided by the following research questions:

1. Are eating disorder symptoms associated with body mass index?
    - Ha: Eating disorder symptoms are positively associated with body mass index.
2. Are eating disorder symptoms associated with psychological flexibility related to body dissatisfaction?
    - Ha: Eating disorder symptoms are positively associated with psychological flexibility related to body dissatisfaction.
3. Are eating disorder symptoms associated with psychological inflexibility related to dieting?
    - Ha: Eating disorder symptoms are positively associated with psychological inflexibility related to body dissatisfaction.
4. Is psychological flexibility related to body dissatisfaction associated with body mass index?
    - Ha: Psychological flexibility related to body dissatisfaction is positively associated with body mass index.
5. Is psychological inflexibility related to dieting associated with body mass index?
    - Ha: Psychological inflexibility related to dieting is positively associated with body mass index.
6. Does psychological flexibility related to body dissatisfaction mediate the association between eating disorder symptoms and body mass index?
    - Ha: Psychological flexibility related to body dissatisfaction partially mediates the association between eating disorder symptoms and body mass index.

7. Does psychological inflexibility related to dieting mediate the association between eating disorder symptoms and body mass index?
    - Ha: Psychological inflexibility related to dieting partially mediates the association between eating disorder symptoms and body mass index.

3. Aim 3: Dieting and body image concerns in US Army ROTC cadets in a Midwestern university: a qualitative investigation.

The purpose of this qualitative study was to address the gaps in knowledge about eating behaviors and body image within the ROTC context by describing the eating behaviors and mediators of eating behaviors from the perspective of ROTC cadets. This aim was guided by the following research questions:

1. How do ROTC cadets describe their eating behaviors?
2. What is the perspective of ROTC cadets on how and why they choose their eating behaviors?
3. How do ROTC cadets describe the role of the ROTC context in shaping and influencing their eating behaviors?
4. How do ROTC cadets describe their preparation to meet physical fitness and body composition standards relative to their eating behaviors?
5. What are the perceptions and experiences of ROTC cadets related to body image within the context of ROTC?

D. Assumptions

The following assumptions were made for all aspects of this dissertation:

1. All participants enrolled and recruited were US Army ROTC cadets enrolled at the programs at Michigan State University and Western Michigan University, 18-35 years of age.
2. Participants were able to read and understand all questionnaire items.
3. Participants provided honest and accurate responses to all questionnaire items.
4. The questionnaires selected accurately measured the identified constructs.

E. Limitations

The following limitations are applied to this study:

1. Convenience sampling was due to personnel availability and recruitment challenges. Therefore, findings may not generalize beyond this population.
2. The cross-sectional study design allows only examination of correlations and precludes making causal conclusions.
3. Self-selection bias may have been present if individuals with interest in eating behaviors chose to participate or not participate in this study.
4. Eating disorder symptoms were assessed using a self-report measure and were not confirmed using a clinical structured interview, allowing only reporting of eating disorder risk classification rates, and not true prevalence of eating disorder risk.
5. This study was conducted over a three-month time period, between February-April 2018. Data collection timing, especially around military and school-related events, could have affected participants' responses in terms of eating behaviors.

F. Delimitations

The following delimitations are applied to this study:

1. The subjects were limited to the US Army ROTC programs at Michigan State University and Western Michigan University.
2. Data regarding the total population for the US Army ROTC programs at Michigan State University and Western Michigan University were provided by the US Army Cadet Command.

G. Significance

The current research is innovative in that it is the first to examine biological, sociocultural, psychological, and behavioral correlates of eating disorder risk classification and eating disorder symptoms in a sample of male and female US Army ROTC cadets. In addition to examining the prevalence of eating disorder symptoms and obesity, this study also examined the potential shared association between eating disorder symptoms and obesity, and potential pathways linking these conditions in military-related populations of young adults, US Army ROTC cadets. This study also provides information on the role of two potential pathways, psychological inflexibility related to body dissatisfaction and dieting, in the shared association between eating disorders and obesity. Finally, this study explores the role of the ROTC context in influencing eating and mediators of eating behaviors, such as dieting and body dissatisfaction, with contextual clues as to what these behaviors are and how they might occur in ROTC populations. The study of eating behaviors, eating disorder symptoms, and obesity in military-related populations is important because of the military requirement for constant operational readiness, which includes adherence to body composition and physical fitness standards. Furthermore, ROTC cadets will be future officers and role models, and therefore represent an important population to shape the eating behaviors of other service members. Collectively, this information could be used to develop targeted strategies to prevent and mitigate problems and

consequences associated with eating disorders and obesity. Given that eating disorders and obesity have potential common pathways, the information provided by this study could provide ways to address both these conditions without exacerbating the other. The information provided by these studies will also assist in bringing attention and resources to the shared problem of eating disorders and obesity in military populations and aid in the development of novel solutions to these complex and burdensome problems. Since eating disorders and obesity may occur in response to programs put in place to address them (e.g. body composition and weight management programs), this study also provides policymakers with information on the challenges with current approaches and potential novel ways to address these challenges.

H. Theoretical Framework for the Study

The theoretical framework for the study was based on the Dual Pathway Model, the Socioecological Model, and Cognitive Behavior Theories of eating disorders and obesity. This integrated framework is presented in Figure 1. Aim 1 described the presence of eating disorder symptoms, as well as the rate of meeting eating disorder risk classification cut-off scores, and probable eating disorder diagnoses in a sample of ROTC cadets. In addition, Aim 1 examined if important biological correlates (such as: sex, weight status, age, race/ethnicity), sociocultural, psychological, and behavioral correlates (such as dieting, body dissatisfaction, negative affect, unhealthy weight control behaviors, military contextual factors) were associated with meeting eating disorder risk classification cut-off scores and the presence of higher levels of eating disorder symptoms.

Aim 2 then examined if eating disorder symptoms were associated with an indicator of weight status, body mass index (BMI). How eating disorder symptoms and BMI were associated

was explored through two mediating mechanisms, psychological inflexibility related to body dissatisfaction, and psychological inflexibility related to dieting.

Aim 3 then explored specific eating behaviors from the perspective of ROTC cadets. Specifically, this study described the usual eating behaviors of ROTC cadets. Next, the study explored the determinants of eating behaviors, such as traditional determinants of eating behaviors (e.g. time, money, food access/availability). In addition, this Aim considered other environmental and contextual factors unique to ROTC cadets (e.g. preparation for physical fitness and body composition assessment).

Together, this theoretical framework helped us determine the rate of eating disorder risk classification in a sample of male and female ROTC cadets. Next, the framework helped exploration of potential correlates associated with increased likelihood of eating disorder risk classification and eating disorder symptoms. Then the framework allowed determination of the shared association between eating disorder symptoms and weight status, and if this association was mediated by two facets of affect regulation, psychological inflexibility related to body dissatisfaction and dieting. Finally, this framework allowed exploration of how some of the correlates of eating behaviors develop in ROTC population, in particular dieting and body dissatisfaction.

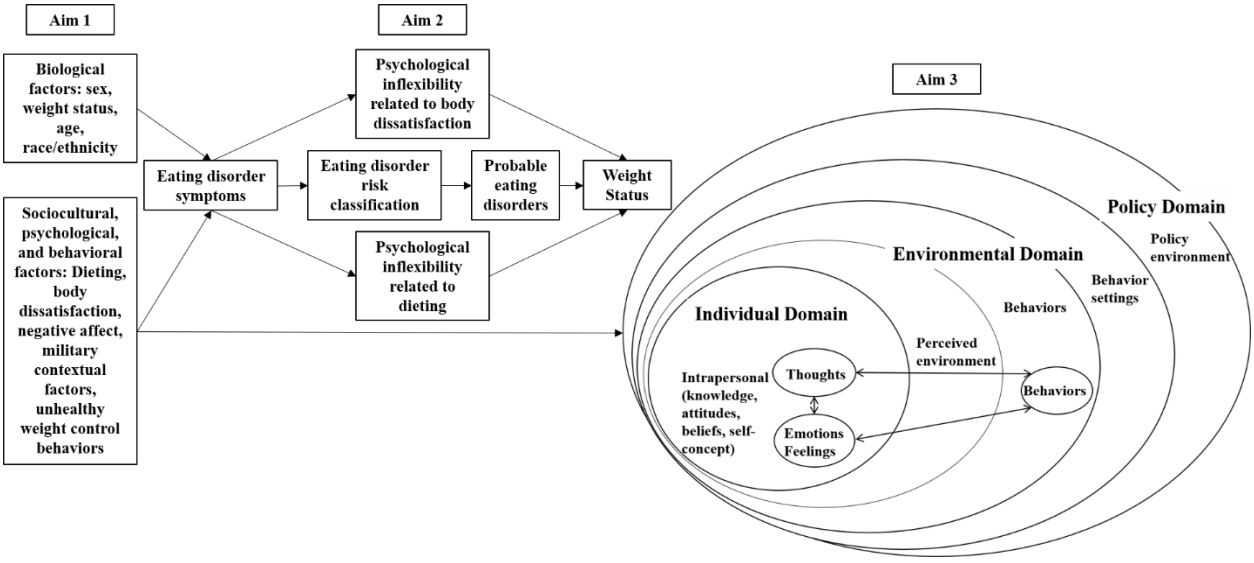

Figure 1.1. Theoretical framework for the study.

I. Working Definition of Terms

Adaptive affect regulation strategies-includes adaptive coping (task-oriented coping) and emotion regulation (reappraisal, problem solving, acceptance) strategies (Endler & Parker, 1994; Endler & Parker, 1990; Gross, 1998).

Adaptive coping regulation strategies-coping strategies aimed at solving a problem or cognitively restructuring the problem; also negatively associated with depression and anxiety; includes task-oriented coping (Endler & Parker, 1994; Endler & Parker, 1990).

Adaptive emotion regulation strategy-emotion regulation strategies associated with positive outcomes, including reappraisal (generating benign or positive interpretations on a stressful situation to reduce distress), problem solving (conscious attempts to change a stressful situation or contain its consequences) (Gross, 1998); and acceptance (present centered awareness in which thoughts, feelings, and sensations are accepted as they are) (Hayes, Strosahl, & Wilson, 1999).

Affect regulation-action aimed directly at altering core affect (Russell, 2003); there are different types of affect regulation, including emotion regulation and coping (Gross & Thompson, 2007).

Appearance fixing-efforts to alter or correct perceived body image-related deficits (Cash, 2011, 2012).

Binge eating-eating an amount of food larger than most people would eat during a discrete period of time and loss of control overeating during that episode (American Psychiatric Association, 1994).

Body dissatisfaction-the general feeling of satisfaction or dissatisfaction based on the evaluation or judgement of one's appearance; arises from comparisons of one's appearance to one's internalized body image ideal and the degree to which these are congruent or not congruent (Cash, 2011, 2012).

Body image-a complex, multidimensional phenomenon consisting of one's attitudes, perceptions, and experiences pertaining to one's on physical appearance (Cash, Santos, & Williams, 2005).

Body image ideal internalization-awareness and adoption of an ideal body image; can include thin ideal internalization and muscular ideal internalization, as well as desire to lose weight, desire to lose weight and gain muscle, and desire to gain weight and gain muscle (Cash, 2011, 2012; McCabe & Ricciardelli, 2001).

Body image investment-the psychological importance or valuation one places on their body image (Cash, 2011, 2012).

Body image-related coping behaviors-behavioral strategies used to lessen the psychological, emotional, and physical consequence of body dissatisfaction and problematic body image emotions; includes experiential avoidance, appearance fixing, and positive rational acceptance (Cash, 2011, 2012).

Causal risk factor-a variable that alters the risk of the outcome when experimentally manipulated (pg. 1125)(Culbert, Racine, & Klump, 2015).

Coping-an individual's efforts to manage its relations with an environment that taxes its ability to respond (Lazarus & Folkman, 1984); typically measured using the Coping Inventory for Stressful Situations, which identifies three coping dimensions: task-oriented coping aimed at solving or cognitively restructuring the problem; emotion-oriented coping consisting of emotional reactions to stress; and avoidance-oriented coping, which includes activities and cognitive changes to avoid dealing with the problem (Endler & Parker, 1994; Endler & Parker, 1990).

Coping strategies-behavioral strategies used to lessen the psychological, emotional, and physical consequences of stressful situations; problem-focused coping (aims to solve the problem); emotion-focused coping (aims to decrease negative emotion experience) (Endler & Parker, 1990; Lazarus & Folkman, 1984; Snyder, 1999; Stanton & Franz, 2015; Tobin, Holroyd, Reynolds, & Wigal, 1989).

Core affect-a simple, nonreflective feeling that is a blend of hedonic (pleasure-displeasure) and arousal (sleepy-activated) values (Russell, 2003).

Correlate-a variable associated with an outcome in cross-sectional and case control studies (pg. 1125)(Culbert et al., 2015);

Depressive symptoms-sadness, anxiety, anger, guilt, shame (Van Dam & Earleywine, 2011).

Dietary restraint-the cognitive effort made by individuals to eat less than desired (Polivy & Herman, 1985; Schaumberg, Anderson, Anderson, Reilly, & Gorrell, 2016).

Dieting- "adherence to a specified eating plan for the purposes of weight loss" (pg. 90)(Schaumberg et al., 2016).

Eating behaviors-all aspects of "food choices and motives, feeding practices, dieting, body dissatisfaction, and eating-related problems such as obesity and eating disorders" (pg. 1) (LaCaille, 2013).

Eating disorders-psychological disorders characterized by abnormal concerns regarding food and body weight, resulting in abnormal physical (weight status, weight fluctuation), behavioral (extreme dieting, binge eating, vomiting, laxative/diuretic use and abuse), and psychological symptoms (overvaluation of weight and shape) (American Psychiatric Association, 1994).

Eating disorder prevalence rate-the point prevalence of individuals meeting eating disorder risk cut-off scores for the sample and population.

Eating disorder risk-identification of individuals that may potentially develop eating disorders using eating disorder assessment score cut-offs.

Eating disorder symptoms-the primary physical (weight status, weight fluctuation, underweight), behavioral (extreme dieting, binge eating, vomiting, laxative/diuretic use and abuse), and psychological symptoms (overvaluation of weight and shape, distress about eating, weight, and shape) that characterize eating disorders (American Psychiatric Association, 1994).

Emotion regulation-attempts individuals make to influence which emotions they have, when they have them, and how these emotions are expressed and experienced (Gross & Thompson, 2007; Sloan & Kring, 2007).

Emotion regulation strategies-strategies used to modify the magnitude and/or type of emotional experience or emotion-eliciting event (Aldao, Nolen-Hoeksema, & Schweizer, 2010; Gross, 1998).

Experiential avoidance-the inability to remain in contact with private experiences, bodily sensations, emotions, thoughts, and memories, with a need to take steps to alter the form or frequency of these events and the context that occasion them; attempts to avoid threatening situations, thoughts, or beliefs; experiential avoidance is also a maladaptive affect regulation strategy (pg. 4) (Hayes, Luoma, Bond, Masuda, & Lillis, 2006; Hayes, Wilson, Gifford, Follette, & Strosahl, 1996).

Flexible restraint-a more flexible and consistent approach to eating, dieting, and weight, such that high calorie foods are still consumed, except these are consumed in limited quantities and without feelings of guilt (Westenhoefer, Broeckmann, Münch, & Pudel, 1994; Westenhoefer et al., 2013; Westenhoefer, Stunkard, & Pudel, 1999).

Healthy dieting-the use of exercise, decreased fat intake, reduced snack intake, and reduced calorie intake (French, Perry, Leon, & Fulkerson, 1995).

Maladaptive affect regulation strategies-includes maladaptive coping (emotion-oriented coping, avoidance coping) and emotion regulation strategies (suppression, avoidance, rumination).

Maladaptive body image-related coping behaviors-coping behaviors that when adopted result in the reinforcement of body dissatisfaction and problematic body image emotions, such as experiential avoidance and appearance-fixing behaviors (Cash et al., 2005).

Maladaptive coping regulation strategy-coping strategies aimed at reducing stress or avoiding stressful situations; positively associated with depression and anxiety; includes emotion-oriented coping and avoidance-oriented coping (Endler & Parker, 1994; Endler & Parker, 1990).

Maladaptive emotion regulation strategy-suppression of unwanted thoughts or emotions; avoidance (experiential avoidance-the suppression or avoidance of an array of psychological experiences including thoughts, emotions, sensations, memories, urges and behavioral avoidance); and rumination (repetitive focus on experience of emotion, its causes, and consequences (Hayes et al., 1999; Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008).

Military contextual factors-factors related to military culture and context, such as the Army values, warrior ethos, and military policy and regulations.

Mediator- A variable that accounts for the relation between a predictor and an outcome (Kraemer, Stice, Kazdin, Offord, & Kupfer, 2001).

Moderator-an effect modifier that impacts the effect of a predictor on an outcome (Kraemer et al., 2001).

Negative affect-the experience of negative emotions; negative emotionality describes a tendency towards experiencing negative emotions; an individual's tendency to experience negative emotions, overall negative mood, and a greater sensitivity for negative situations (Watson & Clark, 1984).

Negative body image emotions-distress, shame, or anxiety related to body image (Cash, 2011, 2012).

Obesity-a complex health condition resulting from abnormal accumulation of adipose tissue and identified using body mass index, waist circumference, and percent body fat (Garrow & Garrow, 1988).

Overvaluation of weight and shape-undue influence of body weight or shape on self-evaluation; individuals demonstrating overvaluation of weight and shape define their self-worth based on judgements of their weight and body shape (American Psychiatric Association, 1994; Masheb & Grilo, 2003).

Psychological inflexibility-rigid dominance of psychological reactions to negative thoughts and feelings over engagement in values-based behavior (Hayes et al., 2006).

Psychological inflexibility related to body dissatisfaction-opposite of body image flexibility; body image flexibility is the active contacting of perceptions, thoughts, beliefs, and feelings about the body without attempts to change their intensity, frequency or form; psychological inflexibility related to body dissatisfaction would then be the inability to remain in contact with private experiences, bodily sensations, emotions, thoughts about body dissatisfaction, with a need to take steps to alter the form or frequency and the context that occasion them (Sandoz et al., 2013).

Psychological inflexibility related to dieting-or inflexible eating, "inflexible adherence to eating rules without regard to internal (hunger or satiety cues) or external (social contexts) contexts, including a sense of control when adhering to rules and a sense of distress when failing to adhere to rules" (pg. 147) (Duarte et al., 2017).

Purging/compensatory behaviors-behaviors used to prevent weight gain following binge eating episodes, including use of vomiting, laxatives, diuretics, fasting, or excessive exercise (American Psychiatric Association, 1994).

Rigid restraint- a dichotomous, all or nothing approach to eating, dieting and weight (Westenhoefer et al., 1994; Westenhoefer et al., 2013; Westenhoefer et al., 1999).

Risk factor-a variable that has been shown to prospectively predict a subsequent pathological outcome (pg. 825)(Stice, 2002).

Self-reported dieting-dieting status assessed with a single questions, such as, "are you currently dieting to lose weight?" (Lowe & Timko, 2004b; Neumark-Sztainer, Jeffery, & French, 1997; Rideout & Barr, 2009).

Sociocultural context-the context that includes Western society and important transmitters of Western cultural ideals, such as the media, peers, and family members.

Sociocultural pressures about body image-perceived pressures about what constitutes an ideal body image as conveyed by sociocultural actors, including peers, family members, and the media (Thompson, Coovert, & Stormer, 1999a).

Unhealthy dieting-the use of fasting or skipping meals, diet pills, and vomiting to induce weight loss (French et al., 1995).

Unhealthy weight control behaviors-fasting, use of diet pills/laxatives/diuretics, excessive exercise, binge eating, and self-vomiting; will be used interchangeable with unhealthy dieting; these are also considered eating disorder symptoms when assessed using an eating disorder

assessment instrument based on DSM-IV eating disorder diagnosis and symptom criteria (Fairburn, Cooper, & Shafran, 2003).

Weight and shape concerns-concerns about one's own weight and shape, including fear of gaining weight, and methods used to lose weight; is considered a facet of body dissatisfaction but not all individuals with body dissatisfaction have weight and shape concerns (Wade, 2017).

Weight status-an individual's body mass index.

CHAPTER 2 - Review of Literature

The published evidence and rationale for this study are summarized in the following order: scope of the problem, eating disorders, current approaches to eating disorders, reviews of alternative approaches to eating disorders, and ROTC and relevant approaches.

A. Scope of the Problem

1. Eating Disorders and Obesity in Young Adults

Two conditions of public health concern related to body weight and eating prevalent amongst US young adults, 18-25 years of age, are obesity and eating disorders (Eisenberg et al., 2011; Racette et al., 2008). Between 1988-2000, rates of obesity nearly doubled in young adults 18-29 years of age, from 7.1-12.1% (Flegal, Carroll, Ogden, & Curtin, 2010; Mokdad et al., 1999). These rates have continued to increase among adults 20-39 years of age, with 34% of adults 20-39 years of age classified as obese in a more recent National Center for Health Statistics (NCHS) survey (Flegal et al., 2016; Hales, Fryar, Carroll, Freedman, & Ogden, 2018). Young adults also experience the largest burden of eating disorders, with 95% of eating disorders diagnosed among adolescents and young adults 12-25 years of age, and an average age of onset between 18-25 years of age for most eating disorders (Hudson et al., 2007a). Therefore, young adults experience a significant burden of the ongoing problems with obesity and eating disorders.

2. Young Adults and the Military

Young adults also comprise an important demographic in the military services. Currently, nearly half of all service members in all the military services are between the ages of 18-25 years (Department of Defense, 2015). Surveys examining the eligibility to serve amongst US young adults 17-24 years of age have determined that 25-50% of young adults in this age range are

ineligible to serve due to weight, health, and fitness related problems (Christeson, Taggart, & Messner-Zidell, 2009). This means that problems related to weight and health, including eating disorders and obesity, have the potential to impact military recruitment, operational readiness, and national security.

3. Eating Disorders and Obesity in the Military

Despite emphasis on physical fitness, body composition standards, and operational readiness, the military is not immune to concerns related to eating disorders and obesity. A recent study examining the prevalence and trends of overweight and obesity from Department of Defense population-based health behavior surveys conducted between 1995-2008 noted that the overall prevalence of obesity has more than doubled from 5% to 12%, with a similar trend across all the services, age groups, and demographics (Reyes-Guzman et al., 2015). These findings are comparable to trends observed in young adults where obesity rates nearly doubled over the last few decades from 7-12%, with 34% of adults 20-39 years of age currently classified as obese (Flegal et al., 2010; Flegal et al., 2016; Hales et al., 2018; Mokdad et al., 1999), which is surprising given the military emphasis on physical fitness and body composition standards.

Similar trends are observed in eating disorder diagnoses and self-report eating disorder risk classification rates. A systematic review by Bodell and colleagues reported on studies of eating disorder diagnoses and self-report eating disorder risk classification rates and summarized findings for studies conducted in active duty military populations, reserve officer training corps (ROTC) and US Military Academy cadets, college students, and college athletes (Bodell et al., 2014). The authors noted that rates of eating disorder diagnoses, identified through medical records review or use of clinical interviews, were similar across populations, ranging 0.1-5% in active duty and ROTC/military academy cadets, compared to 0-5% in college students and

college athletes (Antczak & Brininger, 2008; Beekley et al., 2009; Bodell et al., 2014; Forney & Ward, 2013; Hudson et al., 2007a; Johnson, Powers, & Dick, 1999; Lauder & Campbell, 2001). This finding may be explained due to potential underreporting in military populations, where diagnoses with an eating disorder may be grounds for medical discharge (Department of the Army, 2016). Trends in self-report eating disorder risk classification rates, which range from 2-7% in active duty and ROTC/military academy males and 20-33% in active duty and ROTC/military academy females compared to 8.5-9.5% and 16-25% in college males and females, respectively, provide support to these findings (Beekley et al., 2009; Bodell et al., 2014; Forney & Ward, 2013; Hudson et al., 2007a; Johnson et al., 1999; Lauder & Campbell, 2001; Lauder et al., 1999; Warner et al., 2007), since self-report surveys tend to be anonymous and not tied to a medical diagnosis with a potential detrimental outcome. The evidence suggests that just as eating disorders and obesity are prevalent in young adults, they are also prevalent in military populations.

Since eating disorders and obesity are two public health concerns with significant implications for the health and wellbeing of military-aged young adults, there is a need to examine how prevalent these conditions are in current military populations and reasons for why these conditions occur. In the past, both conditions have been examined separately. However, given that both conditions are related to eating and weight, there may be reasons to examine these two conditions together, especially in military-age populations. Given that most military service members are not obese, it may be important to examine eating disorders, eating disorder symptoms, and their potential risk factors and determinants first to establish if they are present in military populations and if they are possibly associated with obesity. Therefore, this review will begin with an examination of eating disorders.

B. Eating Disorders

1. Definition

Eating disorders are psychological disorders characterized by abnormal concerns regarding food, body weight, and consequent abnormal eating behaviors that significantly impair physical health or psychosocial functioning (American Psychiatric Association, 1994, 2013). Eating disorders were first reported in the 1800s, when two clinicians, Ernest Charles Lasegue and Sir William Withey Gull, coined the term "anorexia hysterica," to describe a condition affecting primarily girls and young women characterized by: weight loss, amenorrhea, constipation, and restlessness (pg. 152) (Vandereycken, 2002). Starting in the 1970s, specific diagnostic criteria was developed to describe and classify eating disorders (pg. 155) (Garfinkel, 2002). In the 1990s, with the publication of the American Psychiatric Association *Diagnostic and Statistical Manual of Mental Disorders* and the World Health Organization *ICD-10 Classification of Mental and Behavioral Disorders*, specific diagnostic criteria for eating disorders was published (pg. 156) (Garfinkel, 2002). The *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition, published in 1994 (DSM-IV), defines and classifies three distinct eating disorders, anorexia nervosa, bulimia nervosa, and binge eating disorder, based on the presence and severity of physical, behavioral, and psychological symptoms (American Psychiatric Association, 1994).

2. Classification of Eating Disorders

The primary psychological symptoms of eating disorders include overvaluation of food, body weight, and shape. Behavioral symptoms include binge eating behaviors and purging behaviors, which are further defined below. Physical symptoms include weight status and the presence of amenorrhea (American Psychiatric Association, 1994). Anorexia nervosa is

diagnosed based on the following symptoms: 1) underweight or refusal to maintain a normal weight (<85% of expected weight); 2) weight and shape concerns, including fear of gaining weight or becoming fat and methods used to lose weight (Taylor, 2016); 3) body image disturbance, including overvaluation of weight or shape (defined next); 4) amenorrhea or the absence of at least 3 consecutive menstrual cycles (American Psychiatric Association, 1994). Bulimia nervosa is diagnosed based on the following symptoms: 1) recurrent binge eating episodes, defined as both eating an amount of food larger than most people would eat during a discrete period of time and a loss of control over eating during that episode; 2) recurrent use of inappropriate compensatory or purging behaviors to prevent weight gain following binge eating episodes, including use of vomiting, laxatives, diuretics, fasting, or excessive exercise; 3) use of binge eating and inappropriate compensatory or purging behaviors for at least two times per week during a three month period; 4) overvaluation of body weight and shape, defined as undue influence of body weight or shape on self-evaluation; 5) these behaviors do not occur in conjunction with anorexia nervosa (American Psychiatric Association, 1994). Bulimia is further categorized by the presence of purging, defined by the use of vomiting, laxatives, or diuretics; or absence of purging, the use only of fasting or excessive exercise as a compensatory behavior (American Psychiatric Association, 1994). In the DSM-IV manual, binge eating disorder was not officially recognized as a mental disorder, but a classification category was created for research purposes (American Psychiatric Association, 1994). The classification criteria for binge eating disorder includes the following symptoms: 1) recurrent binge eating episodes, defined as both eating an amount of food larger than most people would eat during a discrete period of time and a loss of control over eating during that episode; 2) in addition, binge eating episodes include at least 3 of the following characteristics: eating more rapidly than normal, eating until

uncomfortably full, eating large amounts of food when not physically hungry, eating alone due to embarrassment, and feeling disgusted with oneself or guilty after overeating; 3) experience distress over binge eating; 4) binge eating occurs at least two days a week for six months; 5) the binge eating is not associated with regular use of inappropriate compensatory or purging behaviors (American Psychiatric Association, 1994). Most studies reporting on eating disorders use DSM-IV criteria for classification and identification for the presence of eating disorders. This research will classify eating disorders by DSM-IV criteria, instead of the newer *Diagnostic and Statistical Manual for Mental Disorders,* fifth edition, or DSM-5, first published in 2013 by the American Psychiatric Association (APA).

The DSM-5 identifies and classifies diagnostic criteria for five different feeding and eating disorders, including anorexia nervosa, bulimia nervosa, binge eating disorder, other specified feeding or eating disorders, and unspecified feeding or eating disorders (American Psychiatric Association, 2013). With the current publication of the DSM-5, there were some changes to the diagnostic criteria for anorexia nervosa, bulimia nervosa, and binge eating disorder (American Psychiatric Association, 2013). For example, for anorexia nervosa, the first criterion is changed to define the presence of dietary restriction resulting in significantly low body weight (American Psychiatric Association, 2013). The severity of anorexia nervosa is then further classified depending on measured BMI, with mild anorexia nervosa defined by the presence of a BMI of at least 17 kg/m^2 (American Psychiatric Association, 2013). Additionally, the DSM-5 criteria no longer require the presence of amenorrhea (American Psychiatric Association, 2013). Criteria for bulimia nervosa also remains unchanged except for the number of episodes of binge eating and inappropriate compensatory or purging behaviors (American Psychiatric Association, 2013). The number of episodes is used the classify the severity of

bulimia nervosa, with mild bulimia nervosa defined as the presence of 1-2 episodes of binge eating and compensatory or purging behaviors per week (American Psychiatric Association, 2013). Similarly, the criteria for binge eating disorder also remains mostly unchanged, except for classification of severity based on the number of binge eating episodes per week (American Psychiatric Association, 2013). The other categories presented within the DSM-5, including other feeding and eating disorders, are meant to capture cases which present with some of the diagnostic criteria, but fail to meet the definition for the full diagnostic criteria (American Psychiatric Association, 2013).

Eating disorders are disorders related to abnormal eating behaviors, such as dieting and binge eating, and abnormal concerns regarding the body and weight. Eating disorders are predominantly classified based on criteria published in the *Diagnostical Statistical Manual of Mental Disorders*. This classification includes psychological, behavioral, and physical symptoms specific to each eating disorder type. Even with specific criteria for each eating disorder type, there is significant overlap amongst the eating disorder symptoms of all eating disorders. Furthermore, most individuals with eating disorder symptoms do not meet eating disorder diagnostic criteria, although evidence indicates that individuals with subclinical or subthreshold eating disorder symptoms present with symptoms and comorbidity severity comparable to individuals with diagnosed eating disorders (American Psychiatric Association, 2013; Austin et al., 2008; Fairburn et al., 2007; Favaro, Ferrara, & Santonastaso, 2003). Therefore, the focus of this dissertation will be on understanding the development of eating disorder symptoms.

3. Assessment of Eating Disorders

Eating disorder symptoms are assessed using a wide variety of methods, but only a few are validated. The gold standard for eating disorder assessment is a clinical diagnosis using a

structured psychiatric interview, such as the Eating Disorder Examination (EDE) or the Structured Clinical Interview for DSM (SCID), administered by a trained clinician to arrive at a DSM eating disorder diagnoses (American Psychiatric Association, 1994; Fairburn, Cooper, & O'Connor, 1993; First, Gibbon, Spitzer, Benjamin, & Williams, 1997; Stice, Telch, & Rizvi, 2000). However, the expansion of research on the etiology, prevention, and treatment of eating disorders has necessitated the development and use of self-report measures in order to lessen participant burden, decrease the time and costs, and increase accessibility to larger numbers of participants.

While there are existing self-report questionnaires that report eating disorder diagnoses, such as the Bulimia Test-Revised and the Questionnaire for Eating Disorder Diagnoses, only the Eating Disorder Diagnostic Scale (EDDS) yields DSM-IV diagnoses for anorexia nervosa, bulimia nervosa, and binge eating disorder (Mintz, O'halloran, Mulholland, & Schneider, 1997; Stice et al., 2000; Thelen, Farmer, Wonderlich, & Smith, 1991). The EDDS was developed to assess all DSM-IV diagnostic symptoms for anorexia nervosa, bulimia, and binge eating disorder and has demonstrated strong psychometric properties in comparison to structured psychiatric interviews: anorexia nervosa, kappa=0.93, sensitivity (Sn)=0.93, specificity (Sp)=0.93, positive predictive value (PPV)=0.93, negative predictive value (NPV)=1.00, and accuracy=0.99; bulimia nervosa, kappa=0.81, Sn=0.81, Sp=0.98, PPV=0.86, NPV=0.97, accuracy=0.96; and binge eating disorder, kappa=0.74, Sn=0.77, Sp=0.96, PPV=0.80, NPV=0.95, accuracy=0.93 (Stice et al., 2000). Additionally, the EDDS yields a composite score of all relevant symptoms detected, regardless of the presence of a diagnosis or not (Stice et al., 2000). The EDDS symptom composite score also demonstrated good psychometric properties including high test-retest reliability (r=0.87) and internal consistency reliability (α=0.89) and was found to detect changes

in eating disorder symptoms induced by an eating disorder treatment program (Stice, Fisher, & Martinez, 2004b). Self-report questionnaires, such as the EDDS, are useful when there is a need for frequent measurements of eating disorder symptom development and progression, such as in prevention programs, treatments, or prospective studies.

Recently, diagnostic criteria for eating disorders was updated with the release of DSM-5 (American Psychiatric Association, 2013). With the release of DSM-5, there was also a need to develop new, validated instruments to detect eating disorder symptoms and diagnosis. The Eating Disorder Examination, one of the most widely used structured psychiatric interviews, was updated to generate DSM-5 eating disorder diagnoses (Fairburn, 2014). There have also been attempts to create new structured (Eating Disorder Assessment for DSM-5, Eating Disorder Diagnostic Interview) and self-report (EDDS DSM-5) assessment tools, although these have not been tested and validated to the extent of tools developed for DSM-IV (Stice et al., 2013b; Sysko et al., 2015).

Other eating disorder assessment measures frequently encountered in the literature are the Eating Attitudes Test-26 (EAT-26), the Eating Disorder Inventory (EDI), and the Eating Disorder Examination-Questionnaire (EDE-Q) (Fairburn & Beglin, 1994; Garner, Olmstead, & Polivy, 1983; Garner, Olmsted, Bohr, & Garfinkel, 1982). Unlike the measures previously discussed, these measures do not generate eating disorder diagnoses. For example, measures like the EAT-26 and the EDI propose to assess psychological and behavioral symptoms common in eating disorders in order to screen and identify individuals that may potentially develop eating disorders, or individuals with eating disorder risk, using risk classification cut-off scores (Garner et al., 1983; Garner et al., 1982). Furthermore, some of these instruments, such as the EDI and EDE-Q, even report scores on individual subscales, such as dietary restraint, weight and shape

concerns in the EDE-Q, and the bulimia, drive for thinness, and body dissatisfaction subscales of the EDI, in order to assess individual symptom levels, rather than just the presence or absence of symptoms (Fairburn & Beglin, 1994; Garner et al., 1983). Due to the wide variety and quality of eating disorder assessment measures available, it is important to consider the data source, the type of measure used, and whether the measure was self-report or interviewer administered when examining reported rates of eating disorders and eating disorder symptoms.

Eating disorders are assessed using a wide variety of instruments and methodologies. While eating disorders are typically clinically diagnosed using a diagnostic clinical structured interview, this method is usually costly and time consuming. Alternatively, self-report measures based on the criteria within clinical structured interviews have been developed to assess eating disorders, eating disorder symptoms, and eating disorder risk. It is important to consider the instrument, the instrument's development, and the instrument's psychometric properties, such as reliability and validity, when interpreting studies using these instruments. While self-report measures will be less accurate than clinical structured interviews, they may be more useful when frequent measures of eating disorders, eating disorder symptoms, and eating disorder risk are needed, such as in intervention and prospective studies. This dissertation will use a self-report eating disorder assessment measure. Furthermore, this dissertation will consider eating disorder risk as the identification of individuals that may potentially develop eating disorder using eating disorder assessment risk classification cut-off scores.

4. Epidemiological Evidence of Eating Disorders

In the US, there are few studies that have examined the epidemiology of eating disorders in nationally representative samples. Diagnosed eating disorders are not very common, and some individuals may deny the presence of eating disorders and/or eating disorder symptoms,

necessitating large sample sizes and costly study designs (Smink, Van Hoeken, & Hoek, 2012). Furthermore, eating disorder diagnosis is usually confirmed through the use of a structured interview. All these factors make the study of eating disorders resource and time intensive, resulting in few population-based studies of eating disorders in the US. Nonetheless, the National Institute of Mental Health has conducted a few studies examining eating disorders within their Collaborative Psychiatric Epidemiological Studies (CPES), including The National Survey of American Life (NSAL), The National Latino and Asian American Study (NLAAS), and the National Comorbidity Survey Replication (NCS-R) (Alegria et al., 2004; Hudson et al., 2007a; Jackson et al., 2004; Kessler & Merikangas, 2004; National Institutes of Health, 2003). Most recently, the National Institute on Alcohol Abuse and Alcoholism collected data on a nationally representative sample of US Adults through the 2012-2013 National Epidemiologic Survey on Alcohol and Related Conditions (NESARC-III) (Udo & Grilo, 2018).

Large epidemiological surveys of eating disorders have addressed concerns regarding low prevalence and low reporting of eating disorders through a few approaches, including record-based studies, two-stage studies, and studies of special populations (Hoek & Van Hoeken, 2003). For example, record-based studies examine inpatient and outpatient medical records to identify cases of eating disorders. However, most individuals with eating disorders do not receive treatment, resulting in underreporting of cases (Hoek, 1993). Two-stage studies attempt to overcome these limitations by using population-based sampling methods and two-stage screening approaches. The first stage, involves screening a large population using a validated screening questionnaire to identify individuals likely at risk for eating disorders using risk classification cut-off scores (Hoek & Van Hoeken, 2003; Williams, Tarnopolsky, & Hand, 1980). The second stage involves confirming if an individual screened at risk represents a

definitive case using a personal structured interview with both individuals who screen at risk and a random sample of individuals who do not screen at risk (Hoek & Van Hoeken, 2003; Williams et al., 1980). While not without limitations, two-stage approaches improve the detection and reporting of eating disorder incidence and prevalence rates.

The NSAL, NLAAS, NCS-R, and NESARC-III were all conducted using two-stage approaches (Alegria et al., 2004; Hudson et al., 2007a; Jackson et al., 2004; Kessler & Merikangas, 2004; National Institutes of Health, 2003). The NSAL, NLAAS, and NCS-R all evaluated the presence of lifetime and 12-month eating disorder diagnoses using the World Health Organization Composite International Diagnostic Interview, which generates DSM-IV diagnoses (Kessler & Üstün, 2004). However, categories were also created to examine binge eating disorder and any binge eating, which are not DSM-IV diagnoses (Hudson et al., 2007a). The NESARC-III, on the other hand, used the National Institute on Alcohol Abuse and Alcoholism Alcohol Use Disorder and Associated Disabilities Interview Schedule-5 (AUDADIS-5), to assess 12-month and lifetime prevalence of eating disorder diagnoses based on DSM-5 criteria (Grant et al., 2015; Udo & Grilo, 2018). Both interviews were administered by trained lay assessors.

Results from these studies suggest a lifetime weighted prevalence of anorexia nervosa ranging from 0.6-0.8%, bulimia nervosa of 0.3-1%, and binge eating disorder of 0.8-2.8% (Hudson et al., 2007a; Udo & Grilo, 2018). Studies also reported on the 12-month prevalence of eating disorder diagnoses, which ranged from 0-0.05% for anorexia nervosa, 0.14-0.3% for bulimia nervosa, 0.44-1.2% for binge eating disorder (Hudson et al., 2007a; Udo & Grilo, 2018). Prevalence rates were significantly higher for females than males for all eating disorder diagnoses, with female prevalence rates ranging from 1.5-5 times the prevalence rates for males

(Hudson et al., 2007a; Udo & Grilo, 2018). Hudson et al. (2007a) also reported on the rates of any binge eating, which ranged from 2.1-4.5% for the 12-month and lifetime prevalence. Marques et al. (2011), reporting on pooled data from the NSAL, NLAAS, NCS-R, reported that lifetime rates of bulimia nervosa were significantly higher in participants identifying as Latino/a and African American compared to non-Latino Whites. Lifetime rates of any binge eating were also significantly higher in participants identifying as Latino/a, Asian, and African American compared to non-Latino Whites (Marques et al., 2011). Findings from these studies suggest that eating disorders are prevalent in US populations, with binge eating disorder being the most prevalent eating disorder. Eating disorder rates are generally higher in females, although rates are not as disparate as previously reported (ratio of 10:1, female: male prevalence rates) (Hsu, 1996). Specific eating disorders, such as bulimia nervosa, are also higher in certain ethnic groups, suggesting the need for ongoing surveillance and treatment of eating disorders in the general population.

Studies have also examined eating disorder rates by age group, as well as age of onset and persistence of eating disorders. Udo and Grilo (2018) reported the prevalence of eating disorders by age category and reported the highest rates of anorexia among individuals 18-29 years of age, similar rates of bulimia nervosa in individuals 18-29 years of age and 30-44 years of age, and no significant differences in rates of binge eating disorder by age category. Mean age of onset for anorexia nervosa was reported as 18.9-19.3 years of age, 19.7-20.0 years of age for bulimia nervosa, and 20.0-25.4 years of age for binge eating disorder (Hudson et al., 2007a; Udo & Grilo, 2018). Years with episode was reported as 1.7-11 years for anorexia nervosa, 8.3-12.2 years for bulimia nervosa, and 8.1-15.9 years for binge eating disorder (Hudson et al., 2007a; Udo & Grilo, 2018). Finally, Hudson et al. (2007a) reported difference in BMI categories based

on lifetime prevalence of eating disorders. For anorexia nervosa, 15.6% of individuals had a BMI <18.5 kg/m^2 and this classification was associated with a 5.6 odds ratio (OR) of having a lifetime diagnosis of anorexia nervosa (Hudson et al., 2007a). For binge eating disorder, 42.4% of individuals had a BMI >30 kg/m^2, with a BMI >40 kg/m^2 associated with a 4.9 OR of having a lifetime diagnosis of binge eating disorder (Hudson et al., 2007a). These findings suggest that most eating disorders onset during young adulthood (18-25 years of age). Furthermore, while anorexia nervosa and bulimia nervosa are more common in young adulthood, binge eating disorder is common across all age categories. All eating disorders, but especially bulimia nervosa and binge eating disorder, appear to be persistent. Finally, binge eating disorder appears to be more common amongst individuals with obesity.

Taken together, data from epidemiological studies, although limited, provides some insights. Eating disorders are prevalent in US populations. While they are most common in young adulthood, if left untreated, they persist into older age categories. They are also more common in male populations than previously reported, although they tend to primarily affect females. Eating disorders are also common among ethnic minorities. Specific eating disorders, such as binge eating disorders, are more common in individuals with obesity. These findings suggest a need to continue to monitor eating disorder prevalence rates, especially including populations with males, young adults, ethnic minorities, and individuals with obesity. This dissertation did not make use of a randomized sample, nor a two-stage design. Instead, a self-report measure was used to report on the rate of meeting eating disorder risk classification cut-off scores, an indicator of point prevalence of eating disorders, and total number of eating disorder symptoms present. Therefore, the eating disorder prevalence rate in this dissertation

refers to the point prevalence of individuals meeting eating disorder risk classification cut-off scores for the sample and population.

5. Consequences of Eating Disorders

In addition to being prevalent in US populations, eating disorders are also associated with significant morbidity and mortality. Eating disorders are associated with medical and psychiatric comorbidity (Mehler & Brown, 2015; Mehler & Rylander, 2015; Swinbourne et al., 2012). For example, eating disorders frequently co-occur with obesity, anxiety disorders, mood disorders, impulse control disorders, and substance use disorders (Hudson et al., 2007a; Swinbourne et al., 2012). Medical complications in eating disorders arise from weight loss, malnutrition, and purging behaviors (Mehler & Brown, 2015; Mehler & Rylander, 2015; Westmoreland, Krantz, & Mehler, 2016). Malnutrition and weight loss in anorexia nervosa can result in systemic physiological and metabolic changes, such as arrhythmias, loss of vital organ tissue, osteoporosis, and hypoglycemia, that all increase the risk of death (Mehler & Brown, 2015). In bulimia nervosa, two of the most frequently used purging methods, vomiting and laxative use and abuse, result in abnormal metabolic changes, such as metabolic alkalosis, hypokalemia, and dehydration, due to electrolyte disturbances, that can also increase the risk of sudden death (Mehler & Rylander, 2015). As a result, studies report higher standardized mortality rates (SMRs) in individuals with eating disorders, ranging from 1.93 in bulimia nervosa to 5.39 per 1000 person years in anorexia nervosa, with 1/5 deaths in anorexia nervosa attributed to suicidality (Arcelus, Mitchell, Wales, & Nielsen, 2011). Lastly, individuals with eating disorders also have significantly higher healthcare utilization and costs compared with healthy populations (Agh et al., 2016; Samnaliev, Noh, Sonneville, & Austin, 2015). Despite these findings, individuals with eating disorders rarely receive specific treatment for eating disorders (Agh et al.,

2016), suggesting that not only are eating disorders serious conditions with medical and psychiatric comorbidities, high costs, and high rates of death, they are also likely under-identified and undertreated, making them a significant public health burden.

6. Obesity as a Consequence of Eating Disorders

Another way eating disorders contribute to the public health burden is through their consequences of weight gain and onset of obesity. Obesity is also a complex health issue of public health concern arising from a combination of factors. Obesity is defined as a health condition that results in excessive or abnormal accumulation of adipose tissue to such levels that impair health (Garrow & Garrow, 1988). Obesity is identified using a variety of anthropometric measurements and criteria, including body mass index (BMI), waist circumference, waist to hip ratio, and percent body fat (Flegal et al., 2008), although the most commonly used method is BMI-based classifications (Garrow & Webster, 1985). Obesity is classified based on measurements of height and weight, Quetlet's index, which is then used to classify weight status according to the following numerical cut-offs: Underweight = BMI <18.5 kg/m^2; Normal weight = BMI > 18.5-24.9 kg/m^2; Overweight = BMI >25 -29.9 kg/m^2; Obesity = BMI >30 kg/m^2 (American College of Cardiology/American Heart Association Task Force on Practice Guidelines, 2014). There are also several types of obesity reported, depending on a complex interplay between genetic and environmental factors (Geets, Meuwissen, & Van Hul, 2019). The most common type of obesity, referred to as complex obesity, arises due to a complex interaction between genetic factors and environmental factors, including a Western-type diet in combination with a sedentary lifestyle (Geets et al., 2019; Luke et al., 2001; Maes, Neale, & Eaves, 1997; Stunkard, 1986).

6a. Prevalence of Obesity

The prevalence obesity has gradually increased over the last fifty years, with prevalence differing amongst different age subgroups. Over the last fifty years, obesity rates increased from 13.4-40% amongst US adults 20-74 years of age, while rates have nearly doubled over the last 20 years amongst male (14.8-34.8%) and female (20.7-36.5%) US adults 20-39 years of age (Hales et al., 2018). Rates of obesity are highest amongst non-Hispanic Black males (52%) and females (37%) of all ages, and Hispanic males (42%) and females (41%) 60 years of age and older (Toth & Palmer, 2018). No studies have recently reported on rates of obesity in young adults 18-25 years of age, which were reported to have increased from 7-12% in the 1990s (Mokdad et al., 1999). Though, summarizing data from the Behavior Risk Surveillance System and the National Health and Nutrition Examination Survey, these were recently reported to have ranged from 9% in Massachusetts, to 28% in Oklahoma ("The State of Obesity," 2018). So, obesity trends for all US adults, including young adults 18-25 years of age, have continued to increase over the last several decades.

6b. Risks and Consequences of Obesity

Obesity and weight gain resulting in increasing adiposity bring about increased risk for many health conditions, including: type 2 diabetes mellitus (DeFronzo et al., 2015), nonalcoholic fatty liver disease (Clark, 2006), coronary heart disease (Flint et al., 2010), congestive heart failure (Aune et al., 2016), gallbladder disease (Li, Gan, Li, Wu, & Lu, 2016), osteoarthritis (Felson, Anderson, Naimark, Walker, & Meenan, 1988), and cancer (Calle & Kaaks, 2004). Excess adiposity is proposed to result in adipose tissue dysfunctions, such as hormonal alterations including impaired insulin function; altered lipid production and lipotoxicity and dyslipidemia; and increased mechanical stress from the presence of more and larger adipose

tissue stores (Heymsfield & Wadden, 2017). In addition, adiposity, as indicated by BMI, was found to have a curvilinear relationship with all-cause mortality, with BMI cut-points below 20 kg/m^2 and above 30 kg/m^2 associated with the highest risk of all-cause mortality as reported by the Global Burden of Diseases project in a review of 239 prospective studies across the globe (Di Angelantonio et al., 2016). Obesity, weight gain, and increased adiposity are associated with a multitude of serious health-related consequences, necessitating the understanding, prevention, and management of obesity.

The causes of obesity are complex and multifactorial and include a variety of individual and environmental factors that result in energy intake in excess of energy needs leading to the development of excess adipose tissue. While most reviews have focused on genetic (Bouchard, 1997; Chaput, Pérusse, Després, Tremblay, & Bouchard, 2014; Savard, Bouchard, Leblanc, & Tremblay, 1983), environmental (Durand, Andalib, Dunton, Wolch, & Pentz, 2011; Feng, Glass, Curriero, Stewart, & Schwartz, 2010), and lifestyle factors (Chaput et al., 2014; Chow & Hall, 2014; Field, Willett, Lissner, & Colditz, 2007; Juul, Martinez-Steele, Parekh, Monteiro, & Chang, 2018; Mozaffarian, Hao, Rimm, Willett, & Hu, 2011; Parsons, Power, Logan, & Summerbelt, 1999) that contribute to weight gain and obesity onset, few have examined how eating disorders and eating disorder symptoms, in particular, might also contribute to weight gain and the onset of obesity.

Some reasons to consider how eating disorders and eating disorder symptoms might contribute to weight gain and obesity onset are that they tend to co-occur (Flament et al., 2015; Neumark-Sztainer et al., 2002), there is comorbidity between these conditions (Fairburn et al., 1998; Lebow et al., 2015; Neumark-Sztainer et al., 2006c), they have shared risk factors (Haines et al., 2010; Loth et al., 2015; Neumark-Sztainer et al., 2007; Stice et al., 2005b), and both are

difficult to treat (Agras, 2001; Balantekin et al., 2017; Pi-Sunyer, 2002). Furthermore, individuals with co-morbid eating disorder symptoms and obesity also have higher levels of obesity (de Zwaan, 2001; Wonderlich, Gordon, Mitchell, Crosby, & Engel, 2009), are more resistant to eating disorder (Wilfley & Cohen, 1997; Wilson, Grilo, & Vitousek, 2007) and weight management treatment (Devlin et al., 2005; Grilo & Masheb, 2005; Sherwood, Jeffery, & Wing, 1999; Yanovski, Gormally, Leser, Gwirtsman, & Yanovski, 1994), and often display higher levels of psychological comorbidity (Specker, de Zwaan, Raymond, & Mitchell, 1994; Wadden, 1993; Yanovski et al., 1994). Thus, while eating disorders/eating disorder symptoms and obesity represent two distinct, although interrelated conditions, eating disorder symptoms may represent another way to screen for weight gain and obesity onset in order to identify individuals at greater risk for treatment-resistance to target earlier for interventions.

Obesity is another complex health conditions of public health concern that may result from the presence of eating disorders and eating disorder symptoms. Obesity is also highly prevalent in young adult populations and is associated with significant morbidity and mortality. There is evidence suggesting that eating disorders/eating disorder symptoms and obesity are closely associated. Individuals with comorbid eating disorders/eating disorder symptoms and obesity experience more negative consequences. Therefore, in considering eating disorder symptoms and how these develop, this review will also consider how these symptoms and their risk factors and correlates also contribute to weight gain, risk for obesity, and obesity onset. Given that BMI is typically used to identify obesity, and BMI is also an indicator of weight status, the term weight status is defined to mean BMI in this dissertation.

7. Risk Factors for Eating Disorders

In order to identify and treat eating disorders, it is important to understand how eating disorders develop. The study of the development of eating disorders is complex and multifactorial. There are many potential factors that contribute to the development of eating disorders (Culbert et al., 2015; Polivy & Herman, 2002; Stice, 2002). Furthermore, factors reported in the literature are not always consistently defined. For the purposes of this dissertation, the following definitions will be considered (Kraemer et al., 1997; Kraemer et al., 2001; Stice, 2002): a risk factor is "a variable that has been shown to prospectively predict a subsequent pathological outcome" (pg. 825)(Stice, 2002); a causal risk factor is "a variable that alters the risk of the outcome when experimentally manipulated" (pg. 1125)(Culbert et al., 2015); a correlate is "a variable associated with an outcome in cross-sectional and case-control studies" (pg. 1125)(Culbert et al., 2015). When considering the outcome of interest, the focus will be on eating disorder symptoms, as previously defined. Eating disorder symptoms are considered instead of eating disorder diagnoses because eating disorders share many diagnostic symptoms (e.g. overvaluation of weight and shape, binge eating, compensatory/purging behaviors) (American Psychiatric Association, 1994, 2013; Culbert et al., 2015). Additionally, evidence suggests that eating disorder symptoms predict the development of eating disorders (Jacobi, Hayward, de Zwaan, Kraemer, & Agras, 2004) and that the processes by which eating disorders develop are more closely linked to specific symptoms, such as overvaluation of weight and shape, dietary restriction, binge eating, and compensatory/purging behaviors (Cuthbert, 2005).

Several systematic and meta-analytic reviews have summarized the current state of the literature with respect to risk factors and the etiology of eating disorders (Culbert et al., 2015; Jacobi et al., 2004; Stice, 2002; Stice, Marti, & Durant, 2011a; Striegel-Moore & Bulik, 2007).

While each review differed in terms of the classification of risk factors and the level of evidence considered (e.g. cross-sectional vs. longitudinal/prospective vs. experimental), the studies identified common, overlapping themes with respect to risk factors (Culbert et al., 2015; Jacobi et al., 2004; Stice, 2002; Stice et al., 2011a; Striegel-Moore & Bulik, 2007). For the most part, all studies identified biological, sociocultural, and psychological risk factors for eating disorders, although the studies differed on how these categories were named (e.g. "psychosocial factors" vs. "sociocultural factors") (Culbert et al., 2015; Jacobi et al., 2004; Stice, 2002; Stice et al., 2011a; Striegel-Moore & Bulik, 2007).

Biological risk factors are here defined as risk factors that are present at birth or are biologically determined and included genetics, sex, race/ethnicity, age, and weight status. The role of genetics was discussed by three studies, but only explored in detail by two of the studies (Culbert et al., 2015; Jacobi et al., 2004). Culbert et al. (2015) proposed that while twin and adoption studies suggest a significant heritable component to eating disorder symptoms, there is insufficient evidence to identify specific single nucleotide polymorphisms associated with specific eating disorder symptoms. Similarly, Jacobi et al. (2004) concluded that while there appears to be familial aggregation of eating disorder symptoms, most likely these are due to an interaction between genes, environment, and neurobiology, overall limiting the conclusions that can be made about the role of genetics. While the role of sex in eating disorders is discussed across all studies, it is only addressed as a risk factor in two of the reviewed studies (Jacobi et al., 2004; Striegel-Moore & Bulik, 2007). Jacobi et al. (2004) stated that the evidence across studies suggests a higher prevalence of eating disorders amongst females compared to males, with ratios as high as 5:1 for eating disorders such as anorexia nervosa and bulimia nervosa, while ratios for binge eating disorder are lower 2.5:1. Similarly, Striegel-Moore and Bulik (2007) concluded that

eating disorders defined by higher weight and shape concerns, such as anorexia nervosa and bulimia nervosa, appear to be more common in females than males (Striegel-Moore & Bulik, 2007).

Of the reviewed studies, two discussed the role of race/ethnicity as a risk factor for eating disorders. While both reviews reported lower rates of eating disorders amongst Black/African-American individuals compared to White/Caucasian individuals (Striegel-Moore & Bulik, 2007), one of the reviews also reported similar rates among Hispanic and White/Caucasian individuals, and the highest rates among Native American individuals (Jacobi et al., 2004). Of note, both studies also reported the highest rates of binge behaviors among Black/African American individuals (Jacobi et al., 2004; Striegel-Moore & Bulik, 2007). Two studies reporting on age as a risk factor discussed adolescence and young adulthood as the highest age risk period (Jacobi et al., 2004; Striegel-Moore & Bulik, 2007), which agrees with studies reporting the mean age of onset for eating disorders as 18-25 years of age (Hudson et al., 2007a; Stice et al., 2013b).

Weight status, identified by BMI, was examined in only two studies (Jacobi et al., 2004; Stice, 2002). Both studies failed to find that a higher BMI predicted the presence of eating disorders but rather, found that a higher BMI was associated with higher risk for eating disorders because it predicted other risk factors of eating disorders, such as pressure to be thin, body dissatisfaction, and dieting, sociocultural factors that will be addressed next (Jacobi et al., 2004; Stice, 2002). Evidence from these reviews suggests that important biological risk factors include sex and age, particularly young adulthood (18-25 years of age), with less clear findings for race/ethnicity and weight status, while weight status was associated with other risk factors related to eating disorder symptoms.

Sociocultural risk factors were defined as risk factors that develop as a result of sociocultural influences present within the sociocultural context. The sociocultural context has been described as an important influence in the development of risk factors for eating disorders in several etiological models of eating disorders (Stice, 1994; Thompson & Heinberg, 1993). The sociocultural context consists of "culture-wide social ideals, expectations, and experiences" as well as the actors that develop and perpetuate those ideals for body image (pg. 32) (Heinberg, 2001). In Western societies, the societal standard for body image for females is thinness (Striegel-Moore, McAvay, & Rodin, 1986), while the societal standard for males is lean, but muscular (Thompson & Cafri, 2007). As a result of these body image ideals, females generally focus on weight and a desire to be thinner (Brown & Slaughter, 2011), while males focus on having more and larger muscles and a lower body fat (Thompson & Cafri, 2007).

Body image ideals are then transmitted and reinforced by powerful social actors, including the media (print, television, the internet), peers, and family (Thompson, Heinberg, Altabe, & Tantleff-Dunn, 1999b). These social actors then serve to create perceived pressure to adhere to societal body image ideals (Thompson et al., 1999b). For example, the media may create pressure through appearance exposure and appearance-oriented content (Stice & Shaw, 1994; Thompson & Cafri, 2007). Similarly, peers and family members may create pressure through appearance-related comments or modeling of appearance-related behaviors (Ata, Rojas, Ludden, & Thompson, 2011; Haines, Neumark-Sztainer, Hannan, Van Den Berg, & Eisenberg, 2008). Together, these actors convey messages regarding the body image ideal and the need to achieve this body image ideal (Schaefer et al., 2015). According to sociocultural models, this messaging and reinforcement results in sociocultural risk factors for eating disorders, including

exposure to body image ideals, body image ideal internalization, and pressure to be adhere to body image ideals (Thompson et al., 1999b).

Exposure to body image ideals, which has primarily focused on the thin ideal in females, refers to media exposure to ideal images, and was described by two studies (Culbert et al., 2015; Striegel-Moore & Bulik, 2007). Both studies reported that experimental exposure to images of thin women increased the presence of body dissatisfaction, a precursor to and a symptom of eating disorders, but did not result in increased presence of eating disorders (Culbert et al., 2015; Striegel-Moore & Bulik, 2007). Similarly, content analysis of media content suggested that body image ideal messages are prevalent and that exposure to media results in increases in body dissatisfaction through increases in body image ideal internalization, both which are precursors to eating disorder symptoms (Cafri, Yamamiya, Brannick, & Thompson, 2005; Stice, Schupak-Neuberg, Shaw, & Stein, 1994; Thompson et al., 1999b). These findings suggest that exposure to body image ideals may result in increased body dissatisfaction and body image ideal internalization.

Thin ideal internalization, also known as body image ideal internalization, is defined as adoption of a body image ideal, which includes expressing desire to achieve the body image ideal and engaging in behaviors to achieve the body image ideal (Schaefer et al., 2015; Thompson et al., 1999b), and was described by three studies (Culbert et al., 2015; Stice, 2002; Striegel-Moore & Bulik, 2007). Pressure to be thin was described by two studies (Culbert et al., 2015; Stice, 2002). Both studies reported that thin ideal internalization (body image ideal internalization) and pressure to be thin predicted increases in eating disorder symptoms, such as body dissatisfaction and dieting, as well as the onset of binge eating and bulimic behaviors (Culbert et al., 2015; Stice, 2002). Evidence from these studies suggests that sociocultural

aspects, such as body image ideal exposure, appearance pressures, and body image ideal internalization resulted in increases in eating disorder symptoms, such as dieting, body dissatisfaction, binge eating, and bulimic behaviors, if not directly increasing the onset of eating disorders.

Psychological risk factors examined included negative affect/negative emotionality, perfectionism, and impulsivity. Negative affect is the experience of negative emotions, while negative emotionality describes a tendency towards experiencing negative emotions (Culbert et al., 2015). Three studies examined the role of negative affect/negative emotionality as risk factors for eating disorders (Culbert et al., 2015; Jacobi et al., 2004; Stice, 2002). Two studies reported that negative affect/negative emotionality predicted the onset of binge eating, bulimic symptoms, and eating disorders (Culbert et al., 2015; Stice, 2002), while one study found that this risk factor predicted the development of general psychiatric conditions (Jacobi et al., 2004).

Perfectionism, or the tendency towards high personal standards or high levels of self-criticism was also examined by three studies (Culbert et al., 2015; Jacobi et al., 2004; Stice, 2002). Although perfectionism was found to predict increases in eating disorder symptoms, such as body dissatisfaction and bulimic behaviors by two studies (Culbert et al., 2015; Stice, 2002), one study argued that given that perfectionism was not examined premorbid, it instead consists of a correlate rather than a risk factor for eating disorder symptoms (Jacobi et al., 2004). Impulsivity, or the tendency to engage in rash actions, was discussed by two studies (Culbert et al., 2015; Stice, 2002). While Stice reported that impulsivity did not predict bulimic behaviors or eating disorder onset, Culbert et al. reported that one specific aspect of impulsivity, negative urgency or the tendency to act rashly in response to negative emotions, predicted increases in binge eating and purging behaviors (Culbert et al., 2015; Stice, 2002). These findings suggest

that negative affectivity/negative emotionality and negative urgency may represent important psychological risk factors to consider in the development of eating disorders.

While the above discussion on risk factors identified important risk factors to consider, one of the major limitations of the above studies was the examination of these risk factors in univariate models. As previously discussed, eating disorders and eating disorder development are complex and multifactorial processes. Nonetheless, biological risk factors such as sex, ethnicity, and weight status appear important in the consideration of the development of eating disorders and eating disorder symptoms. Similarly, sociocultural risk factors such as body image ideal internalization and appearance-related pressures (pressure to be thin) also appear to reflect important risk factors. Finally, psychological risk factors such as negative affect also represent important risk factors to consider. Therefore, there is a need to examine how these individual risk factors interact to predict the presence or increase of eating disorder symptoms in multivariate, etiologic models. The two most widely examined etiologic models of eating disorders are the Dual Pathway Model and the Tripartite Influence Model.

8. Etiologic Models of Eating Disorders

The Dual Pathway Model posits that body mass index (BMI) and perceived sociocultural pressures for body image ideals, which for women is primarily thinness, promote internalization of the thin ideal (or the body image ideal) (Stice et al., 1998). Together, these risk factors predict the onset of body dissatisfaction and dieting, which in turn increase negative affect (Stice et al., 1998). Dieting and negative affect then predict the onset of eating disorder symptoms, such as binge eating and purging symptoms (laxative/diuretic use, vomiting, etc.) (Stice et al., 1998; Stice & Shaw, 2002). Prospective evidence supports the dual pathway model in samples of adolescent, university, and community males and females (Dakanalis et al., 2014; Puccio, Fuller-

Tyszkiewicz, Buck, & Krug, 2019; Stice, 2001). Therefore, the dual pathway model represents an important model when seeking to understand and examine how risk factors interact in the development of eating disorder symptoms.

Another important model is the Tripartite Influence Model of body image and eating disturbance developed by Thompson et al. in female undergraduate students (Thompson et al., 1999a). In this model, the authors suggested that sociocultural influences, mainly peers, family, and media directly affect the development of a body image ideal. Internalization of the body image ideal, in turn, results in body dissatisfaction and appearance comparison. Body dissatisfaction then is proposed to have a direct effect on dieting, which in turn predicts eating disorder symptoms (Thompson et al., 1999a). Empirical data provides support for this model in adolescent and adult females, as well as adolescent males (Keery, Van den Berg, & Thompson, 2004; Smolak, Murnen, & Thompson, 2005; Van den Berg et al., 2007). The Tripartite Influence Model builds upon the Stice Dual Pathway Model by also considering the influence of peers, family and the media.

Evidence from the Dual Pathway Model and the Tripartite Influence Model suggest that various factors play a role in the development of eating disorder symptoms. Specifically, BMI and sociocultural influences each serve to exert pressures related to a body image ideal. Internalization of this ideal and comparison of this ideal to others' or to one's own weight status, results in the development of body dissatisfaction. From there, the pathway that goes from body dissatisfaction to dieting and negative affect, and then to eating disorder symptom development, is similar across both models. Therefore, evidence from these models suggests that body dissatisfaction, dieting, and negative affect play an important role in the development of eating

disorder symptoms. Understanding how dieting, body dissatisfaction, and negative affect arise are key to understanding the development of eating disorder symptoms.

Body dissatisfaction, dieting, and negative affect play a unique role in understanding the development of eating disorder symptoms. However, there is a need to define what body dissatisfaction, dieting, and negative affect are, how they are related, how they arise, and how they contribute to the development of eating disorder symptoms. Unlike the biological, sociocultural, and psychological risk factors discussed above, body dissatisfaction and dieting are unique in that they are precursors to the development of eating disorder symptoms and are sometimes also classified as eating disorder symptoms, in their extreme forms, representing links between risk factors and eating disorder symptoms (Culbert et al., 2015). Therefore, understanding how body dissatisfaction, dieting, and negative affect arise and result in eating disorder symptoms is important in understanding how eating disorder symptoms develop and potentially how to mitigate the roles of body dissatisfaction, dieting, and negative affect in preventing and treating eating disorder symptoms and their consequences.

8a. Definition of Body Dissatisfaction

In order to discuss what body dissatisfaction is and how it contributes to the onset of dieting and eating disorder symptoms, one must first discuss how our understanding of body dissatisfaction came about. Body dissatisfaction is an element of body image. Body image, in turn, is defined as "a complex, multidimensional phenomenon consisting of one's attitudes, perceptions, and experiences pertaining to one's own physical appearance" (pg. 191) (Cash et al., 2005). Cash describes the multidimensionality of body image using a cognitive behavioral perspective.

In the Cash cognitive-behavioral model of body image, historical and proximal events serve to shape individuals' body image experiences (Cash, 2011). Historical influences include past events that shape individuals' thoughts and feelings about body image, such as an individual's personal and physical characteristics, their exposure to sociocultural values related to body image, and their person experience in relation to body image (Cash, 2011). One important physical characteristic, body weight, is thought to play an important role in the development of body image, particularly in a society that values specific body image ideals (Cash, 2012). Another important personal characteristic suggested to influence the development of body image is negative emotionality, or the tendency to experience negative affect or negative emotions (e.g. anger, disgust, guilt, fear, sadness) (Cash, 2012; Watson & Clark, 1984). Finally, sociocultural values related to body image include the information individuals receive about the accepted standards for physical appearance in the culture that they exist (Cash, 2012). Traditionally, these have consisted of thinness for females and leanness and muscularity for males (Cash, 2012). These historical events, including personal characteristics, in turn, guide the development of body image-related perceptions and attitudes (Cash, 2011).

In the Cash model, body image-related perceptions are mental representations of how one looks (Cash, 2012). Distorted or inaccurate body image perceptions can be a symptom of eating disorders (Cash, 2012). Body image-related attitudes are individual and internal ways of thinking, feeling/perceiving, and behaving in relation to one's own body image (Cash, 2012). Cash describes two specific body image-related attitudes, body image evaluation and body image investment (Cash, 2011). Body image evaluation is defined as the evaluation or judgement of one's appearance, as well as the general feeling of satisfaction or dissatisfaction based on this judgment (Cash, 2011). Body dissatisfaction is thought to derive from comparisons of one's

appearance to one's internalized body image ideal and the degree to which these are congruent or not congruent (Cash & Szymanski, 1995). Body image investment, in turn, describes the psychological importance, or valuation, one places on their body image in terms of self-conceptualization, as well as the motivation to maintain a specific appearance (Cash, 2012). Together, these constructs organize how one responds to specific events related to their body image in terms of thoughts, feelings, and behaviors.

In the Cash model, proximal influences, which are described as specific situational cues or contextual events, interact with body image perceptions and attitudes resulting in body image-related thoughts, feelings/emotions, and behaviors (Cash, 2011). Body image related-experiences interact with cognitive processes and can result in problematic body image-related internal dialogues and cognitions, especially for individuals with negative body image evaluations (Cash, 2012). Some examples of cognitive distortions include dichotomous thinking, overgeneralizations, and biased social comparisons (Cash, 2012). From here, problematic body image cognitions activate specific negative body image-related emotions, such as distress, shame, or anxiety related to body image (Cash, 2012). In turn, individuals are proposed to engage in behavioral strategies to cope with problematic body-image related thoughts and emotions (Cash, 2012). Coping is defined as a behavioral strategy to lessen the psychological, emotional, and physical consequences of stressful situations (Cash et al., 2005; Folkman & Lazarus, 1988). Coping strategies are classified based on behavioral responses to the sources of stress and include problem-focused strategies, emotion-focused strategies, approach strategies, and avoidance strategies (Lazarus & Folkman, 1984; Snyder, 1999; Stanton & Franz, 2015; Tobin et al., 1989). Problem-focused and approach strategies are geared at actively dealing with stressors (Lazarus & Folkman, 1984; Snyder, 1999; Stanton & Franz, 2015; Tobin et al., 1989)

and are associated with better psychological functioning (Endler & Parker, 1990). Emotion-focused and avoidance strategies, on their other hand, are associated with greater levels of psychopathology (Endler & Parker, 1990).

Similar to other distressing situations, individuals develop behavioral coping strategies related to distressing body image-related thoughts and feelings, such as body dissatisfaction and body image distress. While limited research has been conducted related to body image-related coping, research suggests an association between employment of emotion-focused and avoidance coping behaviors and increased eating disorder symptoms (Koff & Sangani, 1997). In response, Cash developed a self-report inventory to assess body-image related coping strategies as well as their association with eating disorder symptoms and other psychopathologies (Cash et al., 2005).

Cash identified three types of body image-related coping behaviors: experiential avoidance, appearance fixing, and positive rational acceptance (Cash et al., 2005). Experiential avoidance was defined as attempts to avoid threatening body image-related situations, thoughts, or beliefs (Cash, 2011). Appearance fixing was defined as efforts used to alter or correct perceived body image-related deficits (Cash, 2011, 2012). Positive rational acceptance was defined as engaging in behaviors and self-talk that emphasize acceptance of body image-related experiences (Cash, 2011). Experiential avoidance and appearance fixing were proposed to be maintained through negative reinforcement (Cash et al., 2005). While these behaviors temporarily decrease body dissatisfaction and body image distress, they also reinforce the importance of body image-related thoughts and feelings, making the reemergence of distressing thoughts and feelings more likely (Cash, 2011). Cash et al. (2005) reported moderate to strong positive associations between body image evaluation, body image importance, body image-related experiential avoidance, and appearance fixing behaviors. Furthermore, there was also a

moderate to strong positive association between eating disorder symptoms and body image-related experiential avoidance and appearance fixing behaviors, with these behaviors explaining 24.5-28.5% of the variance in eating disorder symptoms, in males and females, as measured by the Eating Attitudes Test (EAT-26) (Cash et al., 2005). The authors suggest that one potential mechanism by which negative body image attitudes, such as body dissatisfaction, might be associated with eating disorder symptoms is through the adoption of maladaptive body image-related coping behaviors, such as experiential avoidance and appearance fixing behaviors.

In Cash's cognitive behavioral model of body image (Cash, 2011), several important themes emerged. Body dissatisfaction is an attitudinal construct of body image that conveys a negative body image perception and evaluation. Negative attitudes related to body image, such as body dissatisfaction, in conjunction with situations and contexts that elevate the importance of facets of body image, such as weight and appearance, can in turn precipitate negative body image emotions, such as anxiety, shame, and distress. Negative body image emotions, in turn, result in the adoption of maladaptive body image coping behaviors, such as experiential avoidance and appearance fixing. Adoption of these maladaptive coping behaviors can result in increasing the psychological importance of body image and appearance, resulting in further adoption of more extreme appearance fixing behaviors, such as unhealthy weight control behaviors, and over time, psychopathologies such as eating disorder symptoms.

One common appearance fixing behavior adopted to cope with negative body image emotions, or negative affect related to body image, is dieting. Dieting, as described above, is proposed to arise due to an increase in body dissatisfaction and negative affect (negative body image emotions). Body dissatisfaction results in increased dieting due to the belief that dieting is an effective strategy to induce weight loss (appearance fixing) (Stice & Shaw, 2002). There is,

however, debate on how dieting leads to the onset of eating disorder symptoms, whether all dieting is good or bad, and even what exactly constitutes dieting (Bacon & Aphramor, 2011; Lowe & Levine, 2005; Lowe & Timko, 2004b; Lowe, Whitlow, & Bellwoar, 1991). Therefore, there is a need to examine and define dieting for the purposes of this dissertation.

8b. Definition of Dieting

Dieting, as a behavior, has been defined in many ways. How dieting has been defined and measured likely contributes to the ongoing debates on the role of dieting in the onset of eating disorder symptoms and obesity (Lowe & Timko, 2004b; Schaumberg et al., 2016). Interest in dieting arose in studies trying to understand and characterize differences in eating behaviors between individuals who were "normal weight" and individuals who were "obese" (Herman & Polivy, 1975). At the time, leading theories proposed that individuals with "normal weight" controlled eating behaviors mainly by reliance on internal hunger and satiety cues, while individuals with "obesity" relied on external cues, such as the salience of food cues (Herman & Mack, 1975). From examination of these characteristics in normal weight and obese individuals, Herman and Mack identified the construct of "dietary restraint," which in experimental tests, predicted individuals who increased consumption of highly palatable food following a preload, regardless of weight status (Herman & Mack, 1975).

In their subsequent Restraint Theory, the authors proposed that dietary restraint, as measured by the Restraint Scale, was the cognitive effort made by individuals to eat less than desired (Polivy & Herman, 1985; Schaumberg et al., 2016). The theory proposed that individuals who are dieting possess high levels of dietary restraint in order to restrict their intake and induce weight loss (Polivy & Herman, 1985). However, because using a cognitively regulated eating style overrides internal physiological signals for starting and stopping eating, dieters are left

vulnerable to uncontrolled eating when cognitive controls are disrupted, such as when dietary rules are broken or when a dieter experiences distress (Curry, Marlatt, & Gordon, 1987; Polivy & Herman, 1985; Westenhoefer et al., 1994). Eating disorder symptoms, in turn, are proposed to arise in response to feelings of deprivation resulting from prolonged and rigid restraint, increasing the likelihood of overeating and binge eating (Polivy & Herman, 1985). Failure to maintain dieting status or dietary restraint may also increase distress resulting in further dieting, overeating, and binge eating (Herman & Polivy, 2011). Therefore, one of the first attempts to explain how dieting potentially results in eating disorder symptoms was through the characterization and measurement of dietary restraint.

Early studies using the Restraint Scale found support for the association between dietary restraint and binge eating, obesity onset, and overeating under conditions that make cognitive control more difficult, such as exposure to high calorie foods, distress, and alcohol intake (Polivy & Herman, 1985; Ruderman, 1986; Stice et al., 1998). However, studies using different measures of cognitive restraint, such as the restraint subscale of the Dutch Eating Behaviors Questionnaire (Van Strien, Frijters, Bergers, & Defares, 1986), and the restraint subscale from the Three Factor Eating Questionnaire (Stunkard & Messick, 1985), have challenged the notion that the restraint scale 1) truly measures dietary restraint and 2) predicts the onset of eating disorder symptoms and obesity onset (Lowe, 1993; Schaumberg et al., 2016; Stice, Ozer, & Kees, 1997). For example, studies suggest that the Dietary Restraint scale actually contains three factors, including a concerns for dieting factor, a susceptibility to overeating as a result of violation of cognitive control, which was termed disinhibition, and a weight fluctuation factor (Heatherton, Herman, Polivy, King, & McGree, 1988; Schaumberg et al., 2016; Stunkard & Messick, 1985). Heatherton et al. (1988) proposed that the reason differences arise is because the

Restraint Scale identifies individuals who are unsuccessful dieters, including those who engage in dieting but are susceptible to overeating and weight gain, while other restraint scales identify individuals who are successful dieters and are able to successfully restrict caloric intake (Lowe, 1993). However, subsequent studies using laboratory measures of caloric intake found that none of the restraint scales identified above were associated with caloric intake, suggesting that dietary restraint is a distinct construct from dieting and actual energy intake (Schaumberg et al., 2016; Stice, Cooper, Schoeller, Tappe, & Lowe, 2007a; Stice, Fisher, & Lowe, 2004a; Stice, Sysko, Roberto, & Allison, 2010).

Another proposed explanation for the inconsistent findings regarding dietary restraint is that dietary restraint is actually comprised of two facets, rigid restraint, which involves a dichotomous, all or nothing approach to eating, dieting and weight, while flexible restraint, involves a more flexible and consistent approach to eating, dieting, and weight, such that high calorie foods are still consumed, except these are consumed in limited quantities and without feelings of guilt (Westenhoefer, 1991; Westenhoefer et al., 2013; Westenhoefer et al., 1999). Studies examining the rigid restraint and flexible restraint aspects of dietary restraint reported that rigid restraint was associated with a higher disinhibition score, a higher BMI, more frequent binge eating episodes, and less weight loss (Westenhoefer, 1991; Westenhoefer et al., 1994; Westenhoefer et al., 2013; Westenhoefer et al., 1999). Flexible restraint, on the other hand, was associated with lower disinhibition scores, a lower BMI, less frequent binge eating episodes, and a higher likelihood of successful weight loss (Westenhoefer, 1991; Westenhoefer et al., 1994; Westenhoefer et al., 2013; Westenhoefer et al., 1999). Evidence from cross-sectional and prospective studies suggests disinhibition and hunger are higher in individuals with obesity (Provencher, Drapeau, Tremblay, Despres, & Lemieux, 2003); that rigid restraint is positively

associated with weight gain (Provencher et al., 2003); women with high restraint gained weight over time (Drapeau et al., 2003); higher disinhibition combined with higher restraint predicted eating disorder symptoms, while higher disinhibition with low restraint predicted obesity onset (Bryant, 2010); and specific facets of disinhibition, mainly habitual disinhibition and emotional disinhibition predicted weight gain over time, while flexible cognitive control attenuated the effects of habitual disinhibition on weight gain but not emotional disinhibition (Hays & Roberts, 2008). These findings suggest that dietary restraint can be problematic, depending on the style of dietary restraint adopted, rigid vs. flexible, and that some dietary restraint, especially flexible dietary restraint, can be helpful at preventing obesity onset, especially in individuals with high disinhibition (Schaumberg et al., 2016).

Dietary restraint seems to differ from dieting as dietary restraint is not associated with actual caloric intake (Stice et al., 2007a; Stice et al., 2004a; Stice et al., 2010). Dietary restraint involves eating less than one would like to eat, dieting instead can be conceptualized as "adherence to a specified eating plan for the purposes of weight loss" (pg. 90)(Schaumberg et al., 2016). In order to result in weight loss, a "diet" would require a person to consume less calories than are expended. Some studies suggest that dieting is associated with increased risk for eating disorder symptom development and obesity onset (Neumark-Sztainer et al., 2006c; Neumark-Sztainer, Wall, Larson, Eisenberg, & Loth, 2011; Neumark-Sztainer et al., 2012; Stice, Cameron, Killen, Hayward, & Taylor, 1999; Stice et al., 2011a; Stice et al., 2005b). In contrast, other studies found that dieting was associated with weight loss and decreases in eating disorder symptoms (Burton & Stice, 2006; Presnell, Pells, Stout, & Musante, 2008; Presnell & Stice, 2003; Stice, Presnell, Groesz, & Shaw, 2005a). These findings suggest that different types of dieting definitions used in these studies may explain the differences in their findings.

One explanation for these findings is that participants employ healthy vs. unhealthy dieting behaviors. For example, French et al. reported that healthy dieting was defined as the use of exercise, decreased fat intake, reduced snack intake, and reduced calorie intake (French et al., 1995). On the other hand, unhealthy dieting was defined by the use of fasting or skipping meals, diet pills, and vomiting to induce weight loss (French et al., 1995). Studies examining healthy vs. unhealthy dieting behaviors report that while both types are behaviors are prevalent, some individuals use both healthy and unhealthy dieting behaviors (Gillen, Markey, & Markey, 2012; Kruger, Galuska, Serdula, & Jones, 2004; Neumark-Sztainer et al., 2002). The most frequent healthy dieting behaviors reported were eating fewer calories (61%), exercising more (53-79%), eating more fruits and vegetables (45-64%), and eating less sweets and high fat foods (35-58%) (Kruger et al., 2004; Neumark-Sztainer et al., 2002). The most frequent unhealthy dieting behaviors reported were skipping meals/fasting (9-18%), taking pills (diet pills/diuretics/laxatives) (1-6%), and vomiting (0.1-6%) (Kruger et al., 2004; Neumark-Sztainer et al., 2002). Compared to average weight participants, overweight participants had a greater likelihood of using both healthy (OR: 3.35-7.62) and unhealthy (OR:2.61-4.14) dieting behaviors (Neumark-Sztainer et al., 2002). Neumark-Sztainer et al. (2011) also reported that unhealthy dieting behaviors tended to track over time and even increased as adolescents transitioned into adulthood. Furthermore, endorsing any dieting, including unhealthy dieting behaviors, was associated with an increased prevalence of eating disorder symptoms, such as binge eating and use of diet pills/laxatives/diuretics, greater increases in body mass index, and a higher likelihood of obesity onset (Neumark-Sztainer, Paxton, Hannan, Haines, & Story, 2006a; Neumark-Sztainer et al., 2012; Neumark-Sztainer, Wall, Story, & Sherwood, 2009). However, these studies did not control for the type of dieting in examining the consequences of dieting behaviors. Therefore, the

findings that dieting is associated with eating disorder symptoms and weight status may potentially be due to the type of dieting behavior used (healthy vs. unhealthy).

Finally, there is the question as to whether it is actual dieting, creating a true calorie deficit, or self-reported dieting, endorsing that you are on a diet to lose weight, which is associated with eating disorder symptoms and obesity onset. For example, randomized trials using low calorie and weight maintenance diet assignments have reported significant reductions in binge eating (Reeves et al., 2001), eating disorder symptoms (Burton & Stice, 2006; Presnell & Stice, 2003; Stice et al., 2005a), greater weight loss (Presnell & Stice, 2003), and lower obesity onset (Burton & Stice, 2006). However, some have questioned whether self-reported dieting actually produces an energy deficit (Presnell & Stice, 2003; Wadden, Butryn, & Byrne, 2004). Many studies examining self-reported dieting assess dieting status with a single question, such as, "are you currently dieting to lose weight?" (Lowe & Timko, 2004b; Neumark-Sztainer et al., 1997; Rideout & Barr, 2009).

Only one experimental trial has examined whether self-reported dieters randomly assigned to a "diet as usual" or "no dieting" condition experienced any of the negative or positive consequences associated with dieting (Presnell et al., 2008). Presnell et al. (2008) reported that both groups experienced weight gain, although this finding was only significant in the "no dieting" group. Furthermore, both groups experienced decreases in all eating disorder symptoms (bulimic symptoms, binge eating frequency, compensatory/purging behaviors, overvaluation of shape and weight), with no significant differences between groups (Presnell et al., 2008). However, this finding was moderated by depressive symptoms (e.g. sadness, anxiety, anger, guilt, shame), such that only individuals in the "diet as usual" group with low depressive symptoms experienced improvement in eating disorder symptoms (Presnell et al., 2008). The

authors concluded the findings suggest that self-reported dieting is not usually effective at producing weight loss and that while both conditions reduced eating disorder symptoms, this effect was moderated by depressive symptoms in the "diet as usual" group, suggesting an important interaction between dieting and depressive symptoms.

Overall, studies about dieting suggest that there are multiple constructs related to dieting, including dietary restraint, rigid restraint, flexible restraint, healthy dieting, unhealthy dieting, and self-reported dieting. Depending on which construct was examined, there were differential associations between "dieting" and the purported consequences of dieting, the development of eating disorder symptoms and obesity. For example, it appears that more extreme forms of dieting, including rigid restraint and unhealthy dieting behaviors, were more likely associated with the negative consequences of dieting. Furthermore, dieting was more likely to result in negative consequences when associated with depressive symptoms. Depressive symptoms, in turn appear to reflect negative emotionality/affectivity, and so the focus will be on negative affect, as this is consistent with the etiologic models previously described.

8c. Definition of Negative Affect

Negative affect has also broadly been examined as a risk factor for eating disorder symptoms and obesity. Similar to dieting, negative affect has been described in a variety of ways. Interest in understanding negative affect comes from studies of depression and depressive symptoms. Depression, as a diagnosed clinical condition, is a mood disorder that impacts how individuals feel, think, and handle activities of daily living (Beck, 1980). Depressive symptoms, in turn, include items such as sadness, loss of interest, worthlessness, changes in appetite, sleep, or fatigue, that indicate the presence and severity of depression (Van Dam & Earleywine, 2011). Negative affect, then, is described as a personality trait that reflects an individual's tendency to

experience negative emotions, overall negative mood, and a greater sensitivity for negative situations (Watson, Clark, & Tellegen, 1988). The focus of this dissertation will be on negative affect and its association with eating disorder symptoms and obesity.

8d. Evidence Supporting Etiologic Model

One of the most well described and tested models that describes how body dissatisfaction, dieting, and negative affect may result in the development of eating disorder symptoms and obesity onset is the Dual Pathway Model. The Dual Pathway Model of bulimic behaviors (binge eating and purging) was first proposed by Stice as a way to describe how sociocultural pressures resulted in the development of eating disorder symptoms (bulimic behaviors) (Stice, 1994). Stice proposed that sociocultural pressures resulted in the transmission and adoption of body image ideals (internalization of the body image ideal), which are similar to the historical and proximal influences described by Cash (Cash, 2011; Stice, 1994). Internalization of the body image ideal then interacts with a person's actual body image, which in the current society, most emphasis on body image is placed on weight and shape, and the resulting interaction between the person's body image ideal and actual body image result in body dissatisfaction when these are discrepant (Cash, 2011; Stice, 1994).

Results from several meta-analytic studies support the development of body dissatisfaction as an important process related to eating disorder symptoms and obesity. Cafri et al. (2005) found support that sociocultural factors, including internalization of a body image ideal and perceived pressures to achieve those ideals, resulted in increased body dissatisfaction. Cash and Deagle III (1997) reported that body dissatisfaction is significantly higher in individuals with eating disorder symptoms, especially individuals with binge eating and purging behaviors. Similarly, Weinberger et al. reported that individuals with obesity reported higher

levels of body dissatisfaction than normal weight individuals (Weinberger et al., 2017). Findings from these meta-analytic studies suggest that body dissatisfaction develops in response to sociocultural pressures and is strongly associated with eating disorder symptoms and obesity.

Body dissatisfaction, in turn, predicts eating disorder symptoms through two mediating pathways, a dieting pathway and a negative affect pathway (Stice, 1994). As previously stated, dieting is adopted as an appearance-fixing strategy because of the belief that it is an effective way to change weight and shape to conform to a body image ideal (Stice, 1994). Studies suggest that body dissatisfaction is one of the most potent predictors for negative affect (Presnell, Bearman, & Stice, 2004; Ricciardelli & McCabe, 2001; Stice & Shaw, 2002). Furthermore, meta-analytic evidence suggests that increased body dissatisfaction is associated with increased onset of eating disorder symptoms, which is mediated by increases in dieting and negative affect (Stice, 2002; Stice & Shaw, 2002). Similarly, a systematic review in adolescents and young adults reported that body dissatisfaction was also associated with dieting, including unhealthy dieting behaviors, and eating disorder symptoms (Shagar, Harris, Boddy, & Donovan, 2017). Another study in individuals with obesity found that individuals with high negative affect also had higher body dissatisfaction and more frequent binge eating than was predicted by body dissatisfaction (Jansen, Havermans, Nederkoorn, & Roefs, 2008). These findings suggest that body dissatisfaction is an important predictor of dieting, negative affect, and eating disorder symptoms.

Dieting, in turn, mediates the association between body dissatisfaction and eating disorder symptoms through two proposed mechanisms, a restraint pathway and an affect regulation pathway (Stice, 1994). Restraint Theory posits that dieting results in binge eating due to physiological and cognitive mechanisms (Polivy & Herman, 1985). Dieting may result in

physiological changes, such as increasing the salience of food cues and the reward value of food, leading to increased cravings, as well as adoption of a cognitive regulated eating style susceptible to disruption, leading to disinhibition and binge eating (Polivy & Herman, 1985).

Given that most dieting attempts are not successful either at producing the desired weight change or due to discontinuation of dieting following disinhibition and binge eating, dieting often results in increased onset of eating disorder symptoms, negative affect, and potentially weight gain (Curry et al., 1987; Heatherton & Polivy, 1992; McCarthy, 1990; Polivy & Herman, 1985; Stice, 1994; Westenhoefer et al., 1994). A related model, the spiral model of dieting and disordered eating, suggests that failure in dieting will result in increased body dissatisfaction and negative affect, leading to more restrictive and unhealthful dieting behaviors, including purging behaviors like vomiting, laxative, and diuretic use, as well as greater likelihood of diet failure and binge eating (Heatherton & Polivy, 1992). Since it was previously shown that dieting can be associated with positive effects (Reeves et al., 2001), such as lowered eating disorder symptoms (Burton & Stice, 2006; Presnell & Stice, 2003; Stice et al., 2005a), greater weight loss (Burton & Stice, 2006; Presnell & Stice, 2003), and lower obesity onset (Burton & Stice, 2006), the spiral model provides an explanation as to how dieting can become pathological (Heatherton & Polivy, 1992). So, dieting failure is one way dieting can result in increased negative affect and onset of eating disorder symptoms.

Only one meta-analysis has examined the association between dieting and onset of eating disorder symptoms and negative affect (Stice, 2002). Stice reported evidence suggesting that dieting predicted increases in negative affect and eating disorder symptoms (Stice, 2002). Additional data from prospective studies supports the role of dieting in predicting increases in negative affect and onset of eating disorder symptoms (Goldschmidt et al., 2012; Neumark-

Sztainer et al., 2006c; Neumark-Sztainer et al., 2011; Stice, 2001; Stice, Presnell, & Spangler, 2002), with negative affect mediating this association in at least some studies (Goldschmidt et al., 2012; Stice, 2001). Other prospective studies suggested that dieting also predicts weight gain and obesity onset (Drapeau et al., 2003; Goldschmidt et al., 2016; Goldschmidt et al., 2012; Neumark-Sztainer et al., 2006c; Neumark-Sztainer et al., 2012; Stice et al., 1999; Stice et al., 2005b), with negative affect also mediating this association (Goldschmidt et al., 2016). One meta-analyses of 25 prospective studies on dieting and dietary restraint reported that while neither of these measures predicted weight loss, 75% of the studies reporting on dieting predicted weight gain in those endorsing dieting, suggesting that dieting is not an effective strategy to prevent weight gain in an obesogenic environment (Lowe, Doshi, Katterman, & Feig, 2013). Meta analytic and prospective evidence also supports a path from dieting to eating disorder symptoms and weight gain/obesity onset.

Thus far, the main mediating mechanisms discussed were body dissatisfaction, which predicts increased dieting and negative affect, and dieting, which also predicts increased negative affect and onset of eating disorder symptoms. Negative affect, in turn, arises from both body dissatisfaction and dieting/dieting failures (Stice, 1994). Body dissatisfaction is proposed to be one of the main causes of negative affect (McCarthy, 1990). Similarly, dieting failure and engagement in binge eating is also proposed to result in increased negative affect (feelings of sadness and failure) (McCarthy, 1990). Negative affect, in turn, predicts the onset of eating disorder symptoms by way of the affect regulation pathway.

Meta-analytic evidence suggests the presence of negative affect predicted increases in eating disorder symptoms (Stice, 2002) and increased the odds for developing obesity (Luppino et al., 2010; Mannan, Mamun, Doi, & Clavarino, 2016). Furthermore, evidence suggests that

increasing levels of BMI are associated with increased negative affect (Carr, Friedman, & Jaffe, 2007; Pasco, Williams, Jacka, Brennan, & Berk, 2013), and that participants with negative affect have a higher BMI, higher dietary restraint, and more weight and shape concerns (Werrij, Mulkens, Hospers, & Jansen, 2006). While evidence from these studies support a role for negative affect in predicting increased eating disorder symptoms and obesity, they do not explain how negative affect might result in increased eating disorders symptoms and obesity.

The affect regulation pathway of negative affect and eating disorder symptoms proposes that the association between negative affect and eating disorder symptoms is mediated by the use of emotion regulation and coping strategies (Hawkins, Fremouw, & Clement, 1984; Heatherton & Baumeister, 1991; Stice, 1994). Negative affect is a dimension of core affect, a simple feeling that is a blend of hedonic (pleasure-displeasure) and arousal (sleepy-activated) values (Russell, 2003). Affect regulation, in turn, involves actions aimed directly at altering core affect (Russell, 2003). There are different ways affect can be regulated, including emotion regulation strategies and coping strategies (Rottenberg & Gross, 2007; Russell, 2003). Coping strategies are behavioral strategies used to lessen the psychological, emotional, and physical consequences of stressful situations (Folkman & Lazarus, 1988; Lazarus & Folkman, 1984). Emotion regulation involves influencing emotions and how these emotions are expressed and experienced (Sloan & Kring, 2007), while emotion regulation strategies are used to modify the magnitude or type of emotional experience or emotion-eliciting event (Aldao et al., 2010). There are various ways to define and describe affect regulation.

Furthermore, emotion regulation and coping strategies have also been defined as adaptive and maladaptive. For example, adaptive coping strategies include problem-focused coping and approach coping, which aims to solve the problem creating a stressful situation (Gross, 1998). In

contrast, maladaptive coping strategies include emotion-focused and avoidance coping, which seek to decrease the experience of negative emotion or avoid the problem or emotion creating the stressful situation (Gross, 1998). Similarly, emotion regulation strategies identified as adaptive include problem solving (conscious attempts to change a stressful situation), reappraisal (positive interpretations of a stressful situation), and acceptance (acceptance of stressful thoughts, feelings, and sensations as they are) have been associated with positive outcomes (Gross, 1998; Hayes et al., 1999). Maladaptive emotion regulation strategies include suppression of unwanted thoughts or emotion; avoidance, including experiential avoidance or the suppression/avoidance of thoughts, emotions, sensations, memories, and urges, as well as behavioral avoidance; and rumination, the repetitive focus on an experience of emotion, its causes, and consequences (Gross, 1998; Hayes et al., 1999; Nolen-Hoeksema et al., 2008). Generally, adaptive coping and emotion regulation strategies have been associated with positive outcomes, while maladaptive coping and emotion regulation strategies have been associated with negative outcomes (Aldao et al., 2010; Folkman & Lazarus, 1988; Gross, 1998; Hayes et al., 1999). Given there is significant overlap in the antecedents and consequents of these actions and behaviors (Russell, 2003), and that all these behaviors are adopted to change core affect, this dissertation will use the term affect regulation strategies, including adaptive affect regulation strategies and maladaptive affect regulation strategies.

With regards to eating disorders, affect regulation theories posit that binge eating is used as a way to avoid or deal with negative affect due to the belief that eating reduces negative feelings (Evers, Marijn Stok, & de Ridder, 2010; Gianini et al., 2013; Hawkins et al., 1984; Heatherton & Baumeister, 1991; Oliver, Wardle, & Gibson, 2000; Spoor, Bekker, Van Strien, & van Heck, 2007; van Strien & Ouwens, 2003). Instead, binge eating tends to increase negative

affect and body dissatisfaction due to fear of weight gain from binge eating (Haedt-Matt & Keel, 2011; Hawkins et al., 1984). In this case, purging behaviors, such as vomiting and laxative and diuretic use, are sometimes then used to deal with negative affect that arises as a result of binge eating and consequent increases in body dissatisfaction and negative affect (Haedt-Matt & Keel, 2011; Hawkins et al., 1984). In this case, binge eating and purging are used to regulate emotions and to avoid dealing with emotions, making them maladaptive affect regulation strategies, and as such, they were strongly associated with higher levels of eating disorder symptoms (Endler & Parker, 1994; Spoor et al., 2007). Additionally, when maladaptive affect regulation strategies, such as binge eating and purging, are used to deal with negative affect, they become negatively reinforced due to the temporary relief they provide from feelings of negative affect, body dissatisfaction, and fear of weight gain (Hawkins et al., 1984). At the same time, these behaviors also increase the salience of food, weight, and shape, making it more likely that individuals will continually use these strategies to cope with negative affect that arises as a result of body dissatisfaction, dieting, binge eating, and purging (Hawkins et al., 1984; Stice, 1994).

Evidence appears to support the mediating role of affect regulation as a mediator between negative affect and its causes, mainly body dissatisfaction and dieting, and negative outcomes such as eating disorder symptoms and weight gain/obesity. For example, meta-analytic evidence examining the antecedents and consequences of binge eating reported that negative affect preceded onset of binge and purge behaviors (Haedt-Matt & Keel, 2011), which has been replicated in a study examining stress and negative affect as antecedents to binge and purge behaviors (Goldschmidt et al., 2014). Studies using mediational analysis have provided further evidence of the mediating role of affect regulation in samples of adolescent and adult males and females (Dakanalis et al., 2014; Gianini et al., 2013; Goldschmidt et al., 2017; Harrison et al.,

2016; Lavender & Anderson, 2010; Lillis et al., 2011; Sim & Zeman, 2005; Sulkowski et al., 2011; Whiteside et al., 2007). For example, in a sample of male and female college students, Whiteside et al. reported that while overvaluation of weight and shape and food restriction both predicted binge eating, affect regulation difficulties predicted binge eating beyond these effects, supporting the notion that affect regulation mediates these effects (Whiteside et al., 2007). Similarly, in a sample of college males, Lavender and Anderson also found that affect regulation predicted body dissatisfaction and eating disorder symptoms beyond weight status and negative affect, such that males with more affect regulation difficulties had higher levels of body dissatisfaction and eating disorder symptoms (Lavender & Anderson, 2010). Other maladaptive affect regulation strategies, including emotion-focused coping and avoiding coping, were additionally found to mediate the association between stress and binge eating in college females (Sulkowski et al., 2011). Furthermore, interventions targeting affect regulation strategies overall reported significant decreases in binge eating behaviors and BMI (Godfrey, Gallo, & Afari, 2015; Rogers, Webb, & Jafari, 2018; Ruffault et al., 2017). These findings suggest that affect regulation likely represents an important mediating pathway between dieting, body dissatisfaction, negative affect and their purported effects on eating disorder symptoms and weight gain/obesity onset. Since most studies suggest that affect regulation strategies are predictive of eating disorder symptoms and weight gain/obesity beyond the effects of body dissatisfaction, dieting, and negative affect, the focus of this dissertation will be on affect regulation as an important mediator.

Evidence supporting the Dual Pathway Model comes from a variety of sources, including cross-sectional, prospective, and experimental trials in female adolescents, and male and female colleges students (Dakanalis et al., 2014; Gagnon-Girouard et al., 2009; Mason & Lewis, 2015;

Ouwens, Van Strien, Van Leeuwe, & Van der Staak, 2009; Rohde, Desjardins, Arigo, Shaw, & Stice, 2018; Stice, 2001; Stice, Marti, Rohde, & Shaw, 2011b; Stice, Presnell, Gau, & Shaw, 2007b; Stice et al., 1998). While the original Dual Pathway Model was initially tested in a prospective sample of adolescent females (Stice, 2001; Stice et al., 1998), the results have been replicated in overweight adult females (Gagnon-Girouard et al., 2009), and male and female college students (Mason & Lewis, 2015; Ouwens et al., 2009). Furthermore, a report on the results of a randomized trial of a selective weight gain prevention program in male and female college students found that reductions in body dissatisfaction and negative affect fully mediated decreases in eating disorder symptoms in this sample (Rohde et al., 2018).

Similar findings were reported in other prospective studies not directly examining the Dual Pathway Model. These studies reported that body dissatisfaction, dieting, and negative affect were shared risk factors for eating disorder symptoms and weight gain, with affect regulation mediating these associations in at least one study (Goldschmidt et al., 2017; Goldschmidt et al., 2016; Goldschmidt et al., 2012). Additionally, a study in a military sample reported found factors from the Dual Pathway Model, including BMI, drive for thinness, body dissatisfaction, dietary restraint, and dieting, were all associated with increased odds of engaging in weight control behaviors (OR: 1.06-5.59), with this model accounting for 52% of the variance in weight control behaviors (Seibert, 2007). However, this study used logistic regression to test the effects of the model, and therefore only tested association, not mediation, in the model. So overall, the evidence suggests that the factors identified in the Dual Pathway Model, including dieting, body dissatisfaction, and negative affect, and their purported mediational mechanisms, including affect regulation, appear to represent important links between risk factors and the onset of eating disorder symptoms, weight gain, and obesity onset.

Therefore, the focus of this dissertation will be on eating disorder prevalence, including rates of eating disorders, rates of eating disorder symptoms, and rates of eating disorder risk classification. Additionally, the focus will be on examining correlates of eating disorder risk classification, including dieting and body dissatisfaction. Next, the study will examine associations between eating disorder symptoms and weight status, as indicated by BMI. The study will also test if facets of affect regulation related to dieting and body dissatisfaction, including psychological inflexibility related to body dissatisfaction and dieting, represent viable mechanisms linking eating disorder symptoms and weight status. Finally, this study will examine descriptions of eating behaviors and body image, and facets of the ROTC context that can potentially describe how and why dieting and body dissatisfaction develop within the ROTC context.

9. Epidemiology of Eating Disorders and Obesity in Young Adults/College Students

Even though most eating disorder symptoms present between the ages of 18-25 years, there are few nationally representative studies of eating disorder symptoms in college and university students. Reporting on 2007 data from the American College Health Association's National College Health Assessment (ACHA-NCHA), the American College Health Association reported on prior eating disorder diagnoses rates of 0.2-1% and 2-4% in males and females, respectively (American College Health Association, 2008). One cross-sectional time series study at a California public university reported that the rate of eating disorders was increasing across time from 7.9-25% in males and 23.4-32.6% in females and that this increase was associated with increased use of weight control behaviors (White, Reynolds-Malear, & Cordero, 2011). In a large sample of undergraduate students at a Midwestern university, Eisenberg et al. reported a prevalence of positive eating disorder risk screens of 3.6% and 13.5% for males and females,

respectively (Eisenberg et al., 2011). In an online survey of male and female college students from three universities, Quick and Byrd-Bredbenner reported that 20% and 25% of males and females reported fasting for at least 8 hours to control their weight, with about 25% endorsing binge eating in the past 28 days (Quick & Byrd-Bredbenner, 2013). Additionally 4-6% of participants reported using one of the following purging behaviors to control their weight: vomiting, use and abuse of laxatives and diuretics, and excessive exercise (Quick & Byrd-Bredbenner, 2013). Most recently, in a survey of eating disorder symptoms of undergraduate and graduate students at twelve universities and colleges, Lipson and Sonneville reported eating disorder risk rates of 11.9%, with those risks more prevalent in females (17%) compared to males (5.4%) (Lipson & Sonneville, 2017). Furthermore the authors reported that overall 40% of the sample endorsed items indicating objective binge eating, with this rate significantly higher in females (49% vs. 30%), and that 30% of the sample endorsed compensatory/purging behaviors, with no significant differences between males and females (31% vs. 29%) (Lipson & Sonneville, 2017). While there are limited data in college students from nationally representative samples, overall studies indicate that eating disorder risk and the presence of eating disorder symptoms amongst college student populations remain high, highlighting the importance of continued surveillance, screening, monitoring, and prevention of eating disorder risk and eating disorder symptoms.

Although evidence from etiologic models highlights the roles of dieting, body dissatisfaction, and negative affect in the development of eating disorder symptoms, these have not been carefully examined in college and universities students. In a longitudinal study of college females, Cooley et al. reported that increased body dissatisfaction predicted increased dieting and increased eating disorder symptoms (Cooley & Toray, 2001a; Cooley & Toray,

2001b). In a cross-sectional study of male and female university students, Forney and Ward identified a strong association between body dissatisfaction and eating disorder symptoms, with body dissatisfaction significantly predicting the presence of eating disorder symptoms in females, and weight status and body dissatisfaction strongly predicting eating disorder symptoms in males (Forney & Ward, 2013). A pair of studies in male and female college students reported on BMI, body dissatisfaction, and eating disorder risk and found that although females presented with a greater prevalence of eating disorder risk compared to males (19% vs. 10.5%), females and males did not differ in body dissatisfaction (65.2% vs. 68.6%) (Gitimu et al., 2016; Turel et al., 2018). In a ten-year longitudinal study on dieting and eating disorder symptoms following adolescents through young adulthood, Neumark-Sztainer et al. reported that the prevalence of dieting and eating disorder symptoms remains high across life stages, with eating disorder symptoms tending to track consistently from adolescence to adulthood, such that those individuals presenting with early eating disorder symptoms at highest risk for presenting those symptoms during young adulthood (Neumark-Sztainer et al., 2011). These findings suggest that prominent risk factors, including body dissatisfaction and dieting, are strongly associated with and predictive of eating disorder symptoms and that these symptoms persist from adolescence through adulthood, highlighting the importance of continuing to examine the role of these risk factors in the development and persistence of eating disorder symptoms in college and university students.

Young adults, including college and university students, have also experienced trends in weight gain and obesity development that complement rates observed in US adults. Additional importance is given to these trends since evidence suggests that eating and physical activity behaviors, as well as weight status trajectory, are established during the young adult years that

shape future risk for obesity and obesity-related comorbidities (Dunn, Liu, Greenland, Hilner, & Jacobs, 2000; Kvaavik, Andersen, & Klepp, 2005; Lien, Lytle, & Klepp, 2001; Lipsky et al., 2015; McTigue, Garrett, & Popkin, 2002; Morrell, Lofgren, Burke, & Reilly, 2012; Serdula et al., 1993; Spring et al., 2014; Votruba et al., 2014). Rates of overweight and obesity are reported to be 22% (27.5% males, 19.5% females) and 11.7% (11% males, 11.8% females) amongst college students, respectively (American College Health Association, 2017). Studies also report an average weight gain of 1.5-4.38 kg during the college years, with at least 60.9% of freshman in studies gaining weight (Vadeboncoeur, Townsend, & Foster, 2015). Additionally, those who gain the most weight gain 4.2-6.8 kg on average (Fedewa, Das, Evans, & Dishman, 2014; Pope, Hansen, & Harvey, 2017; Racette et al., 2008; Vella-Zarb & Elgar, 2009), and most of that weight gain is due to increased adiposity (1.17-3.6% body fat) (Fedewa et al., 2014; Gropper, Simmons, Connell, & Ulrich, 2012). In a study screening for risk factors of metabolic syndrome, 47% and 27% of males and females, respectively, were identified as overweight and obese, with 77% and 54% of males and females meeting at least one of the criterion for metabolic syndrome (Morrell et al., 2012). While lifestyle factors, such as dietary intake and physical activity, are commonly implicated in weight gain and obesity onset experienced during young adulthood, less often investigated factors, such as eating disorder symptoms (for example dieting, dietary restraint, binge eating, and body dissatisfaction) may also play a role (Bennett, Greene, & Schwartz-Barcott, 2013; Finlayson, Cecil, Higgs, Hill, & Hetherington, 2012; Kass et al., 2017; Racette et al., 2008; Vella-Zarb & Elgar, 2009). Since eating disorder symptoms typically onset during young adulthood (Hudson et al., 2007a), this age period remains an important time to examine how eating disorder symptoms might contribute to the onset of weight gain and obesity.

Young adults and college students are purported to experience maladaptive eating behaviors, including eating disordered symptoms, that may contribute to weight gain and obesity. One study utilizing a self-report screening tool in 1529 college students identified 15% of the sample as overweight and obese, with over half of those identified as overweight/obese screening at risk for eating disorders (Kass et al., 2017). Another study found that binge eating was associated with increased fat mass during the first year of college/university (Finlayson et al., 2012). While overall eating disorder symptoms tend to decrease during the college years, binge eating symptoms tend to maintain or increase, particularly in association with body dissatisfaction (Berg, Frazier, & Sherr, 2009). These findings suggest a likely association between eating disorder symptoms, and particularly binge eating, and weight gain/obesity in college students.

Previously discussed etiologic models suggested an important role for body dissatisfaction, dieting, negative affect, and affect regulation in relation to eating disorder symptoms and obesity. One study in first-year college males supported the role of negative affect and body dissatisfaction as important predictors of initiation and maintenance of eating disorder symptoms (Dakanalis et al., 2016). Additionally, Whiteside et al. reported that individuals identified as binge eaters had higher levels of food restriction, overvaluation of weight and shape, and emotion regulation difficulties (affect regulation) (Whiteside et al., 2007). Emotion regulation difficulties (affect regulation) were found to predict binge eating above these other factors, suggesting affect regulation represents an important mechanism explaining binge eating in college students (Whiteside et al., 2007). These findings were supported by a systematic review that reported a positive association between stress, eating disorder symptoms, and increased adiposity (Lyzwinski, Caffery, Bambling, & Edirippulige, 2018). Out of the 51 studies

reviewed, fifteen reported a positive association between stress and maladaptive eating behaviors, including emotional eating, binge eating, and disordered eating, while seven studies reported a positive association between stress and weight gain, body mass index, and body fat (Lyzwinski et al., 2018). The findings from these studies suggest that factors purported to result in eating disorder symptom development, including body dissatisfaction, dieting, negative affect, and affect regulation, are also present in college students, potentially resulting in increased eating disorder symptom development and weight gain/obesity.

Young adulthood/college students remain an important demographic in which to examine eating disorder symptoms and obesity. First, these conditions tend to develop and peak during young adulthood years (18-25 years). Once present, these conditions tend to track over time. Young adults also experience factors, such as body dissatisfaction and dieting, that contribute to development of eating disorder symptoms and obesity. They also experience higher levels of stress that may result in difficulties with affect regulation that further contribute to the development of eating disorder symptoms and obesity. Therefore, it is imperative that studies eating disorder symptoms and obesity continue to consider how these are developed and maintained during young adulthood.

10. Epidemiology of Eating Disorders and Obesity in Military Populations

Similar to college students, there are also limited studies of eating disorders in military samples. Studies of eating disorder diagnoses are comprised primarily of medical records review. One first such review was conducted by Antczak et al. in 2008 and reported on the average prevalence of eating disorder diagnoses per year between 1998-2006 (Antczak & Brininger, 2008). A more recent review of medical records was conducted by Williams et al. and reported on eating disorder diagnoses from the defense medical surveillance system between 2013-2017

(Williams, Stahlman, & Taubman, 2018). Overall prevalence of eating disorder diagnoses was 2.7 cases/10,000 person-years (Williams et al., 2018). Bulimia nervosa comprised 46.4% of cases, while other unspecified eating disorder comprised 41.8% of cases (Williams et al., 2018). Females comprised the majority of cases (67.5%) (Williams et al., 2018). Incidence rates were highest in the youngest age group, 18-24 years of age, amongst junior enlisted and junior officers, Army males, and individuals in combat occupations (Williams et al., 2018). The authors reported an overall eating disorder diagnoses rate of 0.30 % (0.04% anorexia nervosa, 0.13% bulimia nervosa, 0.13% eating disorders not otherwise specified), while it was previously reported that overall eating disorder diagnoses increased from 0.2% in 1998 to 0.4% in 2006 (Antczak & Brininger, 2008).

Two studies reported on eating disorder diagnoses using data from the Millennium Cohort, a 21-year longitudinal study to examine the health impacts of military service (Jacobson et al., 2009; Mitchell, Porter, Boyko, & Field, 2016; Ryan et al., 2007). Jacobson et al., who reported on initial data from the Millennium cohort using questions from the Patient Health Questionnaire, reported rates of eating disorder symptoms of 3.3% in females and 2.6% in males (Jacobson et al., 2009). In 2015, after two additional sets of data collection, Mitchell et al. also reported on the presence of eating disorder symptoms, as measured by questions on the Patient Health Questionnaire (Mitchell et al., 2016). Binge eating was reported by 3.6% of females and 4.8% of males, while use of purging behaviors was reported by 6% of females and 3.8% of males. In this study, the presence of post-traumatic stress disorder (PTSD) predicted weight gain, which was mediated by binge eating and purging behaviors, but only in males (Mitchell et al., 2016). While overall eating disorder diagnoses appear to be lower compared to community samples in medical record reviews, this may be partially explained by the fact that an eating

disorder diagnosis is grounds for medical discharge (Department of the Army, 2016). Overall, however, eating disorder symptoms appear to be increasing across time, particularly in females, and young adults.

Other military-specific studies have reported on eating disorder risk rates, the presence of eating disorder symptoms, and the use of unhealthy weight control behaviors using a variety of methodologies, including validated screening questionnaires, clinical interviews, and study-developed questionnaires. Two studies used a two-step process to screen individuals for eating disorder risk and to diagnose individuals identified at risk using a clinical diagnostic interview (Beekley et al., 2009; Lauder et al., 1999). In a sample of female active duty service members, Lauder et al. screened for eating disorder risk using the Eating Disorder Inventory-2 and a predetermined risk classification cut-off score (Lauder et al., 1999). Participants meeting this score were then referred for a clinical diagnostic interview (Lauder et al., 1999). Overall, 33.6% of participants met the eating disorder risk classification cut-off score, with 7.8% of participants diagnosed with an eating disorder, and 25.8% identified at risk for eating disorders (Lauder et al., 1999). Weight dissatisfaction was determined to be a significant predictor of the presence of eating disorder risk classification and eating disorder diagnoses (Lauder et al., 1999). Additionally, those with eating disorders had the highest drive for thinness and presence of eating disorder symptoms, based on the EDI subscales, while those identified with eating disorders and eating disorder risk classification had similar levels of body dissatisfaction, both which were 2x higher compared to individuals identified not at risk (Lauder et al., 1999). The most frequently endorsed dieting behavior was the use of a diet, which was endorsed by 42% with an eating disorder and 34.3% by those identified at risk, followed by binge eating, which was endorsed by 54.5% with an eating disorder and 20.8% at risk, and laxative use, which was

endorsed by 24.2% with an eating disorder, and 9.3% at risk (Lauder et al., 1999). One other study screened eating disorder risk using the Eating Attitudes Test-26 and a clinical diagnostic interview in a population of West Point cadets between 1995-2005, when all females and a random sample of males were screened for eating disorder risk (Beekley et al., 2009). The authors reported an eating disorder diagnosis prevalence of 5% in females and 0.1% in males over the seven-year time period (Beekley et al., 2009). Additionally, 19% of female cadets and 2% of male cadets met eating disorder risk classification cut-off scores (Beekley et al., 2009). While studies using validated eating disorder risk screens and clinical interviews demonstrate a high prevalence of eating disorders and eating disorder risk in military-related populations, these studies were conducted in primarily female samples over one to two decades ago.

Studies using only validated eating disorder risk screens also report comparable rates of eating disorder risk and eating disorder symptoms. McNulty examined the rates of probable eating disorder diagnoses in samples of Navy males, Navy female nurses, and female active duty service members using the Eating Disorder Inventory-2 (EDI-2) (McNulty, 1997a, 1997b, 2001). The overall rates of probable eating disorder diagnoses ranged from 1.1% for anorexia nervosa, 8.1-12.6% for bulimia nervosa, and 28-29% for eating disorder not otherwise specified in female samples, since overall rates were not reported for Navy males (McNulty, 1997a, 1997b, 2001). Participants also endorsed the following unhealthy weight control behaviors: 14.7-44% endorsed fasting or skipping meals, 14-22% endorsed binge eating, 2.1-9.7% endorsed laxative/diet pill/diuretic use, and 3-3.7% endorsed vomiting (McNulty, 1997a, 1997b, 2001). Use of logistic regression identified the following characteristics as significant predictors for a probable eating disorder diagnosis: binge eating, fasting/skipping meals, diuretic use, body dissatisfaction, weight concern, feeling overweight, and fear of being kicked out (McNulty, 1997a, 1997b,

2001). Lauder and Campbell also reported on eating disorder risk using the EDI-2 in a sample of female ROTC cadets (Lauder & Campbell, 2001). Lauder and Campbell reported that 20% of female ROTC cadets in the sample met the eating disorder risk classification cut-off scores (Lauder & Campbell, 2001). Although the sample mean BMI was 22.7 kg/m^2, 85% of the sample reported wanting to weigh less, and 59% of individuals identified at risk were weight dissatisfied compared to 33% of individuals not identified at risk (Lauder & Campbell, 2001). In examining the EDI-2 subscales, those identified at risk had body dissatisfaction scores that were 2x higher than those not identified at risk (Lauder & Campbell, 2001). The most endorsed eating disorder symptoms reported by those identified at risk were diet pill use (55%), binge eating (35%), and vomiting (15%) (Lauder & Campbell, 2001). In a sample of initial military recruits, Warner et al. screened for eating disorder risk using the Eating Attitudes Test-26. The authors identified 9.8% of participants as meeting the eating disorder risk classification cut-off score, which included 28.6% of females and 7% of males (Warner et al., 2007). The authors reported that those with overweight status (2.21 OR) and female sex (5.58 OR) had the highest likelihood for meeting eating disorder risk classification cut-off scores (Warner et al., 2007). Studies using self-report eating disorder risk classification measures differed in the type of samples they used, their reporting of eating disorder risk vs. probable eating disorder diagnoses, their reporting of eating disorder symptoms, and reporting of potential risk factors and correlates. The most significant predictors for eating disorder risk classification in these samples appear to be sex, the presence of binge eating and at least one compensatory/purging behavior, body dissatisfaction, and weight status. These samples were also limited by the use of primarily female samples, samples from various military populations, the use of self-report eating disorder risk classification measures, with most studies conducted over one to two decades ago.

One additional group of studies looked at various weight control behaviors used by military service members to meet military standards. The first study was conducted out of the US Army Research Institute of Environmental Medicine and included a random sample of Army active duty military service members who completed a survey on weight control behaviors (Rose et al., 1993). Overall, 73% of the sample was currently trying to lose weight, even though only 16% of the sample was identified as overweight (Rose et al., 1993). Additionally, when asked about weight control methods, the most commonly endorsed methods were diet (52%), exercise (28%), and drugs (diet pills, laxatives, diuretics) (6.2%). When asked about reasons for losing weight, the most cited reason was appearance (43%), followed by health (33%), and military weigh-in (20.9%) (Rose et al., 1993). Sweeney et al. also examined weight control behaviors in a sample of Army reserve soldiers and the most commonly endorsed methods were diet (26.5%), diet pills (26%), diuretics (19.6%), and laxatives (12.3%) (Sweeney & Bonnabeau, 1990). In a sample of Navy sailors, Carlton et al. examined weight control behaviors in relation to meeting the physical fitness standards (Carlton et al., 2005). Generally, 53% of the sample reported being dissatisfied with their bodies, and 41% reported a fear of gaining weight (Carlton et al., 2005). The most commonly reported weight loss methods were binge eating (31-39%), fasting (25%), and diet pill use (18%) (Carlton et al., 2005). The authors reported that a higher BMI predicted more eating disorder symptoms and worry about meeting the standards (Carlton et al., 2005). A more recent study reported on the weight control behaviors used by Army ROTC cadets from Army ROTC programs in Florida colleges and universities in 2017 (Wilson & James, 2018). Weight control behaviors included increasing physical activity (80%), reducing sweets (16%), reducing fried foods (59%), fasting (15%), protein shakes (14%), and skipping at least one meal (12%) (Wilson & James, 2018). Most cadets were classified as having a normal weight BMI

(63%), while 30% were classified as overweight, and 6% were classified as obese (Wilson & James, 2018). Male cadets were more likely to be classified as overweight and obese, and 5.3-18.8% of Cadets reported being very dissatisfied to dissatisfied with their weight, with females more likely to report weight dissatisfaction (Wilson & James, 2018).

No military studies have examined risk factors for eating disorders and eating disorder symptoms, since no prospective or experimental trials have been conducted in military samples. Some military studies have examined correlates of eating disorders and eating disorder symptoms using a wide variety of eating disorder screening tools and analytic methodologies. The majority of studies report that bulimia nervosa and symptoms of binge eating and purging behaviors are the most commonly reported eating disorders and eating disorder symptoms in military populations (Antczak & Brininger, 2008; Lauder & Campbell, 2001; Lauder et al., 1999; McNulty, 1997a, 1997b, 2001; Mitchell et al., 2016; Williams et al., 2018).

Biological correlates investigated included: age, sex, race/ethnicity, and weight status. Three studies reported a significant association between eating disorder risk classification or level of eating disorder symptoms and age, with eating disorder symptoms most commonly reported in young adults (McNulty, 2001; Mitchell, Rasmusson, Bartlett, & Gerber, 2014; Williams et al., 2018). Four studies reported female sex was significantly associated with eating disorder risk classification or eating disorder symptoms (Antczak & Brininger, 2008; Carlton et al., 2005; Warner et al., 2007; Williams et al., 2018). Race and ethnicity were significantly associated with eating disorder risk classification in two studies, with eating disorders most commonly reported by individuals identifying as White/Caucasian (Antczak & Brininger, 2008; Williams et al., 2018). Only two studies examined self-reported weight status and found that an overweight BMI (>25 kg/m^2) was associated with eating disorder symptoms (Carlton et al.,

2005; Warner et al., 2007). Therefore, there is some evidence for the association between biological correlates, eating disorder risk classification, and eating disorder symptoms in military populations.

A few studies have examined sociocultural correlates of eating disorder classification and eating disorder symptoms, such as drive for thinness. While some studies have reported on appearance pressures, these were mainly described as pressures to meet military weight requirements and will be discussed further when discussing military contextual factors. Only two studies reported on drive for thinness, measured using the EDI-2 (Garner et al., 1983), and found that drive for thinness scores were significantly higher in individuals classified as meeting eating disorder risk cut-off scores (Lauder & Campbell, 2001; Lauder et al., 1999). While drive for thinness appears to be a correlate of eating disorder risk classification, this was only examined in females.

Similarly, only a few studies have examined psychological correlates of eating disorder risk classification and eating disorder symptoms in military population. Two studies reported that having a diagnosis of PTSD or depression was significantly associated with eating disorder symptoms (Mitchell et al., 2016; Mitchell et al., 2014). At the same time, only a few studies have examined etiologic factors, such as dieting, body dissatisfaction, and negative affect in association with eating disorder risk classification and eating disorder symptoms. For example, three studies reported that dieting was significantly higher in individuals meeting eating disorder risk classification or was found to be a correlate with eating disorder risk classification (Jacobson et al., 2009; Lauder & Campbell, 2001; Lauder et al., 1999). Three studies also reported that body dissatisfaction was more prevalent in individuals meeting eating disorder risk classification (Lauder & Campbell, 2001; Lauder et al., 1999; McNulty, 1997a), while only one study reported

negative affect (measured as depression) as significantly associated with eating disorder risk classification (Mitchell et al., 2014). Very few studies have examined important risk factors or correlates for eating disorders and eating disorder symptoms, such as sociocultural factors, psychological factors, and other etiological factors, in military populations. Furthermore, many used instruments developed for eating disorder populations or researcher-developed tools and examined these factors primarily in female samples. None of these studies examined these factors in a mixed sample of male and female ROTC cadets.

Researchers have also sought to describe how military contextual factors may be associated with eating disorder risk classification and eating disorder symptoms. One challenge has been that the military context has not been adequately described by these studies. As a result, most studies investigate these factors using specific questions designed for each study sample, which may limit comparability across samples. The most commonly reported factors included rank, branch of service, and pressure to meet military weight requirements. For example, most studies reported that rank (enlisted vs. officer) was not significantly associated with eating disorder risk classification or eating disorder symptoms, while two studies found that these were more common in junior enlisted and junior officers, as well as female cadets in their second and third years (Antczak & Brininger, 2008; Beekley et al., 2009; McNulty, 1997a, 1997b, 2001; Williams et al., 2018). Three studies examined rates of eating disorder risk classification and eating disorder symptoms across branch of service and reported the highest rates amongst female Marines (Antczak & Brininger, 2008; McNulty, 2001; Williams et al., 2018). While rank was not found to be significantly associated with eating disorder risk classification or symptoms for most studies, the studies that did report an association with rank may potentially be reflecting rank as

an artifact of age, suggesting these are more common in military young adults, as previously hypothesized.

Several studies also described the role of military weight standards by asking participants specific questions about weight standards. For example, Lauder et al. (1999) asked about the most common external pressure for eating behaviors and reported that military pressure about weight was reported at a higher rate by females meeting eating disorder risk classification cut-off scores. Similarly, several studies reported a significant association between eating disorder risk classification and eating disorder symptoms and related questions about military weight standards (e.g. testing periods, being forced into a weight program, military weight standards, mandatory physical fitness, and worry about physical fitness assessments) (Carlton et al., 2005; McNulty, 1997b, 2001). Other studies also described factors such as: exercising for weight loss, the military environment, feeling overweight, stress, supervisor harassment for weight, fear of being kicked out, and no help available (Lauder et al., 1999; McNulty, 1997b, 2001). Overall, it is difficult to interpret these findings due to a lack of a clear definition of military contextual factors. Therefore, a working definition of the military context and military contextual factors will be explored next.

Just like the sociocultural context creates an environment in which sociocultural facets, such as body image ideals (e.g. thinness for females, and leanness/muscularity for males) and appearance-related comments communicated by the media, family, and peers, result in sociocultural risk factors, such as appearance pressure and body image ideal internalization, there is also likely a sociocultural context related to the military, which this dissertation will refer to as the military context/military cultural context. However, unlike the sociocultural context that

results in sociocultural risk factors, the military context has not been as well defined or described, at least in military studies on eating behaviors.

Most studies describing the military context, to include military culture, come from research on stigma related to seeking help for mental health concerns (Britt et al., 2008; Brooks, 2010; Greene-Shortridge, Britt, & Castro, 2007; Hoge et al., 2004; Lunasco, Goodwin, Ozanian, & Loflin, 2010; Sharp et al., 2015; Shields, Kuhl, & Westwood, 2017; Westphal & Convoy, 2015). The military represents its own unique culture since it has its own "language, code of manners, norms of behaviors, belief systems, dress, and rituals" (pg. 24)(Reger, Etherage, Reger, & Gahm, 2008). The military culture is further defined by characteristics unique to its culture and environment, such as the chain of command structure, military norms, and military identity (Meyer & Wynn, 2018). For example, the chain of command represents a power hierarchy that identifies "a service member's rightful place…service members' relationship with each other…[and] appropriate behavior based on service members' role and status" (pg. 76) (Meyer & Wynn, 2018). One important delineation typically made with respect to the chain of command is that of rank, for example, being an enlisted members versus an officer. Enlisted members are subordinate to and must follow orders given by commanding officers, while officers must ensure the safety and ultimately accept responsibility for actions of enlisted members under their command.

Another important aspect of military culture is military norms. Norms represent the various "beliefs, values, traditions, behaviors, and events" that comprise every day military life (Meyer & Wynn, 2018). During initial military training, new military recruits are indoctrinated to various behaviors and beliefs understood to be essential to accomplish their warfighting mission (McGurk, Cotting, Britt, & Adler, 2006). For example, central values to the Army, such

as loyalty, duty, respect, selfless service, honor, integrity, and personal courage, are contained in the Army Values and the Soldier's Creed (US Army). Similarly, within the Soldier's Creed, the Warrior Ethos espouses, "I will always place the mission first. I will never accept defeat. I will never quit. I will never leave a fallen comrade" (US Army). These norms, in turn, enable civilians to become Soldiers' and allow them to learn to "thrive and survive in combat environments" (pg. 509) (Lunasco et al., 2010).

Military norms also help shape the military identity, which has been described as a "warrior ethos" (Castro & Adler, 1999). Part of the warrior ethos embraces conformity to military norms because these help promote group cohesion, which is seen as essential to mission success (King, 2006). The warrior ethos, as defined by the Center for Strategic and International Studies (1988), is "a code that expects individuals to aggressively engage and defeat an armed enemy in battle, promoting and valuing traits of moral and physical courage, tactical skills, emotional and physical stamina, loyalty to comrades and determination to accomplish the tactical mission regardless of personal risk" (pg.4-5) (Buckingham, 1999). As a result of these various facets of military culture, such as chain of command, military norms, and military identity, Gabriel (1988) suggests the military services seek to indoctrinate civilians into a sense of "stoicism, agency, and belonging" in order to cultivate "high standards of self-discipline and emotional control," "a valued group identity," and a "strong warrior persona that is aggressive, dominant, and risk taking, and that precludes experience or expressions of weakness" (pg. 216) (Shields et al., 2017).

Several lines of research suggest that aspects of military culture and context, which may be effective for indoctrinating civilians into warriors that win the nation's wars, may also be potentially harmful, especially when they clash with other cultural contexts, such as healthcare

culture (Shields et al., 2017; Skopp et al., 2012). For example, Skopp et al. (2012) suggests that facets of warrior ethos that emphasize stoicism, agency, and self-discipline, while omitting expressions of weakness, may prevent help-seeking and use of mental health services. Similarly, other researchers suggest that the warrior ethos may cultivate a sense of vulnerability, stigma, and shame, since experiencing trauma and mental health conditions clash directly with warrior ethos (Linford, 2013; Oliffe & Phillips, 2008; Shields et al., 2017). This is evidenced in reports on rates of service members seeking help for mental health conditions, reported barriers to seeking help (e.g. concerns about stigma, lack of trust in mental health professionals), and perceptions of career impact for seeking help (e.g. negative impact to career, different treatment by coworkers) (Britt et al., 2008; Brooks, 2010; Greene-Shortridge et al., 2007; Hoge et al., 2004; Lunasco et al., 2010; Sharp et al., 2015; Shields et al., 2017; Westphal & Convoy, 2015). One underexplored area in the military is stigma related to overweight and obesity. Since the warrior ethos promotes strength, being overweight and obese may potentially be seen as a lack of discipline and a sign of weakness. Schvey et al. (2017) assessed the experience of weight-based stigma in active duty personnel and reported that nearly half of participants experienced weight stigma, with respondents reporting being mocked, punished with additional physical training sessions, and denied career advancement and opportunities because of weight and shape. Furthermore, respondents reported coping with weight stigma by engaging in unhealthy weight control behaviors, such as binge eating, purging, use of body wraps, and liposuction (Schvey et al., 2017). Taken together, these findings suggest that while the military culture and context may be helpful and even necessary to produce effective warriors for the battlefield, it may also clash with other cultures in ways that makes service members more vulnerable to the impacts of

stigmatizing conditions, such as mental health conditions, eating disorder symptoms, and obesity.

Another important facet of the military culture and context are the policies and regulations that govern the military services. In the US Army, many of these policies and regulations appear to reinforce the warrior ethos in ways that might similarly stigmatize service members that do not adhere to expected military norms. For example, the Army has several regulations and policies related to physical fitness, appearance, and body composition. In terms of physical fitness, Field Manual 7-22: Army Physical Readiness Training, states the following (Department of the Army, 2012):

> "The personal appearance and physical qualifications of the Physical Readiness Training (PRT) leader affect his effectiveness. He should exemplify the things he is seeking to teach. It is a great advantage if the leader himself can do all and more than he asks of his men. He must be physically fit because PRT leadership is so strenuous that considerable strength, endurance, and mobility are essential prerequisites for success (pg. 3-1)."
>
> "General of the Army Omar N. Bradley: The American soldier demands professional competence in his leaders in battle; he wants to know that the job is going to be done right, with no unnecessary casualties. The non-commissioned officer wearing the chevron is supposed to be the best Soldier in the platoon, and he is supposed to know how to perform all duties expected of him. The American soldier expects his sergeant to be able to teach him how to do his job and expects even more from his officers (pg. 3-1)."
>
> "Good posture has many values for the Soldier. First, a Soldier is often judged by his appearance-the man with good posture looks like a good Soldier, he command attention. Secondly, it is an accepted psychological fact that good posture is associated with good morals, a man with good posture feels better and is more positive. A man with poor posture cannot feel as positive, consequently he may develop a negative and discouraged attitude. Thirdly, good posture permits the body to function most efficiently (pg. c-1)."

Similarly, Army Regulation 670-1: Wear and Appearance of Army Uniforms and Insignia, states (Department of the Army, 2014):

> "The Army is a profession. A soldier's appearance measures part of his or her professionalism. Proper wear of the uniform is a matter of personal pride for all soldiers. It is indicative of esprit de corps and morale within a unit. Soldiers have an individual responsibility for ensuring their appearance reflects the highest level of professionalism.

> Leaders, at all levels, have a responsibility for implementing and applying the standards contained in this regulation to ensure the best interest of the Army, including shared traditions and customs (pg. 1)."
>
> "A vital ingredient of the Army's strength and military effectiveness is the pride and self-discipline that American Soldiers bring to their service through a conservative military image. It is the responsibility of commanders to ensure that military personnel under their command present a neat and soldierly appearance. Therefore, commanders must determine a Soldier's compliance with standards (pg. 4)."

Within the military services, a soldier's appearance is paramount to demonstrating facets of the warrior ethos, such as discipline, strength, effectiveness, pride, and professionalism. Leaders, especially officers, are expected to exemplify these attributes.

Another regulation that governs military appearance is Army Regulation 600-9: The Army Body Composition Program (ABCP), which states (Department of the Army, 2013):

> "The primary objective of the ABCP is to ensure all Soldiers achieve and maintain optimal well-being and performance under all conditions (pg. 1)."
>
> "Secondary objectives of the ABCP are to: (1) assist in establishing and maintaining—(a) Operational readiness; (b) Physical fitness; (c) Health; (d) A professional military appearance in accordance with Army Regulation (AR) 670–1 and to (2) Establish body fat standards-Soldiers must maintain a high level of physical readiness in order to meet mission requirements. Body composition is one indicator of physical readiness that is associated with an individual's fitness, endurance, and overall health (pg. 1)."
>
> "Individuals with desirable body fat percentages generally exhibit increased muscular strength and endurance, are less likely to sustain injury from weight bearing activity and are more likely to perform at an optimal level. Soldiers will meet Army body composition standards, as prescribed in this regulation, for the individual and collective benefit to themselves, their unit, and the entire Army (pg. 1)."

The previous version of this regulation, The Army Weight Control Program (AWCP), published in 2006, stated (Department of the Army, 2006):

> "The primary objective of the AWCP is to insure that all personnel—(1) Are able to meet the physical demands of their duties under combat conditions.; (2) Present a trim military appearance at all times (pg. 1)."

> "Excessive body fat (1) Connotes a lack of personal discipline; (2) Detracts from military appearance; (3) May indicate a poor state of health, physical fitness, or stamina (pg. 1)."
>
> "Objectives of the AWCP are to—(1) Assist in establishing and maintaining—(a) Discipline; (b) Operational readiness.; (c) Optimal physical fitness; (d) Health; (e) Effectiveness of Army personnel through proper weight control (pg. 1)."
>
> "The Army traditionally has fostered a military appearance that is neat and trim. Further, an essential function of day-to day effectiveness and combat readiness of the Army is that all personnel are healthy and physically fit. Self-discipline to maintain proper weight distribution and high standards of appearance is essential to every individual in the Army (pg. 1)."

Even Army body composition and appearance regulations define a soldier's appearance as an aspect of warrior ethos and relegate excessive body fat and an appearance that is not trim as indicating lack of discipline, stamina, and combat readiness, the opposite of warrior ethos.

One last example of the codification of appearance as an essential component of military culture and context is Army Doctrine Publication No. 6-22: Army Leadership, which stated (Department of the Army, 2012.):

> "Attributes shape how an individual behaves and learns in their environment. The leader attributes are character, presence, and intellect. These attributes capture the values and identity of the leader (character); the leader's outward appearance, demeanor, action, and words (presence); and the mental and social faculties the leader applies in the act of leading (intellect) (pg. 6)."
>
> "The impression a leader makes on others contributes to success in getting people to follow. This impression is the sum of a leader's outward appearance, demeanor, actions, and words and the inward character and intellect of the leader. Presence entails the projection of military and professional bearing, holistic fitness, confidence, and resilience. Strong presence is important as a touchstone for subordinates, especially under duress. A leader who does not share the same risks (pg. 6)."

Thus, not only are individuals' physical, intellectual, and operational capabilities judged by their outward physical appearance, this appearance is also an expected attribute of leaders. Failure to

meet these expectations may result not only in failure to adhere to the warrior ethos, but likely also rejection and potentially stigma from other members of the military culture and context.

Therefore, one potentially unexplored correlate and factor related to eating behaviors is the military culture and context. While some studies have attempted to examine this association in relation to eating behaviors, in particular eating disorder risk classification and eating disorder symptoms, most studies lacked a definition of the military culture and context. The strongest aspects of the military culture and context that may likely be related to eating behaviors are Army policies and regulations, such as the Army Body Composition Program, that set body composition parameters, weight-based stigma, as well as the expectations for body image that are expressed through these policies and programs, including a trim, neat, strong, fit appearance.

Additional evidence regarding the role of the military culture and context on influencing eating behaviors comes from qualitative studies in military populations. One of the first qualitative studies in military service members was conducted by Smith, Klosterbuer, and Levine (2009) in a sample of primarily male military veterans. The veterans discussed aspects of military culture, such as learning to eat fast during boot camp and coping with military stress using foods. These habits were continued even after leaving the service and becoming less physically active, which may have contributed to the high rates of overweight and obesity of this sample (87%) in conjunction to the lack of education on proper exercise and eating habits after discharge (Smith et al., 2009). Similar themes were discussed by female veterans in a set of studies by Breland and colleagues. For example, female veterans also discussed learning to eat a large amount of food quickly as part of military training, which resulted in weight gain over time (Breland, Donalson, Nevedal, Dinh, & Maguen, 2017). Similarly, female veterans also used foods, especially sweets, to cope with stress and negative affect or as rewards (Breland et al.,

2017). Unlike the previous study, female veterans spent more time discussing the "battle to make weight," which resulted in scrutiny and judgements over eating habits and appearance, leading some to develop eating issues (Breland et al., 2017). Some female veterans also discussed using eating disorder symptoms, like binge eating and purging, to cope with stress, negative affect, and bullying due to gender, as well as exert control in a strict military environment where they felt they had no control (Breland et al., 2017). Similar to the previous study, female veterans also felt their poor eating habits remained after leaving the service, especially because they felt unsupported by the military after discharge (Breland et al., 2017).

Some of these findings were also reported in other samples of female veterans. For example, in a sample of female veterans that experienced military-related trauma, many reported using binge eating and purging behaviors for emotion regulation (e.g. to deal with guilt, shame, and negative affect) (Breland, Donalson, Dinh, & Maguen, 2018). And while binge eating and purging provided short term relief, these also resulted in additional negative affect, that served to reinforce binge eating and purging (Breland et al., 2018). When asked about treatment preferences for eating disorders, one sample of female veterans emphasized the importance of teaching veterans who separate from the military important skills of daily living, such as shopping, cooking, and eating, given the young age of most individuals who enter the military (Breland, Donalson, Dinh, Nevedal, & Maguen, 2016). Female veterans also desired assistance with learning how to cope with emotions, self-esteem, and weight-related stigma (Breland et al., 2016). Aspects of the military culture and context, such as military training, meeting military weight standards, and military stress, contribute to the development of eating behaviors, such as eating fast, binge eating, and purging, as ways to cope with these contextual factors. Most of these behaviors are maintained after leaving the service, potentially contributing to eating

disorder symptoms, weight gain, and obesity, due to lack of support and nutrition education to assist with transition out of the military context for veterans. Therefore, there is a need to screen for eating disorder symptoms as well as nutrition education needs for veterans transitioning out of the military.

Other qualitative studies have examined different aspects of the military culture and context, such as socioecological factors. For example, Jay, Mateo, Squires, Kalet, and Sherman (2016) examined the personal experiences of male and female military veterans related to health behaviors, including barriers and facilitators. When describing the impact of military service on health behaviors, participants discussed facets related to the socioecological model, such as individual factors, environmental factors, and policy level factors (Jay et al., 2016). The authors reported that important military culture and contextual factors included pressure to maintain weight and fitness, with an emphasis primarily on physical fitness and lack of support and education regarding healthy eating and healthy food choices (Jay et al., 2016). As a result, many veterans felt they gained weight once chronic conditions, pain, and injuries interfered with regular physical activity, with many even suggesting exercise was the most important component of managing a healthy weight (Jay et al., 2016). Environmental aspects of military service described included the regimented exercise structure promoted by the military that allowed veterans to maintain a healthy weight and level of physical fitness, but that was not present once veterans left the service (Jay et al., 2016). Policy level aspects of military service impacting health behaviors included the lack of support and services, including nutrition education, upon leaving the military, which many veterans felt left them unprepared to maintain health behaviors and habits (Jay et al., 2016). According to this study, aspects of military service and culture, such as an emphasis on fitness and weight, and structured exercise regiments, while beneficial in

promoting fitness and healthy weights for service members while in the service, may be lacking important components, such as nutrition education and emphasis on healthy eating, to support service members once they transition out of the military services, leaving many veterans vulnerable to unhealthy lifestyle choices.

Another qualitative study also examined factors that influence health behaviors in Air Force active duty service members (Hatzfeld, Nelson, Waters, & Jennings, 2016). Participants similarly discussed aspects of the military culture and context that influenced health behaviors (Hatzfeld et al., 2016). For example, physical fitness and body composition standards were an important determinant of health behaviors (Hatzfeld et al., 2016). However, these standards were viewed more as required for employment rather than a motivator and contributor to health. As a result, many participants felt the standards negatively impacted health because of unhealthy behaviors adopted in preparation to meet these standards, such as stress related to the standards or trying to lose weight quickly (Hatzfeld et al., 2016). In contrast to the study by Jay and colleagues, participants in this study viewed structured physical activity as a negative aspect contributing to health, either because it contributed to increased risk of injury or did not provide a challenging enough physical training session (Hatzfeld et al., 2016). A lesser discussed aspect of military culture and context, leadership, was also discussed by participants. Participants reported that leaders had an important role in developing and supporting health behaviors both through explicit and implicit support of health behaviors. For example, subordinates felt leaders needed to model and "lead by example," when it came to health behaviors by participating in physical activity, having a healthful diet, and performing well on physical fitness assessments (Hatzfeld et al., 2016). Participants also felt leaders needed to support health behaviors by developing and honoring policies that allowed time for healthy meals and physical activity

during the duty day, while not adding additional stress that prevented adoption of health behaviors (e.g. mandatory weekend fitness program and extended work days) (Hatzfeld et al., 2016). Military physical fitness and body composition standards were again discussed as an important influence of eating behaviors. Rather than supporting healthy behavior changes, such as healthier eating and regular physical activity, service members suggested that the stress and pressure around meeting the standards promotes unhealthy behaviors, such as trying to lose weight quickly. Unlike previous studies, mandatory physical fitness was viewed negatively as in potentially contributing to injuries or lack of adequate training. A newly discussed theme was the role of leadership in supporting healthy behaviors, either by modeling and living healthfully, or by creating and developing policies that support the health behaviors of subordinates. Findings from this study suggest an important role for leadership in both the culture of health behaviors within the military, for example with how body composition standards are implemented, as well as creating a context that enables health behaviors, through policies, education, and enforcement of those policies.

The leadership role of military members was also explored by Jayne et al. (2019) in a study of the nutrition-related attitudes, beliefs, and knowledge of Army drill sergeants. Army drill sergeants were viewed as important informants due to their role in the acculturation of civilians into soldiers during initial military training and their potential to instill healthy behaviors and eating attitudes into the military culture and context (Jayne et al., 2019). While drill sergeants are viewed as important mentors and coaches that instill military behaviors and values into new recruits, they viewed their role as primarily focusing on training and leading soldiers, and not teaching soldiers how to eat healthfully or instilling healthy behaviors in soldiers (Jayne et al., 2019). At the same time, drill sergeants considered “physical fitness” and

"a fit appearance" as key attributes in the "ideal soldier" (pg. 71) (Jayne et al., 2019). When probed further on why they felt that despite a military cultural and contextual emphasis on fitness and a fit appearance it wasn't their job to instill nutrition habits that support fitness, drill sergeants expressed a lack of confidence in their own nutrition knowledge and ability to give nutrition instruction due to a lack of proper training and preparation (Jayne et al., 2019). Findings from this study, in agreement with previous qualitative studies, suggest that fitness and a fit appearance are key attributes of the military culture and context but that soldiers, especially leaders, may be lacking adequate nutrition knowledge and preparation to support development of healthy eating and exercise habits in their soldiers that enable fitness and a fit appearance.

A more recent qualitative thesis investigated the nutrition knowledge and dietary habits of ROTC cadets (Nevarez, 2017). ROTC cadets were selected because of their future roles as leaders and mentors of soldiers, which is in line with the previous qualitative studies suggesting an important role for leaders in shaping eating behaviors within the military culture and context (Hatzfeld et al., 2016; Jayne et al., 2019; Nevarez, 2017). While not discussed explicitly by the cadets, the author reported that cadets that fail to meet weight standards are counseled by cadre members, who are commissioned and senior non-commissioned officers that serve as their military ROTC instructors. However, this counseling does not include advice to seek assistance from a dietitian, likely because there are no dietitians assigned directly to ROTC (Nevarez, 2017). Cadets in this study discussed that nutrition was something that was not emphasized in the ROTC program until it came time for physical fitness and body composition assessments (Nevarez, 2017). Therefore, some cadets reported making changes to their eating habits 5-7 days before the assessments, while other cadets made little to no changes to their eating habits (Nevarez, 2017). Cadets who were more stressed about the assessments because they might not

meet the standards were more likely to report more extreme measures, such as skipping meals or fasting (Nevarez, 2017). At the same time, cadets reported receiving minimal assistance from the cadre members, which mostly consisted of encouragement to "do as much cardio as they can" (pg. 35) (Nevarez, 2017). As a result, most cadets relied on other cadets, such as kinesiology majors, for nutrition and exercise advice for body composition management (Nevarez, 2017). Findings for this study also support previously reported findings about the important role of leadership in shaping eating behaviors within the military culture and context, with a current lack of active participation of leaders in these roles. Similarly, the physical fitness and body composition standards were also military cultural and contextual aspects that were central to many ROTC cadets' experiences related to eating behaviors in ROTC. Finally, a lack of nutrition education both for the cadets and cadre seems to limit the potential impact of nutrition in shaping eating behaviors within the military culture and context.

Findings from these military qualitative investigations suggest that the military culture and context plays an important role in shaping the eating behaviors and eating attitudes of service members from their initial military training (basic training, ROTC) throughout their career, and even extending into their separation from the military services. Within the military culture and context, participants assigned an important role to physical fitness and body composition standards, their enforcement, as well as lack of nutrition education and support to healthfully meet these standards. Similarly, while leaders were expected to both model healthy behaviors and enact policies that supported healthy behaviors, most leaders failed to do so, likely due to a lack of confidence in their own nutrition knowledge and preparation. Taken together, these findings suggest an import role for eating behaviors and nutrition knowledge to healthfully support aspects of the military culture and context, such as physical performance and a fit

appearance, which contribute to operational readiness. However, lack of these supports potentially results in negative consequences in response to trying to achieve military ideals for fitness and body image, such as a negative body image, stress, negative affect, unhealthy coping behaviors, and engagement in unhealthy weight control behaviors (e.g. binge eating and purging behaviors).

Findings from military quantitative and qualitative studies on eating behaviors suggest there are important correlates to eating disorder risk classification and eating disorder symptoms present within the military culture and context. Outside of the military culture and context, traditional risk factors such as biological risk factors (e.g. sex, race, ethnicity, weight status), sociocultural risk factors (e.g. body image ideal internalization, appearance pressure), psychological risk factors (e.g. negative affect), and etiologic factors (e.g. dieting, body dissatisfaction, negative affect) are present within military environments and have been associated with eating disorder risk classification and eating disorder symptoms. Beyond traditional risk factors, there are also military culture and contextual factors that may also contribute to development of eating disorders and eating disorder symptoms, such as meeting military body composition standards and military body image expectations, which may additionally exacerbate traditional risk factors. Thus, military service members experience factors such as problematic thoughts about weight and shape, including body dissatisfaction, and unhealthy weight control behaviors, such as binge eating, fasting, and diet pill/laxative/diuretic use, all which can contribute to eating disorder risk and eating disorder symptoms, and potentially weight gain and obesity, that are prevalent in levels equivalent or higher to similar civilian populations, such as college students. However, only two studies have examined some of these factors quantitative or qualitatively in ROTC cadets.

Unlike in civilian populations, the Department of Defense (DoD) has attempted to limit the prevalence of overweight and obesity by setting body composition, appearance, and physical fitness standards, which are presumed to motivate the adoption of physical fitness and nutrition habits that promote operational readiness, appearance, and health (Friedl, 2012). Military service members are evaluated for weight status (BMI) and body composition at least semi-annually (Department of the Army, 2013; US Department of Defense, 2002). Military members are first screened using an age- and sex-specific BMI- based weight-for-height screening table, with an average cut off BMI of 25 kg/m^2 for females and 27.8 kg/m^2 for males (Department of the Army, 2013; US Department of Defense, 2002). Military members meeting screening weights are assumed to be compliant with age- and sex-specific percent body fat limits (Department of the Army, 2013; US Department of Defense, 2002). Although the DoD sets body fat standards at 18% for males and 26% for females, each service was allowed to specify a maximum allowable body fat, which was determined to be 20% for males and 30% for females for the US Army, with 2% increments by age, and a maximum total allowable body fat of 26% and 36% for the oldest categories of soldiers (Department of the Army, 2013; US Department of Defense, 2002). Service members exceeding weight-for-height screening tables are then assessed for percent body fat using the DoD circumference measurements and regression equations, which include serial measurements of neck and waist circumferences for males and serial measurements of neck, waist, and hip circumferences for females (Department of the Army, 2013; US Department of Defense, 2002). Service members found to exceed percent body fat standards are referred for disciplinary counseling, which includes unfavorable personnel actions, and enrollment into service-specific weight management programs (Department of the Army, 2013; US Department of Defense, 2002).

Despite the existence and enforcement of occupational body composition standards, including physical fitness programs and mandatory service-specific weight management programs, the military is not immune to trends in overweight and obesity observed in civilian populations. Military service members are not included in nationally representative surveys on nutrition, eating behaviors, and weight status, such as the National Health and Nutrition Examination Survey. So the military collects data on overweight and obesity using a variety of methods, including the Department of Defense Health Related Behaviors Survey, which is a repeated cross-sectional survey that randomly selects a nationally representative samples of military service members every five years (Meadows et al., 2018); the Medical Surveillance Monthly Report, which reviews medical records for medical diagnoses codes of overweight and obesity to report on prevalence and trends of overweight and obesity (Clark & Taubman, 2016); data from a longitudinal sample of military members and veterans (Rush, LeardMann, & Crum-Cianflone, 2016); and for the US Army, data from the Comprehensive Soldier and Family Fitness Global Assessment Tool (GAT), an annual screening for behaviors related to resilience, performance, and military readiness (Purvis, Lentino, Jackson, Murphy, & Deuster, 2013). All of these data sources, except for medical records reviews, use self-reported height and weight, resulting in different rates of overweight and obesity across military populations.

The most recent Department of Defense Health Behavior Survey, conducted in 2015, reported the prevalence of overweight and obesity at 51.0% and 14.7%, respectively (which was 48.1% and 12.7% in young adults), with the highest prevalence of obesity in the Army (18.5%) (Meadows et al., 2018). In contrast, Clark and Taubman and Purvis et al., reporting on medical diagnoses of overweight and obesity and self-report height and weight, reported a point prevalence of 4.5-7.4% for overweight/obesity during 2011-2015 and of 16.9% and 17.3% for

overweight and obesity, respectively, in 2012 (Clark & Taubman, 2016; Purvis et al., 2013). Data from the Millennium Cohort Study, which tracks military service members and veterans over a 21-year period and includes 42,200 participants, of which 22,073 (52%) are active duty service members, report rates of overweight and obesity of 49% and 24%, respectively, which are much higher than previously reported (Rush et al., 2016), suggesting a lot of variability in methods and trends in overweight and obesity in military service members. Even data from incoming soldiers between 1998-2012, indicated increased trends of overweight (25.8-37.2%) and obesity (5.6-8%), reflecting the increasing trends in overweight and obesity in civilian populations (Hruby et al., 2015). So, overall rates are increasing, with a greater trend for higher levels of obesity (Reyes-Guzman et al., 2015), putting military service members at greater risk for comorbidities of obesity, including increased risk for diseases, injuries, reduced readiness and performance, recruitment and retention challenges, and other comorbidities.

Studies in military populations have reported on BMI and risk for cardiovascular disease, injuries, impacts to readiness and performance, retention, as well as engagement in weight loss behaviors, and other psychological comorbidities. Two studies reported on cardiovascular disease risk, with both studies identifying an association between overweight and obesity and a higher risk of developing metabolic syndrome, hypertension, dyslipidemia, and insulin disorders compared to soldiers not classified as overweight or obese (Hruby et al., 2017; Rush et al., 2016). Three studies reported on the association between BMI and incidence of injury (Hruby et al., 2016; Jones et al., 2017; Rappole, Grier, Anderson, Hauschild, & Jones, 2017). Rappole et al. reported an injury incidence of 47% in a sample of 1099 Army brigade soldiers, with older age (≥30 years) and higher BMI (≥27 kg/m^2) associated with greater risk of injury (Rappole et al., 2017). Two studies examined injury risk and incidence in Army basic combat training trainees

(Hruby et al., 2016; Jones et al., 2017). Both studies reported greater risk of injuries amongst soldiers who were underweight (7%), overweight (11%) and obese (33%), with Jones et al. describing an interaction between BMI and run times, such that the highest risk group (26.6% in males, 63.1% in females) was comprised of trainees with the slowest run times and lowest BMI, suggesting that while BMI is associated with injury risk, this risk is not conferred in a linear manner (Hruby et al., 2016; Jones et al., 2017).

Only a few studies have recently examined relationships between body composition and physical performance (Crawford et al., 2011; Jones, DeBeliso, Sevene, Berning, & Adams, 2012; Pierce et al., 2017; Steed, Krull, Morgan, Tucker, & Ludy, 2016). The studies used a variety of indices of performance, such as an Army physical fitness test, a Wingate cycle protocol, and military specific tasks, as well as indices of body composition including BMI and percent body fat determined by air displacement plethysmography (Crawford et al., 2011; Jones et al., 2012; Pierce et al., 2017; Steed et al., 2016). Studies reporting on the Army physical fitness test and body composition indices reported no significant correlation between body composition, as measured by BMI or air displacement plethysmography, and the individual events of the Army physical fitness test, including push-ups, sit-ups, and the 2-mile run (Jones et al., 2012; Steed et al., 2016). One study, using more standardized performance measures, included a Wingate test, a maximal oxygen uptake test, musculoskeletal assessments, and the APFT (Crawford et al., 2011). The authors reported a significant difference between individuals above and below 18% body fat. Those below 18% body fat performed significantly better on tests of anaerobic power, maximal oxygen uptake, push-ups, and all musculoskeletal assessments, with no significant differences between groups on sit-ups and 2-mile run times (Crawford et al., 2011). On the contrary, Pierce et al. reported that soldiers with a higher BMI performed better on tests of

lower- and upper-body muscular strength and lower-body muscular power, compared to soldiers in the lowest BMI tertile (Pierce et al., 2017). Similarly, soldiers with a higher BMI also had better lower- and upper-body muscular power, and upper- and lower-body muscular endurance, while they demonstrated worse speed and agility (Pierce et al., 2017). Additionally, BMI was not associated with performance on any military-specific task (Warrior Task Battle Drills and Loaded Ruck March times), but was associated with 2-mile run times, with soldiers with a higher BMI having slower run times (Pierce et al., 2017). Other consequences of overweight and obesity in the military are increased costs due to discharges and attrition (Voss, Pavela, & Stanford, 2018), with previous studies reporting high rates of discharge due to weight status (Gattis, 2011), although findings have been mixed, with very few early discharges associated with overweight (0.5%) in peer-reviewed studies (Bedno et al., 2010; Swedler, Knapik, Williams, Grier, & Jones, 2011).

Although evidence on rates of overweight and obesity appears mixed due to reliance on self-report height and weight, as well as various sampling methodologies, overall trends appear to suggest that rates of overweight and obesity are high in military populations and comparable to those of civilian populations, despite the use and enforcement of body composition performance standards. Additionally, there are some studies that suggest that higher rates of overweight and obesity have a potential negative impact on outcomes of military interest, such as health, performance, readiness, and retention. However, the evidence suggests that while overweight and obesity is prevalent in military populations, there are mixed impacts in relation to outcomes of military interest.

Another less often explored consequence of obesity is related to psychological comorbidities and behaviors, such as depressive symptoms, eating disorder symptoms, and

engaging in dieting and unhealthy weight control behaviors. Two studies examined data from the US DoD Survey of Health Related Behaviors, 2001 and 2005 (Kress, Peterson, & Hartzell, 2006; Smith, White, Hadden, & Marriott, 2014). Kress et al. reported the highest percentage of depressive symptoms amongst underweight men (37%) and obese women (49%) (Kress et al., 2006), while Smith et al. noted sex-specific differences, such that males with overweight and obesity had a positive association with symptoms of anxiety, while females with obesity had a positive association with symptoms of stress and depression (Kress et al., 2006; Smith et al., 2014). A cross-sectional study in soldiers in advanced individual training, training that follows basic combat training, found that overweight status increased the risk for eating disorder symptoms (3.06 OR) compared to normal weight status (Warner et al., 2007). Two studies reported on data from the Millennium Cohort Study (Mitchell et al., 2016; Rush et al., 2016). While Rush et al. reported that the prevalence of PTSD (1.8%), and depressive symptoms (15.5%) were highest amongst those with obesity, Mitchell et al., in a longitudinal study with the Millennium Cohort population of 33,937 service members found that PTSD at baseline predicted eating disorder symptoms and weight gain after baseline (Mitchell et al., 2016; Rush et al., 2016). Furthermore, mediation analysis suggested that weight change was mediated by eating disorder symptoms, resulting from engagement in binge eating and compensatory/purging behaviors (vomiting, laxative use, fasting, over-exercise) (Mitchell et al., 2016). A newer study examined the role of weight-related stigma in a military population with overweight and obesity (Schvey et al., 2017). Almost half of respondents (49%) reported having at least on military-related stigmatizing experience, with most experiences related to weight (71%) and shape (61%) (Schvey et al., 2017). Additionally, after controlling for age sex, and body fat percentage, the experience of weight stigmatizations was positively associated with depressive symptoms,

maladaptive coping behaviors (affect regulation) (e.g. binge eating and avoiding physical activity), the use of compensatory/purging behaviors (e.g. laxative misuse, fasting), and emotional eating (Schvey et al., 2017). Similar to adults with obesity and college students, military service members with overweight and obesity experience interrelated psychological risk factors such as depressive symptoms and weight stigmatization, that are associated with higher levels of eating disorder symptoms, maladaptive coping (affect regulation), and compensatory/purging behaviors.

Although military regulation requires mandatory enrollment in service-specific weight management programs, these programs have failed to produce the outcomes necessary to reduce trends of overweight and obesity in military active duty populations (Sanderson et al., 2011; Shams-White & Deuster, 2017; Spieker et al., 2015). One systematic review of thirteen weight management interventions, including two randomized controlled trials, one cluster randomized controlled trial, one non-randomized controlled trial, and nine non-experimental trials, reported on the efficacy of the programs, correlates of success, and use of evidence-based frameworks (Sanderson et al., 2011). Correlates of obesity in study participants included age, gender, marital status, lack of time/motivation, and low physical activity levels (Sanderson et al., 2011). The study also reported on adoption of theoretical frameworks, which most studies used a cognitive behavioral approach or a transtheoretical model approach (Sanderson et al., 2011). Four studies did not use a theoretical framework, although the authors reported that those studies that adopted a theoretical framework were more effective in producing weight loss (Sanderson et al., 2011). The authors concluded that military weight management interventions could be improved by using a theoretical framework, including a longer follow up period, increasing participation and

adherence, as well as employing measures of the proposed mediating factors or mechanisms of actions changed in order to produce favorable outcomes (Sanderson et al., 2011).

More recently, Shams-White and Deuster provided an update of ongoing efforts across the DoD for prevention of obesity (Shams-White & Deuster, 2017). The authors identified three lifestyle behavioral change-based interventions, Teaching Kitchens, Healthy Eating, Activity, and Lifestyle Training Headquarters (H.E.A.L.T.H) and Preventing Obesity in the Military Community (POMC) Project Fit4Duty (Samueli Institute, 2015; Shams-White & Deuster, 2017; Spieker et al., 2015; Stewart et al., 2011). While the authors do not report on the efficacy of the programs, the programs appear focused on specific behavior changes such as cooking self-efficacy, self-monitoring, and improving dietary intake and physical activity (Samueli Institute, 2015; Shams-White & Deuster, 2017; Spieker et al., 2015; Stewart et al., 2011). Other initiatives have focused on changing the nutrition environment by providing nutrition guidance stoplight-based labeling (Arsenault, Singleton, & Funderburk, 2014), assessment of the built environment (Navy and Marine Corps Public Health Center, 2018), and quantitatively/qualitatively assessing military installations (Military One Source, 2018), although data is not available on the impact of these interventions (Shams-White & Deuster, 2017). Interestingly, a recent publication examined the role of an intuitive eating-based education program in mixed military populations, including active duty service members, online and in person (Cole et al., 2019). While the study reported improvements in BMI and intuitive eating characteristics, the study had problems with retention, limiting the assessment of intervention effects (Cole et al., 2019).

So, while the military and DoD is actively engaging in interventions that address the socioecological model of obesity, including individual and environmental factors, there is limited data or evidence suggesting progress or efficacy of these efforts. None of these studies appear to

address potential mechanisms of action, of which affect regulation appears to be an important link between dietary intake, dieting, and specific eating disorder symptoms, such as body dissatisfaction, binge eating dieting, and compensatory/purging strategies, that ultimately impact risk for eating disorder symptoms and obesity. Therefore, there is a need for current studies to examine the association between eating disorder symptoms and weight/gain obesity, including examination into how these might be associated through dieting, body dissatisfaction, negative affect, and affect regulation.

The next section will explore current theories on how to treat complex problems such as eating disorders and obesity. As previously stated, the most commonly adopted theoretical framework for both eating disorder and obesity interventions are based on cognitive behavioral theory. Therefore, the section will begin with an exploration of cognitive behavioral theories related to eating disorders and obesity, as well as a discussion of their limitations. Furthermore, this section will introduce a newer cognitive behavioral approach, Acceptance and Commitment Therapy, which is based in Relational Frame Theory, as an approach with the potential to address the central links between eating disorders and obesity, dieting, body dissatisfaction, negative affect, and affect regulation.

C. Cognitive Behavioral Theories of Weight-Related Disorders

Behavior therapy, as a field, arose in the 1960s as a challenge to the complex explanations of emotion and behavior posited by psychoanalysts of the day (Hayes, 2004). Rather than claim that emotions and behaviors arose due to unconscious fears and desires, behavior therapists, relying on experimentally derived data, developed empirical theories based on contingencies and learned behavioral principles, termed the first wave of behavior theories (Hayes, 2004). Similarly, due to failures in first wave theories of explaining facets of human

experience, such as language and cognition, a second wave of behavioral theories arose in the late 1960s (Hayes, 2004). Rather than develop general models or theories that explain behaviors, these second wave approaches adopted disorder-specific approaches based in cognitions (Hayes, 2004). In other words, problematic emotions and behaviors were purported to arise from problematic cognitions or thoughts and the goal was to develop cognitive models in order to identify and modify problematic cognitions driving problematic behaviors (Beck, 1993; Hayes, 2004). Much of the understanding of eating disorders, body image, and obesity comes from second-wave cognitive behavioral models.

1. Eating Disorders

The first cognitive behavioral approach to the management of eating disorders was described by Fairburn et al. in relation to the management of bulimia nervosa (Fairburn, 1981). Fairburn described an important role to control over eating, eliminating avoidance of food, and addressing problematic thoughts that drive problematic behaviors (Fairburn, 1981). Fairburn followed up this description of treatment and management eating disorders with a more comprehensive description of the cognitive behavioral factors that cause and maintain anorexia nervosa (Fairburn, Shafran, & Cooper, 1999). In this description, Fairburn et al. posited that a foundation of anorexia nervosa is the need to control eating behavior, as a means to gain control in one's life, or because control of eating behavior from dietary restriction is accepted in Western societies that emphasize the importance of weight and shape, and control of eating tends to result in changes in weight (Fairburn et al., 1999). As control leads to weight loss and starvation, these are proposed to maintain the condition of dietary restriction both from the physiological impacts of starvation, as well as the salience of weight, shape, and food that arises from dietary restriction and starvation (Fairburn et al., 1999). The need to control weight, shape, and eating,

gives rise to other behaviors and emotions such as body checking, body avoidance, and fear of weight gain (Fairburn et al., 1999).

Fairburn et al. most recently extended this model to be descriptive of the development and maintenance of all forms of eating disorders and eating disorder symptoms, and to include additional maintenance factors (Fairburn et al., 2003). In this theory, individuals with eating disorders are posited to judge themselves on the basis of their weight, shape, and eating behaviors, which in turns leads to an overemphasis of eating, weight, and shape (Fairburn et al., 2003). The over importance or overvaluation of weight, shape, and eating behaviors, consequently, represents the maintenance mechanism, or core psychopathology, of eating disorders (Fairburn et al., 2003). Other aspects of eating disorders include body checking/avoidance and body dissatisfaction, and unhealthy weight control behaviors such as dietary restraint, self-induced vomiting, use and abuse of laxative/diuretics, and overexercising (Fairburn et al., 2003). Binge eating, then, is explained as arising as a response to dietary restraint, or the use of rigid cognitive rules to control eating (Fairburn et al., 2003). When there is a violation of these rules, the result is complete abandon of dietary restriction, a form of disinhibition from overreliance on cognitive control of dietary intake vs. physiological hunger/satiety cues (Fairburn et al., 2003). Additionally, in this transdiagnostic, expanded model, Fairburn et al. described a role for additional maintaining mechanisms of eating disorders, including perfectionism, low self-esteem, mood intolerance or difficulties with affect regulation, and interpersonal difficulties (Fairburn et al., 2003). Difficulties with affect regulation, in particular, represent an important maintenance factor in eating disorders in that emotional states tend to be a trigger for both binge eating and compensatory/purging behaviors (Fairburn et al., 2003; Polivy & Herman, 1993; Stice et al., 2002). These behaviors may serve to distract or

change an individual's mood state, which may temporarily help them "cope" with the mood, but ultimately result in intensifying the mood state (Fairburn et al., 2003; Polivy & Herman, 1993; Stice et al., 2002). The proposed target of therapy posed to drive the subsequent behaviors is the overvaluation of eating, shape, and weight, and their control by challenging and modifying the content of those thoughts (Fairburn et al., 2003). Similar theories have been developed for obesity.

Similar to the previous description of the Dual Pathway Model, Fairburn et al. suggested that an important underlying factor across all eating disorders is the overvaluation of weight, shape, and eating behavior. Overvaluation of weight, shape, and eating behaviors, similar to body dissatisfaction, results in increases in negative moods (negative affect). Eating disorder symptoms, such as binge eating and compensatory/purging behaviors, in turn, arise as a way to regulate negative moods (negative affect). Therefore, the core purpose of cognitive behavioral therapies is to disrupt these mechanisms by challenging and modifying thoughts related to weight, shape, and eating behaviors.

2. Obesity

Another cognitive behavioral theory was developed for obesity to explain the lack of success of current obesity management problems with producing and sustaining weight loss (Cooper & Fairburn, 2001). Cooper and Fairburn proposed that individuals with obesity fail to manage weight successfully due to weight loss goals and weight maintenance skills (pg. 503) (Cooper & Fairburn, 2001). With respect to weight loss goals, the authors described the difference between desired weight loss and evidenced weight loss (Cooper & Fairburn, 2001). Cooper and Fairburn suggested individuals with obesity desire to lose 20-30% of body weight, which is in line with societal expectations of thinness, and the belief that weight is under

personal control, despite the fact that health benefits of weight loss are achieved after a more modest weight loss of 5-10% of body weight (Cooper & Fairburn, 2001). Additionally, Cooper and Fairburn indicated individuals with obesity are trying to lose weight for primary reasons other than health, such as improving appearance or improving self-confidence, which do not necessarily require weight loss (Cooper & Fairburn, 2001). As a result, when both weight loss goals and additional goals are not achieved to the extent individuals believe is identified as successful, individuals gradually abandon weight loss efforts (Cooper & Fairburn, 2001). Consequently, individuals gradually return to prior eating and activity habits, believing their efforts to have failed, resulting in gradual weight regain (Cooper & Fairburn, 2001). Therefore, Cooper and Fairburn suggested that failure from obesity treatments results from failure to address weight loss goals and weight maintenance strategies (Stice, 2002; Stice et al., 2011a; Stice & Shaw, 2002). Cooper and Fairburn therefore suggested a cognitive behavioral approach to obesity in which individuals are instructed on: strategies to value and accept any weight loss achieved; strategies to transition to weight maintenance as a goal; and development of cognitive strategies for successful weight maintenance (pg. 505) (Cooper & Fairburn, 2001). In support of this theory, one prospective study of participants that had completed a weight management program suggested that individuals who regained weight had desired more weight loss, were less satisfied with the weight loss they achieved, judged self-worth in terms of weight and shape, adopted a more dichotomous thinking style, and tended to use maladaptive affect regulation strategies than those who lost or maintained weight loss (Byrne, Cooper, & Fairburn, 2003; Byrne, Cooper, & Fairburn, 2004). While prospective data suggests that cognitive factors, such as higher weight-loss expectations, appearance-based weight loss goals, and unsatisfactory progress, play an important role in treatment discontinuation (Dalle Grave, Calugi, &

Marchesini, 2014), overall evidence suggests that cognitive behavioral therapy has not provided expected improvements in weight loss outcomes in individuals with obesity (Cooper et al., 2010).

There are also similarities between cognitive behavioral approaches to obesity and eating disorders. Cooper and Fairburn appear to suggest that similar to eating disorders, overvaluation of weight, shape, and affect regulation also play a central role in obesity management and success/failure of obesity treatments. In this regard, failure to achieve weigh loss goals that are likely unrealistic, results in abandonment of weight management behaviors. Similar to the previous description of the Dual Pathway Model, Fairburn et al. suggested that an important underlying factor across all eating disorders is the overvaluation of weight, shape, and eating behavior. Overvaluation of weight, shape, and eating behaviors, similar to body dissatisfaction, results in increases in negative moods (negative affect). Eating disorder symptoms, such as binge eating and compensatory/purging behaviors, in turn, arise as a way to regulate negative moods (negative affect). Therefore, the core purpose of cognitive behavioral therapies is to disrupt these mechanisms by challenging and modifying thoughts related to weight, shape, and eating behaviors.

3. Limitations

While current guidelines suggest that cognitive behavioral therapy (CBT) is the suggested choice for treatment of eating disorders (Wilson & Shafran, 2005), some researchers are bringing attention to the limitations of these approaches. For example, a large proportion (30-50%) individuals with bulimia nervosa and binge eating disorder who receive CBT still remain symptomatic, including binge eating episodes post-treatment (Brownly, Berkman, Sedway, Lohr, & Bulik, 2007; Fairburn et al., 2009; Juarascio et al., 2013b; Wilson et al., 2007). Similarly, only

50-80% of binge eating disorder patients receiving CBT maintain abstinence from binge eating at least 1-year post treatment (Mitchell, Devlin, De Zwaan, Crow, & Peterson, 2008). Furthermore, evaluations of CBT for anorexia nervosa suggest the treatment has limited efficacy in reducing the eating pathology (Juarascio et al., 2013a; Juarascio, Forman, & Herbert, 2010; Wilson et al., 2007; Wilson & Shafran, 2005), with few patients agreeing to start treatment (Byrne, Fursland, Allen, & Watson, 2011; Fairburn et al., 2009; Juarascio et al., 2013a; Juarascio et al., 2013b).

There are many suggested reasons that CBT may not be effective in the long run. Primarily, individuals with eating disorders, for whom their eating disorder has helped them achieve their goals of weight loss and control over eating behaviors, may be reluctant to give up these behaviors, seeing that most disorders are characterized by overvaluation of weight and shape, including extreme fear of gaining weight (Juarascio et al., 2010; Vanderlinden, 2008). While cognitive behavioral theories suggest that the overvaluation of weight, shape, and eating behavior are important components that maintain the disorder, mainly by promoting dietary restriction, binge eating, and compensatory/purging behaviors, treatment strategies often include self-monitoring of food intake and body image thoughts (Fairburn et al., 2015; Fairburn et al., 2003; Fairburn & Wilson, 2013). However, some patients may find it difficult to successfully and consistently engage in these behaviors (Juarascio, Manasse, Schumacher, Espel, & Forman, 2017; Wilson, Fairburn, Agras, Walsh, & Kraemer, 2002; Zendegui, West, & Zandberg, 2014). Additionally, strong negative emotions (negative affect) tend to be triggers for binge eating and subsequent dietary restraint and other compensatory/purging behaviors. Therefore, affect regulation may play an important role in treatment outcome, with some studies suggesting that higher levels of emotional eating (maladaptive affect regulation) resulting in treatment resistance

(Juarascio et al., 2017; Ricca et al., 2010). For example, in individuals receiving treatment for binge eating disorders, those with lower levels of negative affect and overvaluation of weight and shape had greater improvements in symptoms and severity of the condition (Grilo, White, Wilson, Gueorguieva, & Masheb, 2012a; Grilo, Masheb, & Crosby, 2012b; Grilo, White, & Masheb, 2012c). Other studies have reported that patients with more severe symptoms, such as more bingeing, more emotional problems, and higher baseline symptoms, had higher risk of treatment failures (Butryn, Lowe, Safer, & Agras, 2006; Castellini et al., 2012; Juarascio et al., 2013a; Vrabel, Rosenvinge, Hoffart, Martinsen, & Rø, 2008). Therefore, successful treatments must address underlying causes for symptom severity, including difficulties with affect regulation, in addition to overvaluation of weight, shape, and eating behaviors.

D. Third Wave Approaches for Behavioral Theories

One newer treatment philosophy with the potential to address limitations of cognitive behavioral approaches is Acceptance and Commitment Therapy or ACT. Acceptance and Commitment Therapy (ACT) arose as a response to limitations within the second wave behavioral approaches (Hayes, 2004). In particular, second wave behavioral approaches were critiqued due to their failure to consider basic behavior theory in formulating cognitive models, which resulted in "information processing"-type models that emphasized the information, thoughts, and cognitions, but not the context or function that these thoughts and cognitions had in leading to emotional and behavioral effects (Hayes, 2004). ACT, in turn, was founded in Relational Frame Theory and functional contextualism (Barnes-Holmes & Roche, 2001; Hayes et al., 2006; Hayes & Wilson, 1993; Hayes et al., 1996). Briefly, Relational Frame Theory, or RFT, posits that at the center of human language and cognition is the ability to arbitrarily relate ideas and events such that how they function and relate to each other depends on the specifically

defined context (Barnes-Holmes & Roche, 2001; Hayes et al., 2006). Hayes et al. described an example of a nickel and a dime, in which a child first learns that a nickel is larger (in size) than a dime, whereas an older child learns that a dime is worth more than a nickel, so in a sense is bigger than a nickel (Hayes et al., 2006). So how one relates to the other depends upon the context in which they function, physical size or value (Hayes et al., 2006). Of greater importance, empirical studies in RFT have demonstrated that comparative relations can be trained and that relations and functions are regulated by features of a context (Hayes et al., 2006; Wulfert & Hayes, 1988).

From these empirical investigations of language, cognitions, and context, work extended into the areas of psychopathology and psychotherapy. While verbal processes are necessary for learning and problem solving, they can also create relations and meanings that serve a psychopathologic function, but since verbal processes are still necessary for learning, one cannot merely eliminate them in order to eliminate their psychopathologic function (Barnes-Holmes & Roche, 2001; Hayes et al., 2006). For example, just as specific learned content can become extinct but not eliminated, similarly, psychopathologic content cannot be eliminated since it exists as part of historical learning (Barnes-Holmes & Roche, 2001). Therefore, attempts to change the content of verbal processes increase the functional importance of the content, but fail to equip individuals with skills to cope with content when it does reemerge (Barnes-Holmes & Roche, 2001; Hayes et al., 2006). Instead, it may be more useful to change how the content functions by reducing its impact, such as with negative cognitions, rather than reducing their frequency or eliminating them (Barnes-Holmes & Roche, 2001; Hayes et al., 2006). Traditionally, CBT has been focused on changing the content of problematic cognitions, such as overvaluation of weight, shape, and eating behaviors by teaching strategies that challenge the

accuracy or validity of this content. RFT and ACT argue that attempting to change the content of language and thoughts merely increases the importance of these thoughts. In this sense, RFT and ACT directly challenges the premise of CBT, which focuses on the frequency and content of cognition, rather than its function (Hayes et al., 2006).

1. Relational Frame Theory

Relational Frame Theory (RFT) posits that psychopathology arises from the way language and cognition interact to prevent an individual from engaging in behavior that serves their values-based goals (Hayes et al., 2006). The resulting pathological process is termed experiential avoidance and is defined as the inability "to remain in contact with private experiences, bodily sensations, emotions, thoughts, and memories)...with a need to take steps to alter the form or frequency of these events and the context that occasion them" (pg. 4) (Hayes et al., 2006; Hayes et al., 1996). Experiential avoidance, in turn, is not unique to RFT and ACT, but rather has been described by various psychological theories using different terms such as emotional avoidance, cognitive avoidance, emotion or thought suppression, or other forms of escape and avoidance, making it a type of maladaptive affect regulation strategy (Hayes et al., 2006; Hayes et al., 1996). This is another aspect in which RFT and ACT differ from second wave behavioral approaches, such as CBT. CBT approaches focused on changing the content and expression of private experiences though relaxation strategies or challenging irrational beliefs. On the other hand, third wave therapies focus less on controlling negative thoughts and feelings themselves, and instead on changing the function of negative thoughts and feelings from defining who a person is to describing them as just another aspect of human experience (Hayes et al., 2006; Hayes & Wilson, 1993). RFT and ACT instead focus on the values and goals of individuals, so as to assist individuals in reframing the context of negative private experiences to

allow individuals to continue in values-based behaviors while experiencing negative private experiences (Hayes et al., 2006).

2. Acceptance and Commitment Therapy (ACT)

What distinguishes ACT approaches from CBT approaches is also a focus on general psychopathology, rather than a focus on disorder-specific contextual situations. From this perspective, experiential avoidance is problematic because it results in psychological inflexibility, or an inability to persist in values-based behavior (Hayes et al., 2006). ACT describes several processes that result in psychological flexibility (Hayes et al., 2006). Briefly, cognitive fusion is defined as the tendency to become entangled with one's private events such that these are perceived as reflecting reality rather than transitory mental contents (Hayes et al., 2006). Cognitive fusion results in behaviors governed by private events rather than by previous learning or the current environmental context, leading to maladaptive experiential avoidance strategies (maladaptive affect regulation strategies) to avoid or escape these events, and resulting in behavior that is inconsistent with values or goals (Hayes et al., 2006). ACT targets these core problems in order to increase contact and experience of the present moment and to increase psychological flexibility, which allows one to engage in values-based behaviors in the face of difficult private experiences (Hayes et al., 2006). In other words, instead of focusing on challenging the accuracy and validity of negative thoughts and feelings, as is done in CBT, RFT and ACT instead focus on changing how one relates to negative thoughts and feelings so that one is able to continue to engage in values-based behavior without having to change these behaviors in order to deal or cope with negative thoughts and feelings.

3. Psychological Inflexibility

So, with the conceptualization and targeting of experiential avoidance, a type of maladaptive affect regulation strategy that makes use of emotion-based coping, avoidance, and emotional suppression, RFT and ACT approaches suggest that maladaptive affect regulation strategies are the root problematic processes in psychopathology (Hayes, 2004; Hayes et al., 2006). Furthermore, the ACT/RFT model of psychopathology suggests that experiential avoidance in conjunction with other processes that result from difficulties in changing the context of how language functions, lead to the development of psychopathology. These processes include: experiential avoidance, cognitive fusion, dominance of the conceptualized past, attachment to the conceptualized self, lack of values clarity, and inaction, impulsivity, or avoidance persistence (Hayes et al., 2006). Together, these processes result in psychological inflexibility, or the rigid dominance of psychological reactions to negative thoughts and feelings over engagement in values-based behavior (Bond et al., 2011; Hayes et al., 2006).

RFT and ACT approaches address psychological inflexibility as the root problematic process in psychopathology Previously, it was discussed that the root of many eating disorder symptoms and eating behaviors associated with obesity also had maladaptive affect regulation, such as experiential avoidance, as a root cause or mechanism resulting in pathological behavior. Thus, it may be that examining and understanding psychological inflexibility in the etiologic pathways of eating disorder symptoms and obesity may lead to improved interventions that target and address psychological inflexibility (maladaptive affect regulation) as the cause and maintaining processes in many of these disorders.

Indeed, studies examining psychological inflexibility have identified it as an important mediator in many eating- and weight-related processes, including rigid dieting (Duarte et al.,

2017; Duarte et al., 2016), body dissatisfaction (Masuda et al., 2015; Sandoz et al., 2013), binge eating (Lillis et al., 2011), food cravings (Forman et al., 2013a; Forman, Hoffman, Juarascio, Butryn, & Herbert, 2013b; Juarascio, Forman, Timko, Butryn, & Goodwin, 2011), weight-related concerns (Lillis & Hayes, 2007; Lillis, Hayes, Bunting, & Masuda, 2009), intuitive eating (Sairanen et al., 2017) and barriers to physical activity (Butryn et al., 2015). Previously discussed risk factors for eating disorder symptoms and obesity included dieting and body dissatisfaction, based on prospective research suggesting increased risk for onset of eating disorder symptoms and obesity onset based on the presence of dieting and body dissatisfaction (Neumark-Sztainer et al., 2006a; Neumark-Sztainer et al., 2002; Neumark-Sztainer et al., 2006c; Neumark-Sztainer et al., 2012; Neumark-Sztainer et al., 2018; Stice, 2002; Stice et al., 1999; Stice et al., 2011a; Stice et al., 2005b). Kraemer et al. suggests that if these two risk factors are involved in the mechanism of onset of obesity and eating disorder symptoms, mediation analysis would help to elucidate this relationship (Kraemer et al., 2001).

Maladaptive affect regulation appears to represent part of the root psychopathology in many disorders, potentially including eating disorder symptoms and obesity. Furthermore, experiential avoidance, a type of maladaptive affect regulation strategy, leads to the development of psychological inflexibility, another maladaptive affect regulation strategy. Additionally, dieting, body dissatisfaction, negative affect, and maladaptive affect regulation were previously identified as important links in the development of eating disorder symptoms and obesity. Therefore, if maladaptive affect regulation represents an important mechanism, and psychological flexibility captures the construct of maladaptive affect regulation, then perhaps measures of psychological inflexibility related to body dissatisfaction and dieting might represent important mechanisms linking eating disorder symptoms and obesity.

3a. Psychological inflexibility related to body dissatisfaction

Sandoz et al. (2013) conducted one of the first studies that examined psychological inflexibility related to body dissatisfaction. In this study, this construct was named "body image flexibility." However, this dissertation will continue to refer to this construct as psychological inflexibility related to body dissatisfaction. This term more clearly communicates the importance of body dissatisfaction and affect regulation associated with this construct. This measure, the Body Image Action and Acceptance Questionnaire (BI-AAQ), was developed in a sample of male and female undergraduate students (Sandoz et al., 2013). The central construct, termed "body image flexibility," was defined as the "active contacting of perceptions, thoughts, beliefs, and feelings about the body without attempts to change their intensity, frequency, or form" (pg. 41) (Sandoz et al., 2013). In this regard, instead of psychological inflexibility, body image flexibility represents psychological *flexibility* related to body dissatisfaction. Unlike other measures of affect regulation related to body dissatisfaction, such as the body image avoidance scale developed by Cash et al., body image flexibility focused on the function of body image related thoughts, mainly body dissatisfaction, and their impact on one's ability to engage with these private experiences while still continuing with values-based behavior (Cash et al., 2005; Sandoz et al., 2013). The authors hypothesized a negative association between body image flexibility, body dissatisfaction, and eating disorder symptoms (Sandoz et al., 2013). Their study provided support for their hypothesis, such that when body image flexibility was low, and psychological inflexibility related to body dissatisfaction was high, body dissatisfaction and eating disorder symptoms were high (Sandoz et al., 2013). Furthermore, hierarchical regression analysis demonstrated that when controlling for weight status (BMI), and body dissatisfaction, body image flexibility was still a significant predictor of eating disorder symptoms, and even

moderated the association between body dissatisfaction and eating disorder symptoms such that only individuals with high body dissatisfaction and low body image flexibility (or high psychological inflexibility related to body dissatisfaction) evidenced higher eating disorder symptoms (Sandoz et al., 2013). The authors concluded that the BI-AAQ was a reliable and valid measure of body image flexibility, and that the construct of body image flexibility improved understanding of the association between weight status (BMI), body dissatisfaction, and eating disorder symptoms (Sandoz et al., 2013). These findings suggest that the presence of body dissatisfaction is not enough to predict eating disorder symptoms. Rather, body dissatisfaction, in conjunction with maladaptive affect regulation strategies, in this case, psychological inflexibility related to body dissatisfaction, were both needed to predict the presence of eating disorder symptoms.

Other studies have expanded our understanding of the utility of psychological inflexibility related to body dissatisfaction (body image flexibility) in understanding the relation between weight status and eating disorder symptoms. Over 44 studies have examined the role of body image flexibility in mediator/moderator relationships, and in intervention research in samples of all ages, and from many countries (Rogers et al., 2018). A systematic review of these studies suggests an explanatory role for body image flexibility, with the construct demonstrating change following intervention (Rogers et al., 2018). One study examined the importance of body image flexibility in predicting eating disorder symptoms in female college students, compared to other measures of body image including body dissatisfaction and body image avoidance (Timko, Juarascio, Martin, Faherty, & Kalodner, 2014). The authors reported that body image flexibility mediated the association between body dissatisfaction and eating disorder symptoms and predicted unique variance in eating disorder symptoms beyond weight status (BMI), body

dissatisfaction, and body image avoidance, suggesting a unique role in understanding eating disorder symptoms (Timko et al., 2014).

Two studies examined the moderator role of body image flexibility in samples of female college students, and male and female community members (Duarte & Pinto-Gouveia, 2016; Moore, Masuda, Hill, & Goodnight, 2014). Moore et al. reported that when controlling for BMI, individuals with high eating disorder cognitions and low body image flexibility (high psychological inflexibility related to body dissatisfaction) presented with higher eating disorder symptoms, while Duarte and Pinto-Gouveia reported that individuals with high emotional eating scores and low body image flexibility (high psychological inflexibility related to body dissatisfaction) presented with higher levels of binge eating (Duarte & Pinto-Gouveia, 2016; Moore et al., 2014). In a study of male college students, Masuda et al. examined the relationship between weight status (BMI), eating disorder cognitions, and body image flexibility on eating disorder symptoms and reported that when controlling for weight status (BMI), body image flexibility mediated the association between eating disorder cognitions and eating disorder symptoms such that high eating disorder cognitions predicted lower body image flexibility (higher psychological inflexibility related to body dissatisfaction), which in turn predicted higher eating disorder symptoms (Masuda et al., 2015).

Another study examined the mediator role of body image flexibility in mediating the association between body image shame (a negative body image emotion), binge eating, and weight status (BMI), and reported that higher body image shame predicted lower body image flexibility (higher psychological inflexibility related to body dissatisfaction), which in turn predicted higher binge eating and higher weight status (BMI), meaning body image shame indirectly predicted increased binge eating and increased weight status (BMI) through lower

body image flexibility (higher psychological inflexibility related to body dissatisfaction) (Duarte & Pinto-Gouveia, 2016). Two studies examined changes in body image flexibility and eating disorder symptoms pre- and post- treatment at a treatment facility in male and female patients (Butryn et al., 2013; Pellizzer, Waller, & Wade, 2018). Both studies reported that body image flexibility was the strongest and most consistent predictor of eating disorder symptoms, with body image flexibility scores moderating eating disorder symptom outcomes such that individuals with the highest body image flexibility (lowest psychological inflexibility related to body dissatisfaction) had the greatest improvement in eating disorder symptoms (Butryn et al., 2013; Pellizzer et al., 2018). These studies demonstrate important relationships between body image flexibility (psychological inflexibility related to body dissatisfaction), as measured by the BI-AAQ, and hypothesized important factors that link obesity and eating disorder symptoms.

Psychological inflexibility related to body dissatisfaction is a construct that reflects maladaptive affect regulation strategies in relation to body dissatisfaction. The BI-AAQ, through its measure of body image flexibility, which merely represents the opposite of psychological inflexibility related to body dissatisfaction, is a valid and reliable instrument for assessing this construct in various populations of females and males. Furthermore, studies using the BI-AAQ have supported the notion that psychological inflexibility related to body dissatisfaction predicts eating disorder symptoms beyond body dissatisfaction, such that high levels of psychological inflexibility related to body dissatisfaction are needed in conjunction with high levels of body dissatisfaction to predict body dissatisfaction, indirectly supporting the tenets of the Dual Pathway Model. Furthermore, psychological inflexibility related to body dissatisfaction also functioned as a mediator explaining the association between body dissatisfaction and eating disorder symptoms and body image shame (negative body image emotion) and increased binge

eating and weight status (BMI). Finally, in non-experimental treatment studies, changes in psychological inflexibility related to body dissatisfaction, predicted changes in post-treatment eating disorder symptoms. Taken together, these findings suggest psychological inflexibility related to body dissatisfaction likely represents an important mechanism to examine and target in order to produce reductions in eating disorders symptoms and obesity.

3b. Psychological inflexibility related to dieting

A measure of psychological inflexibility related to dieting, named the Inflexible Eating Questionnaire (IEQ), was developed by Duarte et al. in community sample of males and females (Duarte et al., 2017). While the study defined this construct as "eating inflexibility," this dissertation will continue to refer to this construct as psychological inflexibility related to dieting, since this term acknowledges the dieting and affect regulation constructs that this measure taps into. The authors defined eating inflexibility (psychological inflexibility related to dieting) as "inflexible adherence to eating rules without regard to internal (hunger or satiety cues) or external (social contexts) contexts, including a sense of control when adhering to rules and a sense of distress when failing to adhere to rules" (pg. 147) (Duarte et al., 2017). The authors reported a strong positive association between the IEQ (psychological inflexibility related to dieting) and measures of dietary restraint and eating disorder symptoms, as well as strong positive associations between the IEQ (psychological inflexibility related to dieting) and stress/depressive symptoms (Duarte et al., 2017). Additionally, the authors reported that psychological inflexibility related to dieting moderated the association between dietary restraint and eating disorder symptoms such that individuals with higher inflexible eating (psychological inflexibility related to dieting) and higher dietary restraint had higher eating disorder symptoms (Duarte et al., 2017). Similar to psychological inflexibility related to body dissatisfaction, these

findings also suggest that the presence of dietary restraint is not enough to predict eating disorder symptoms. An individual must present with both high dietary restraint and high levels of psychological inflexibility related to dieting in order for these to significantly predict eating disorder symptoms.

Other studies have examined the role of eating inflexibility (psychological inflexibility related to dieting) with other purported risk factors for eating disorder symptoms and obesity (Duarte et al., 2016; Pinto, Ferreira, Mendes, & Trindade, 2017; Trindade & Ferreira, 2015). Trindade and Ferreira reported on the relationship between body image related-cognitive fusion, a facet of psychological inflexibility related to body image, and eating inflexibility (psychological inflexibility related to dieting) and found that body image-related cognitive fusion mediated the association between body dissatisfaction and inflexible eating. This finding suggests that in individuals with body dissatisfaction, those with higher body image-related cognitive fusion, or higher levels of psychological inflexibility related to body dissatisfaction, evidenced higher inflexible eating (psychological inflexibility related to dieting) (Trindade & Ferreira, 2015).

Two studies examined the role of eating inflexibility (psychological inflexibility related to dieting) as a mediator of the association of weight status, and eating disorder symptoms in adolescent and community females (Duarte et al., 2016; Pinto et al., 2017). Both studies reported a significant positive association between weight status (BMI), eating inflexibility (psychological inflexibility related to dieting), and eating disorder symptoms, as well as a strong positive association between eating inflexibility (psychological inflexibility related to dieting) and eating disorder symptoms (Duarte et al., 2016; Pinto et al., 2017). Duarte et al. also reported that the association between body dissatisfaction and eating disorder symptoms was also mediated by

eating inflexibility (psychological inflexibility related to dieting) (Duarte et al., 2016). Furthermore, both studies reported that eating inflexibility (psychological inflexibility related to dieting) mediated the association between weight status (BMI) and eating disorder symptoms, such that a higher weight status (BMI) predicted higher levels of eating inflexibility (psychological inflexibility related to dieting), which in turn predicted higher levels of eating disorder symptoms (Duarte et al., 2016; Pinto et al., 2017). Similar to the BI-AAQ as a measure of body image flexibility (psychological inflexibility related to body dissatisfaction), eating inflexibility (psychological inflexibility related to dieting) both predicted eating disorder symptoms beyond measures of dietary restraint, and mediated the association between weight status and eating disorder symptoms, making it an important construct in examining the association between weight status (BMI) and eating disorder symptoms.

Psychological inflexibility related to dieting is a construct that also reflects maladaptive affect regulation strategies in relation to dieting. The IEQ, which measures eating inflexibility or psychological inflexibility related to dieting, appears to be a valid and reliable instruments for assessing this construct in various samples of males and females. Studies provided some evidence that the IEQ, as a measures of psychological flexibility related to dieting, predicts eating disorder symptoms beyond measures of dietary restraint and body dissatisfaction. Indeed, high levels of psychological inflexibility related to dieting were needed in conjunction with high levels of dieting/dietary restraint to predict either disorder symptoms. Additionally, psychological inflexibility related to dieting also functioned as a mediator between weight status, body dissatisfaction, and eating disorder symptoms. In all, these findings support the pathway proposed by the Dual Pathway Mode between dieting/dietary restraint, affect regulation, and eating disorder symptoms, suggesting that psychological inflexibility related to dieting represents

a potential mechanism linking dieting/dietary restraint and eating disorder symptoms, and potentially obesity.

4. Shared Risk Factors

As this review has demonstrated, eating disorder symptoms and obesity have many shared pathways, as described in the Dual Pathway Model. Additionally, eating disorder symptoms and obesity tend to co-occur (Flament et al., 2015; Neumark-Sztainer et al., 2002), have overlapping comorbidity (Fairburn et al., 1998; Lebow et al., 2015; Neumark-Sztainer et al., 2006c), have shared risk factors (Haines et al., 2010; Loth et al., 2015; Neumark-Sztainer et al., 2007; Stice et al., 2005b), and both are difficult to treat (Agras, 2001; Balantekin et al., 2017; Pi-Sunyer, 2002). However, both obesity and eating disorder symptoms appear to have affect regulation difficulties as a potential root cause of the risk factors and behaviors which result in the development of both conditions (Dakanalis et al., 2014; Fairburn et al., 2003; Gianini et al., 2013; Lavender & Anderson, 2010; Stice et al., 2002; Whiteside et al., 2007). And as was previously discussed, experiential avoidance is a specific type of maladaptive affect regulation strategy that is also a facet of psychological inflexibility (Hayes et al., 2006; Hayes et al., 1996). Therefore, psychological inflexibility, in turn, may likely capture affect regulation difficulties linking the Dual Pathway Model etiological factors with eating disorder symptoms and obesity. Two specific constructs of psychological inflexibility, psychological inflexibility related to body dissatisfaction and dieting, are both associated with obesity and eating disorder symptoms (Duarte et al., 2017; Sandoz et al., 2013). Furthermore, previous studies have demonstrated relationships between eating disorder symptoms, weight status (BMI), dieting/dietary restraint, and body dissatisfaction, with psychological inflexibility related to body dissatisfaction and dieting playing an important role in mediating these associations (Duarte et al., 2016; Masuda et

al., 2015; Pinto et al., 2017). Therefore, psychological inflexibility related to body dissatisfaction and dieting represent two underexplored types of maladaptive affect regulation strategies that potentially link eating disorder symptoms and obesity. Limited studies in military populations have investigated the association between eating disorder symptoms and obesity. No studies have explored how eating disorder symptoms may potentially be associated with obesity and if facets of affect regulation, such as psychological inflexibility related to body dissatisfaction and dieting, represent important paths that mediate this association.

E. Special Considerations for Military-Related Populations

1. Reserve Officer Training Corps (ROTC) Cadets as a Military Population of Young Adults

One population of young adults 18-25 years of age that may potentially be at risk for eating disorder symptoms and obesity is US Army Reserve Officer Training Corps (ROTC) cadets, who are college and university students in training to become officers in the US military (Today's Military, 2017). US Army ROTC cadets are required to adhere to body composition and physical fitness standards, that in turn may lead to an overemphasis on weight and shape, body dissatisfaction, and use of unhealthy weight control behaviors, in order to meet these standards and retain scholarship benefits, as well as be competitive for favorable officer commission opportunities (Bodell et al., 2014; Johnson, Davis, & Gonzalez, 2014; US Army Cadet Command, 2018). Indeed, one study in female US Army ROTC cadets reported an eating disorder risk rate of 20% of cadets in the sample who met the eating disorder risk classification cut-off score based on a self-report measure of eating disorder symptoms (EDI-2) (Lauder & Campbell, 2001). Cadets identified at risk had a higher rates of eating disorder symptoms (bingeing, purging, laxative/diet pill/diuretic use), as well as a higher rates of body

dissatisfaction (Lauder & Campbell, 2001). However, the association between weight status, as indicated by self-reported BMI, and eating disorder symptoms was not reported (Bodell et al., 2014; Johnson et al., 2014; US Army Cadet Command, 2018). Another study in male and female West Point cadets found a similar risk rate of cadets who the eating disorder risk classification cut-off score based on another self-report measure of eating disorder symptoms (EAT-26). However, this study did not report on body dissatisfaction or the association between eating disorder symptoms and weight status (BMI) (Beekley et al., 2009). A more recent study in a large sample of male and female ROTC cadets reported rates of overweight and obesity of 30.1% and 6.2%, respectively. Additionally, 24% of cadets in the sample were dissatisfied to very dissatisfied with their weight, and 14.9% and 11.6% of cadets reporting using unhealthy weight control methods consisting of fasting on water or juices or skipping at least one meal to lose weight (Wilson & James, 2018). Studies of eating disorder symptoms in ROTC cadets suggest that high rates of cadets meet eating disorder risk classification cut-off scores.

Although US Army ROTC cadets may not appear to pose a risk for obesity due to their physical fitness and body composition requirements, one study examining longitudinal changes in weight status in ROTC cadets reported a significant increase in body fat throughout the study period, despite a non-significant increase in weight and BMI (Crombie et al., 2012). A mixed methods thesis with qualitative focus groups, reported that struggling with meeting body composition standards has an influence on cadets eating behaviors and dietary intake (Nevarez, 2017). So, while ROTC cadets are military officers in training, and are expected to meet physical fitness and body composition standards, which may increase their risk for dieting and body dissatisfaction, both which may increase risk for weight gain/obesity onset and eating disorder symptoms, few studies have examined the prevalence of obesity and eating disorder symptoms in

this population, and no studies have examined the association between eating disorder symptoms and obesity, nor the role of dieting, body dissatisfaction, and affect regulation in this population.

2. Weight Status in Military Populations

Since weight status and eating disorder symptoms are of importance in ROTC cadets, another important question that remains to be answered is which indicator of weight status is most relevant in investigating eating disorder symptoms. Previous studies reporting on the prevalence of overweight and obese weight status in military service members report body mass index (BMI) (Barlas, Higgins, Pflieger, & Diecker, 2013; Meadows et al., 2018; Reyes-Guzman et al., 2015; Smith et al., 2012). The military application of BMI, as a weight-for-height screening tool, was relevant when screening for underweight as an indicator of disease and malnutrition (Friedl, 1992; Johnson, 1997). However, given that risks from being overweight come from carrying extra weight as body fat, the military adopted body fat standards, so as to not unnecessarily exclude service members who were heavier due to greater proportions of fat-free mass (Friedl, 1992; Johnson, 1997). The current approach used by the US Army and US Army ROTC Programs is to screen weight-for-height and to determine percent body fat only for service members and cadets exceeding their weight-for-height screen (Friedl, 1992; US Department of Defense, 2002).

Service members meeting age- and sex-specific weight-for-height screens are assumed to be compliant with age- and sex-specific body fat standards (Friedl, 1992; US Department of Defense, 2002). For service members exceeding weight-for-height screens, body circumference measurements are taken at the neck, abdomen, and hips (for females) and the resulting measures are entered into sex-specific regression equations to estimate percent body fat (Friedl, 1992; US Department of Defense, 2002). The DoD body circumference equation has been demonstrated to

be within acceptable limits of precision and accuracy compared to underwater weighing and dual-energy X-ray absorptiometry (Friedl, 1997; Hodgdon & Beckett, 1984a, 1984b; Hodgdon & Friedl, 1999). In a recent study comparing BMI, waist circumference, and waist-stature ratio to percent body fat from dual-energy X-ray absorptiometry, Flegal et al. found that waist-stature ratio most strongly correlated with percent body fat in men, while BMI most strongly correlated with percent body fat in women (Flegal et al., 2008). So, one question that remains to be answered is, which of the available weight status indicators, including BMI, percent body fat, waist circumference, and waist-to-stature ratio, is most strongly associated with eating disorder symptoms in ROTC cadets.

3. Qualitative Approaches in Military Populations

Given that the examination of eating disorder symptoms, obesity, and their shared association within military populations is a relatively new area, and that there are limited studies in US Army ROTC cadets examining these factors, qualitative approaches may be beneficial in identifying and understanding these factors within a US Army ROTC population. Additionally, qualitative approaches may assist with uncovering previously unidentified risk factors, as well as suggesting questions for future research (Curry, Nembhard, & Bradley, 2009).

There has only been one qualitative study with ROTC cadets (Nevarez, 2017), as well as a limited number of qualitative studies with military service members and veterans (Breland et al., 2018; Breland et al., 2017; Hatzfeld et al., 2016; Jay et al., 2016; Smith et al., 2009). Nevarez found that meeting body composition standards and struggles with food cost were important contributors to the dietary habits of US Army ROTC cadets at Eastern Illinois University (Nevarez, 2017). Similarly, Smith et al. reported that food insecurity and military service impacted veterans' weight status during and after military service (Smith et al., 2009).

Additionally, Breland et al. found that military environments and stressors, such as trauma and the need to meet military weight requirements, promoted eating disorder symptoms (Breland et al., 2017). Therefore, an understanding of US Army ROTC cadets' eating behaviors and the motivations and determinants driving their eating behaviors may be necessary to understanding the shared association between eating disorder symptoms and weight status in this population.

F. Theoretical Framework

The primary purpose of this study is to examine the prevalence and correlates of eating disorders, eating disorder symptoms, and eating disorder risk in a sample of US Army ROTC cadets. Additionally, this study will determine if eating disorder symptoms are associated with obesity and if this association is mediated by psychological inflexibility related to body dissatisfaction and dieting. This study will also explore the nature of eating behaviors from the perspective of ROTC cadets, such as dieting and body image, and how the ROTC context potentially influences the development of these behaviors. The conceptual framework for this study is adapted from three existing models, the Dual Pathway Model, cognitive behavioral theories of eating disorders, body image, and obesity, and the socioecological model. These models allow for examination on how individual factors may interact with contextual situations to subsequently impact eating disorder symptoms and weight status.

By gaining a better understanding of how individual factors from the Dual Pathway Model and cognitive behavioral theories of eating disorders and obesity exist and interact in an ROTC-specific context, we can gain a better understanding as to how risk for the development of eating disorder symptoms and obesity is manifested in ROTC samples. The Theoretical Framework for the Dissertation is presented in Figure 1 (Chapter 1, H: Theoretical Framework for the Study).

CHAPTER 3 – Methods

A. Approach for Aim 1: Prevalence and correlates of eating disorder symptoms in US Army ROTC cadets in two Midwestern universities

The first aim of this study was to determine whether male and female US Army ROTC cadets present with probable eating disorders, eating disorder symptoms, and eating disorder risk. The objective if this aim was to examine the prevalence and correlates of probable eating disorders, eating disorder symptoms, and eating disorder risk classification in a current sample of male and female US Army ROTC cadets.

1. Research Questions and Hypotheses

This aim is guided by the following research questions:

1. What is the rate of meeting eating disorder risk classification cut-off scores in a sample and population of US Army ROTC cadets at two Midwestern universities?
2. Which biological, sociocultural, psychological/etiological, and behavioral characteristics are associated with the likelihood of meeting eating disorder risk classification cut-off scores?
3. Which biological, sociocultural, psychological/etiological, and behavioral characteristics are associated with elevated eating disorder symptoms?

2. Research Design

A descriptive, cross-sectional study design using quantitative approaches was selected. Participant recruitment and data collection were conducted between February-April 2018. Participants were recruited using an email flyer and in-person recruitment briefs. On the day of data collection, interested participants were given the opportunity to attend a mass briefing in a

vacant ROTC classroom. Participants who met inclusion criteria were given the opportunity to provide informed consent, where the details of the study were explained. Once participants signed written informed consent forms, they were provided with a study questionnaire packet that included a "Demographics and Lifestyle Information" questionnaire, a "Military-Specific Eating Habits" questionnaire, a "Military-Specific Mediators of Eating Behavior" questionnaire, and the Eating Disorder Diagnostic Scale. After completing questionnaire packets, questionnaires were checked for completeness, while participants completed anthropometric measures. Anthropometric measures consisted of a height measure using a portable stadiometer, a weight measure using a digital scale, and a body composition estimation using body circumferences. Specific details are provided below. After participants completed all questionnaires and measures, they were provided with a $10 grocery gift card for participation. Consent and data collection forms are found in Appendices.

3. Sample

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4. Instruments

The measures below were selected to identify and measure specific biological, sociocultural, psychological/etiological, and military contextual factors that may potentially be associated with eating disorder risk classification and eating disorder symptoms in a military-related population. Since there are currently no validated instruments on these factors for military populations, single-item indicators were identified and selected from the measures below based on theoretical definitions of the constructs. For example, biological correlates included age, sex, race/ethnicity, ROTC year, measured BMI and percent body fat (%BF). Sociocultural correlates included single item indicators of desire for muscularity and desire for thinness. Dieting factors

included weight loss as the primary reason for eating style and attempting to lose weight in the last 6 months. Body dissatisfaction factors included perceiving oneself as overweight, desiring to change weight (gain weight/lose weight), exercising primarily for weight loss, disliking one's body, and being willing to engage in extreme behaviors to change one's body. Negative affect factors included stress about the body composition process and worrying about one's weight. Military contextual factors included failing a body fat assessment, failing a BMI screen, engaging in any dieting to meet body composition standards, attempting weight loss to meet body composition standards, leader concerns about weight, and peer comments related to weight. These items were selected from three military-specific questionnaires currently under development by the US Army Research Institute of Environmental Medicine (Cole, 2016).

Demographics. Demographic characteristics were asked using the newly developed Military-Specific Demographics and Lifestyle Information Questionnaire, currently being piloted and validated by the US Army Research Institute of Environmental Medicine as part of their Development of a Military Specific Eating Behavior Survey Study (Cole, 2016). Within these demographic characteristics, biological correlates included: age, sex, race, ethnicity, and ROTC year.

Weight Status. Anthropometric measures included height, weight, and body circumferences using Army Regulation 600-9 (AR 600-9): The Army Body Composition Program procedures (Department of the Army, 2013). Height and weight were measured with participants wearing a physical fitness uniform without shoes, a combat uniform with empty pockets, and coat and boots removed, or civilian clothing without shoes. Height was measured using a Seca 213 portable stadiometer and was rounded to the nearest 0.1cm (seca GmbH, Hamburg, Germany). Weight was measured using a Seca 872 Digital medical scale (seca GmbH,

Hamburg, Germany) and was rounded to the nearest 0.1 kg. Height and weight were used to compute body mass index (kg/m2) (Janssen, Katzmarzyk, & Ross, 2002). Body circumferences were measured using the procedures in AR 600-9 using a Gulick measuring tape (5193, Richardson Products), and measurements were recorded to the nearest 0.1 cm at the following sites: neck (below the larynx, perpendicular to the neck), the waist for females (the point of minimal abdominal circumference) or the navel for males, and the hips for females (around the greatest gluteal protrusion) (Department of the Army, 2013). Each measurement was taken in series at least three times by one research assistant and recorded by a second research assistant. If two measurements at one location were greater than 0.5 cm different, a fourth set of measurements was taken. The measurements were converted to inches and rounded according to AR 600-9, and input into a sex-specific body fat equation for males, % body fat = [86.010 x Log10 (waist – neck)] – [70.041 x Log10 (height)] + 36.76, and females, % body fat = [163.205 x Log10 (waist + hip – neck)] – [97.684 x Log10 (height)] – 78.387. Percent body fat was recorded to the nearest whole percent (Department of the Army, 2013; US Department of Defense, 2002). From these measures, the biological correlates of BMI and %BF were selected.

Eating Behaviors and **Mediators of Eating Behaviors.** Additional questions regarding military-specific eating behaviors and mediators of eating behaviors were asked using the newly developed Military-Specific Eating Habits and Military-Specific Mediators of Eating Behaviors Questionnaires, currently being piloted and validated by the US Army Research Institute of Environmental Medicine as part of their Development of a Military Specific Eating Behavior Survey Study (Cole, 2016).

Two questions were selected as single-item indicators of sociocultural correlates, “I need to be muscular to be in good shape” and “I want to be as thin as possible.” Both questions were

rated on a five-point Likert scale ranging from "definitely disagree" to "definitely agree." Two questions were selected as single-item indicators of dieting correlates, "What is your primary reason for the eating style noted above" and "Did you purposely try to lose weight within the past 6 months." The eating style question was recoded to a binary item to indicate if weight loss was the primary reason for eating style (yes/no). The attempting weight loss question was also recoded to a binary item to indicate if a participant had attempted weight loss (yes/no).

Five questions were selected as single item indicators of body dissatisfaction correlates, "I think I am: very underweight to very overweight," "I would like to weigh: more, stay the same, less," "Why did you exercise," "I don't like my body type or shape," and "I would go to extreme measures to avoid being viewed as overweight." The first question was recoded to a binary item to indicate if a participant perceived themselves as overweight (yes/no). The next question was recoded to a binary item to indicate if a participant would like to weigh more (yes/no) or weigh less (yes/no). The exercise question was recoded to a binary item to indicate if weight loss was the primary reason for exercise (yes/no). The last two questions were rated on a five-point Likert scale ranging from "definitely disagree" to "definitely agree."

Two questions were selected as single item indicators of negative affect correlates, "How do you typically feel the week prior to the record height and weight (body composition assessment)," and "I constantly worry about being or becoming fat." The first question was recoded to a binary item to indicate if a participant was stressed or not stressed about the body composition assessment (yes/no). The second question was rated on a five-point Likert scale ranging from "definitely disagree" to "definitely agree."

Six questions were selected as single item indicators of military contextual factors, "Have you ever failed the body fat assessment," "Have you ever failed your BMI measurement," "Did

you use any of the following methods leading up to your last Height & Weight (body composition assessment)," "What is the one primary reason you tied to purposely lose weight in the past 6 months," "Leaders are more concerned about my weight than I am," "Other military personnel have made offensive comments about my weight." The first two items were recoded to binary items (yes/no). The question about methods was recoded to a binary item to indicate if a participant had used any dieting/weight loss method leading up to the body composition assessment (yes/no). The question about attempting weight loss was recoded to a binary item to indicate if meeting the body composition standards was the primary reason for attempting weight loss (yes/no). The last two questions were rated on a five-point Likert scale ranging from "definitely disagree" to "definitely agree."

Eating Disorder Diagnostic Scale, DSM-IV (EDDS) (Stice et al., 2000). The EDDS is a self-report measure of eating disorder symptoms and eating disorder risk classification based on the diagnostic criteria for eating disorders in the *Diagnostic and Statistical Manual for Mental Disorders*, 4th edition (American Psychiatric Association, 1994). There are a total of 22 questions, including questions about current height, weight, and birth control usage (Stice et al., 2000). The other 19 questions relate to eating disorder symptoms, such as body dissatisfaction (Has your weight influenced how you think about/judge yourself as a person), binge eating behaviors (During these episodes of overeating and loss of control did you eat alone because you were embarrassed by how much you were eating), binge eating frequency (How many times per week on average over the past 3 months have you eaten an unusually large amount of food and experienced a loss of control), and frequency of purging behaviors (How many times per week on average over the past 3 months have you engaged in excessive exercise specifically to

counteract the effects of overeating episodes), such as vomiting, laxative/diuretic use, fasting, and excessive exercise to counteract effects of overeating (Lee et al., 2007).

Participants with at least 80% of completed responses (18/22 questions) had their questionnaires scored and analyzed. Items are either scored and summed for a total eating disorder symptoms score, or they are standardized and summed to determine eating disorder risk classification based on a standardized cut-off score ≥ 16.5 (Krabbenborg et al., 2012), with higher scores indicative of higher levels of eating disorder symptoms (Stice et al., 2004b; Stice et al., 2000). The items can also be used to determine probable eating disorder diagnoses based on DSM-IV criteria (Stice et al., 2000). The authors reported a Cronbach's alpha of 0.89, and test-retest reliability of 0.87 for the total eating disorder symptoms score (Stice et al., 2000), as well as excellent criterion, convergent, and predictive validity (Stice et al., 2004b).

The standardized total eating disorder symptoms score was used to classify individuals as meeting eating disorder risk cut-off scores based on a score of ≥ 16.5. The probable eating disorder algorithm was used to generate probable eating disorder diagnoses, based on DSM-IV criteria. The total eating disorder symptoms score was used to measure the level of eating disorder symptoms. The eating disorder symptoms score demonstrated good internal consistency in the current study ($\alpha = 0.82$).

5. Analysis

Data was examined for univariate and multivariate normality using SPSS statistical software (v. 25; SPSS Inc., Chicago, IL). Normality was assessed according to the values of skewness (Sk) and kurtosis (Ku), where values $Sk > |3|$ and $Ku > |10|$ indicate severe violations of normality (Kline, 2015). Potential differences in demographic characteristics by site were examined using Chi-Square Tests of Independence (McHugh, 2013).

The rate of meeting the eating disorder risk classification cut-off score was determined using the total number of subjects who completed and returned the questionnaires as well as the total available population at the two Michigan US Army ROTC Programs during the data collection from data provided by the US Army Cadet Command (Tatro, personal communication, December 4, 2018). Demographic characteristics were compared across sites and determined not to be significantly different. Data from both sites was pooled for further analysis. Correlations between study variables were examined using Pearson, biserial, and point biserial correlations. Correlates of meeting eating disorder risk classification cut-off scores were determined using Chi-square tests of independence.

Differences between total eating disorder symptoms scores by various biological correlates were examined using t-tests and one-way analyses of variance (1-way ANOVA) for normally distributed variables, and independent samples Mann-Whitney U test for nonparametric variables. Association between biological, sociocultural, dieting, body satisfaction, negative affect, and military contextual factors and likelihood of meeting eating disorder risk classification cut-off scores were examined using univariate logistic regression models. Significant factors associated with a greater likelihood of meeting eating disorder risk classification cut-off scores were then examined using a multivariable logistic regression model. Factors with unreliable confidence intervals were excluded from the final model. The same biological, sociocultural, dieting, body dissatisfaction, negative affect, and military contextual factors were examined as predictors of the total eating disorder symptoms score in a multiple linear regression model. Data are reported as mean (standard deviation), unless indicated, and a p-value <0.05 was considered statistically significant.

B. Approach for Aim 2: Association between eating disorder symptoms and weight status in US Army ROTC cadets in two Midwestern universities

The second aim of this study was to determine whether there is an association between eating disorder symptoms and weight status and to examine the nature of that association. The objective if this aim was to examine the association between eating disorder symptoms and an indicator of obesity, body mass index (BMI). In addition, to examine if two shared pathways, psychological inflexibility related to body dissatisfaction and dieting, mediate the association between eating disorder symptoms and BMI.

1. Research Questions and Hypotheses

1. Are eating disorder symptoms associated with BMI?
    a. Ho: Eating disorder symptoms are not associated with BMI.
    b. Ha: Eating disorder symptoms are positively associated with BMI.
2. Are eating disorder symptoms associated with psychological inflexibility related to body dissatisfaction?
    a. Ho: Eating disorder symptoms are not associated with psychological inflexibility related to body dissatisfaction.
    b. Ha: Eating disorder symptoms are positively associated with psychological inflexibility related to body dissatisfaction.
3. Are eating disorder symptoms associated with psychological inflexibility related to dieting?
    a. Ho: Eating disorder symptoms are not associated with psychological inflexibility related to dieting.

    b. Ha: Eating disorder symptoms are positively associated with psychological inflexibility related to body dissatisfaction.

4. Is psychological inflexibility related to body dissatisfaction associated with BMI?
    a. Ho: Psychological inflexibility related to body dissatisfaction is not associated with BMI.
    b. Ha: Psychological inflexibility related to body dissatisfaction is positively associated with BMI.
5. Is psychological inflexibility related to dieting associated with BMI?
    a. Ho: Psychological inflexibility related to dieting is not associated with BMI.
    b. Ha: Psychological inflexibility related to dieting is negatively associated with BMI.
6. Does psychological inflexibility related to body dissatisfaction mediate the association between eating disorder symptoms and BMI?
    a. Ho: Psychological inflexibility related to body dissatisfaction does not mediate the association between eating disorder symptoms and BMI.
    b. Ha: Psychological inflexibility related to body dissatisfaction partially mediates the association between eating disorder symptoms and BMI.
7. Does psychological inflexibility related to dieting mediate the association between eating disorder symptoms and BMI?
    a. Ho: Psychological inflexibility related to dieting does not mediate the association between eating disorder symptoms and BMI.
    b. Ha: Psychological inflexibility related to dieting partially mediates the association between eating disorder symptoms and BMI.

2. Research Design

A descriptive, cross-sectional study design using quantitative approaches was selected. Participant recruitment and data collection were conducted between February-April 2018. Participants were recruited using an email flyer and in-person recruitment briefs. On the day of data collection, interested participants were given the opportunity to attend a mass briefing in a vacant ROTC classroom. Participants who met inclusion criteria were given the opportunity to provide informed consent, where the details of the study were explained. Once participants signed written informed consent forms, they were provided with a study questionnaire packet that included a "Demographics and Lifestyle Information" questionnaire, a "Military-Specific Eating Habits" questionnaire, a "Military-Specific Mediators of Eating Behavior" questionnaire, and the Eating Disorder Diagnostic Scale. After completing questionnaire packets, questionnaires were checked for completeness, while participants completed anthropometric measures. Anthropometric measures consisted of a height measure using a portable stadiometer, a weight measure using a digital scale, and a body composition estimation using body circumferences. Specific details are provided below. After participants completed all questionnaires and measures, they were provided with a $10 grocery gift card for participation. Consent and data collection forms are found in Appendices.

3. Sample

A descriptive, cross-sectional study design using quantitative approaches was selected. Participant recruitment and data collection were conducted between February-April 2018. Participants were recruited using an email flyer and in-person recruitment briefs. On the day of data collection, interested participants were given the opportunity to attend a mass briefing in a vacant ROTC classroom. Participants who met inclusion criteria were given the opportunity to

provide informed consent, where the details of the study were explained. Once participants signed written informed consent forms, they were provided with a study questionnaire packet that included a "Demographics and Lifestyle Information" questionnaire, a "Military-Specific Eating Habits" questionnaire, a "Military-Specific Mediators of Eating Behavior" questionnaire, and the Eating Disorder Diagnostic Scale. After completing questionnaire packets, questionnaires were checked for completeness, while participants completed anthropometric measures. Anthropometric measures consisted of a height measure using a portable stadiometer, a weight measure using a digital scale, and a body composition estimation using body circumferences. Specific details are provided below. After participants completed all questionnaires and measures, they were provided with a $10 grocery gift card for participation. Consent and data collection forms are found in Appendices.

4. Instruments

Demographics. Demographic characteristics were asked using the newly developed Military-Specific Demographics and Lifestyle Information Questionnaire, currently being piloted and validated by the US Army Research Institute of Environmental Medicine as part of their Development of a Military Specific Eating Behavior Survey Study (Cole, 2016). Demographic characteristics included: age, sex, race, ethnicity, and ROTC year.

Eating Disorder Diagnostic Scale, DSM-IV (EDDS) (Stice et al., 2000). The EDDS is a self-report measure of eating disorder symptoms based on the diagnostic criteria for eating disorders in the *Diagnostic and Statistical Manual for Mental Disorders*, 4th edition (American Psychiatric Association, 1994). There were a total of 22 questions, including one question about current height, one question about current weight, and one question about birth control usage. The other 19 questions relate to eating disorder symptoms, such as body dissatisfaction (Has

your weight influenced how you think about/judge yourself as a person), binge eating behaviors (During these episodes of overeating and loss of control did you eat alone because you were embarrassed by how much you were eating), binge eating frequency (How many times per week on average over the past 3 months have you eaten an unusually large amount of food and experienced a loss of control), and frequency of purging behaviors (How many times per week on average over the past 3 months have you engaged in excessive exercise specifically to counteract the effects of overeating episodes), such as vomiting, laxative/diuretic use, fasting, and excessive exercise to counteract effects of overeating (Lee et al., 2007). Items are scored and summed to yield a total eating disorder symptoms score, with higher scores indicating greater levels of eating disorder symptoms (Stice et al., 2004b; Stice et al., 2000). Items can also be standardized and summed if using a risk classification cut-off score, with a cut-off score ≥ 16.5 indicating a positive screen for eating disorder risk (Krabbenborg et al., 2012). The items can also be used to determine a probable eating disorder diagnoses based on DSM-IV criteria (Stice et al., 2000). The authors reported a Cronbach's alpha of 0.89, and test-retest reliability of 0.87 for the total eating disorder symptoms score (Stice et al., 2000), as well as excellent criterion, convergent, and predictive validity (Stice et al., 2004b). The total eating disorder symptoms score was used to measure eating disorder symptoms and demonstrated good internal consistency in the current study ($\alpha = 0.82$).

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Body Image-Action and Acceptance Questionnaire (BI-AAQ) (Sandoz et al., 2013). The BI-AAQ is a 12-item measure of psychological inflexibility related to body dissatisfaction. The BI-AAQ is a self-report measure of the degree to which one avoids experiences related to body dissatisfaction (If I start to feel fat, I try to think about something else), as well as to the

degree one engages in values-based activities despite body dissatisfaction (Worrying about my weight makes it difficult for me to live a life that I value) (Masuda et al., 2015; Sandoz et al., 2013). All items are rated on a seven-point Likert scale ranging from 1 (never true) to 7 (always true). Items can be scored and summed or reverse scored and summed, ranging from 12-84. When items are reverse scored and summed, this provides a measure of body image *flexibility*. When items are scored and summed, higher scores indicate higher levels of *psychological inflexibility related to body dissatisfaction*. Previous studies indicate the BI-AAQ had good internal consistency ($\alpha = 0.92$), as well as concurrent, criterion-related, and incremental validity (Sandoz et al., 2013). Although most studies report on the total of the reverse scored items, for this study, the total BI-AAQ score without reverse scoring was used to measure psychological inflexibility related to body dissatisfaction. The BI-AAQ demonstrated good internal consistency in the current study ($\alpha = 0.95$).

Inflexible Eating Questionnaire (IEQ) (Duarte et al., 2017). The IEQ is an 11-item self-report measure of psychological inflexibility related to dieting (When I cannot follow my eating plan, I feel very anxious or nervous). Items are rated on a five-point Likert scale ranging from 1 (totally disagree) to 5 (totally agree). Items are scored and summed, with total possible scores ranging from 11-55, and higher scores indicating higher levels of psychological inflexibility related to dieting (Duarte et al., 2017). Previous studies indicate the IEQ had good internal consistency ($\alpha = 0.95$), test-retest reliability, and construct validity in samples of males and females (Duarte et al., 2017). The total IEQ score was used to measure psychological flexibility related to dieting. The IEQ demonstrated good internal consistency in the current study ($\alpha = 0.92$).

Weight Status. Anthropometric measures included height, weight, and body circumferences using Army Regulation 600-9 (AR 600-9): The Army Body Composition Program procedures (Department of the Army, 2013). Height and weight were measured with participants wearing a physical fitness uniform without shoes, a combat uniform with empty pockets, and coat and boots removed, or civilian clothing without shoes. Height was measured using a Seca 213 portable stadiometer and was rounded to the nearest 0.1cm (seca GmbH, Hamburg, Germany). Weight was measured using a Seca 872 Digital medical scale (seca GmbH, Hamburg, Germany) and was rounded to the nearest 0.1 kg. Height and weight were used to compute BMI (kg/m^2) (Janssen et al., 2002). Body circumferences were measured using the procedures in AR 600-9 using a Gulick measuring tape (5193, Richardson Products), and measurements were recorded to the nearest 0.1 cm at the following sites: neck (below the larynx, perpendicular to the neck), the waist for females (the point of minimal abdominal circumference) or the navel for males, and the hips for females (around the greatest gluteal protrusion) (Department of the Army, 2013). Each measurement was taken in series (neck, abdomen for males; neck, waist, hips for females) at least three times by one research assistant and recorded by a second research assistant. If two measurements at one location were greater than 0.5 cm different, a fourth set of measurements was taken. The measurements were converted to inches and rounded according to AR 600-9, and entered into a sex-specific body fat equation for males, % body fat = [86.010 x Log10 (waist – neck)] – [70.041 x Log10 (height)] + 36.76, and females, % body fat = [163.205 x Log10 (waist + hip – neck)] – [97.684 x Log10 (height)] – 78.387. Percent body fat was recorded to the nearest whole % (Department of the Army, 2013) (Appendix L).

5. Analysis

Data was examined for univariate and multivariate normality using SPSS statistical software (v.25; SPSS Inc., Chicago, IL). Normality was assessed according to values of skewness (Sk) and kurtosis (Ku), where values Sk > |3| ad Ku > |10| indicate severe violations of normality (Kline, 2015). Demographic characteristics by site were examined using Chi-Square Tests of Independence (McHugh, 2013). In order to determine which indicator of weight status most strongly determined eating disorder symptoms, we conducted a Pearson correlation between indicators of weight status (BMI, waist circumference, and percent body fat), with the total eating disorder symptoms score, using sex, race, and ethnicity as covariates. Data are reported as mean (standard deviation), unless indicated, and a p-value <0.05 was considered statistically significant.

We tested our hypotheses regarding the indirect effects of eating disorder symptoms on weight status via psychological inflexibility related to body dissatisfaction and psychological inflexibility related to dieting in two mediation path models while using sex and race/ethnicity as covariates. Tests of model fit were examined to determine the goodness-of-fit of the proposed models using the following fit indicators: Chi-square ($\chi 2$), Tucker Lewis Index (TLI) ≥ 0.95, Comparative Fit Index (CFI) ≥ 0.95, Root-Mean Square Error of Approximation (RMSEA) with 90% confidence interval ≤ 0.08, and the Standardized Root Mean Square Residual (SRMR) ≤ 0.08 (Bentler & Bonett, 1980; Hu & Bentler, 1999; MacCallum, Browne, & Sugawara, 1996). The fit and comparison of reverse (nonnested) models was also considered using the Bayesian information criterion (BIC) (Merkle, You, & Preacher, 2016; Raftery, 1995; Schwarz, 1978). Analyses were conducted in Mplus (Mplus Version 8; Muthen & Muthen, 1998-2018) using full information maximum likelihood estimation to handle missing data in cases. To examine the

specific hypotheses, we implemented the nonparametric, percentile bootstrap method (Falk, 2018; MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002), with 5,000 resamples to construct percentile bootstrap 95% confidence intervals around the product coefficient of the indirect effect of eating disorder symptoms via the hypothesized mediators of psychological inflexibility related to body dissatisfaction and psychological flexibility related to dieting on weight status (BMI) (Preacher & Hayes, 2008).

C. Approach for Aim 3: Dieting and body image concerns in US Army ROTC cadets in a Midwestern university: a qualitative investigation

The third aim of the study was to address gaps regarding experiences related to eating behaviors and body image within the ROTC context. The objective if this aim was to qualitatively describe the eating behaviors and mediators of eating behaviors from the perspective of ROTC cadets.

1. Research Questions

1. How do ROTC cadets describe their eating behaviors?
2. What is the perspective of ROTC cadets on how and why they choose their eating behaviors?
3. How do ROTC cadets describe the role of the ROTC context in shaping and influencing their eating behaviors?
4. How do ROTC cadets describe their preparation for physical fitness and body composition assessments relative to their eating behaviors?
5. What are the perceptions and experiences of ROTC cadets related to body image within the context of ROTC?

2. Research Design

A qualitative descriptive design (Sandelowski, 2010) using in-depth responsive interviews (Patton, 2002) was used to describe the eating behaviors and mediators of eating behaviors of ROTC cadets. This method was used in order to explore cadets' eating behaviors and reasons for engaging in these eating behaviors, particularly in relation to the ROTC context. All research procedures were approved by the Institutional Review Board at Michigan State University.

2a. Site Selection

Army ROTC cadets were recruited from the Michigan State University (MSU) ROTC Program, which was selected because it is one of the largest programs within the seventh brigade region of the ROTC. Additionally, recent data from the 2016 National College Health Assessment on students from MSU reported that there were rates of overweight and obesity of 23% and 10.6%, respectively. Although 66.3% of students were classified as having a normal weight status, 33% of those students were still trying to lose weight (Hembroff, 2016). The study also reported that over half of respondents consumed less than 2 servings of fruits and vegetables per day (66.5%), while 3.7% of students surveyed reported a problem with eating disorders over the last 12 months (Hembroff, 2016). Similarly, the CDC currently ranks Michigan 17th in terms of adult obesity, with 18.1 % of young adults between 18-25 years of age classified as obese, and a high rate of metabolic abnormalities identified among Michigan university students (Centers for Disease Control and Prevention/National Center for Chronic Disease Prevention and Health Promotion/Division of Population Health, 2017; Yahia et al., 2017). Therefore, the ROTC program at Michigan State provided an opportunity to describe a broad range of eating behaviors.

2b. Sampling

The Army ROTC is comprised of eight brigades responsible for managing Army ROTC programs within their regions and includes over 30,000 enrolled college and university students (Tatro, personal communication, December 4, 2018). The seventh brigade comprises Army ROTC programs in the states of Michigan, Indiana, Ohio, Kentucky, and Tennessee and includes over 3,400 enrolled ROTC cadets (Tatro, personal communication, December 4, 2018). There are five Army ROTC programs within the state of Michigan, with the largest program at Michigan State University (Tatro, personal communication, December 4, 2018). In the 2017-2018 school year, there were 145 students enrolled at the Army ROTC Program at Michigan State University (Tatro, personal communication, December 4, 2018). ROTC year groups are determined by year of enrollment in the program and are an abbreviation of the class name Military Science (MS) (Today's Military, 2017). Thus, students are identified as MS1 for first year students, MS2, for second year students, MS3 for third year students, and MS4 for fourth- and fifth-year students. Students within the program are organized using military hierarchical organization, including squads and companies. The entire MSU ROTC organization is considered a battalion, which in the military, signifies a group of companies (Today's Military, 2017). The MSU ROTC program is the "Spartan Battalion." The program is headed by a battalion commander, an Army commissioned officer in the rank of Major or Lieutenant Commander, who is named the chairperson of the Department of Military Science. The rest of the staff consists of non-commissioned officers and commissioned officers. Commissioned officers, in the rank of Captain, are assigned as the primary instructors for each year group (MS1, MS2, MS3, MS4). Non-commissioned officers, who are enlisted personnel in the rank of staff sergeant, sergeant first class, and master sergeant, are assigned as assistant instructors for each

year group (MS1, MS2, MS3, MS4). Within the context of a military educational setting, all instructors are termed “cadre” or the cadre.

3. Sample

Following IRB approval, this qualitative study was conducted as a follow on to a larger, quantitative study on the eating behaviors and mediators of eating behaviors in Army ROTC cadets (Chapter 4, Chapter 5). During the informed consent process, in addition to providing consent to participate in the quantitative, face-to-face portion of the study, cadets were asked to provide consent to participate in qualitative, in-depth telephone interviews. Of the 205 ROTC cadets that provided informed consent and participated in the larger quantitative study, 114 ROTC cadets were from MSU. Of the 114 ROTC cadets that were from MSU, 34 consented to participating in the qualitative telephone interviews.

Sample size was determined to achieve maximum information power (Fusch & Ness, 2015; Malterud, Siersma, & Guassora, 2016; Mason, 2010). Purposive sampling was used in order to select a range of participants with various experiences related to ROTC for one-on-one telephone interviews, including “information-rich” participants as well as extreme and negative cases (Patton, 2002; Pope & Mays, 1995). Consenting cadets were selected considering the following break characteristics: sex and year group (Military Science (MS) 1, MS2, MS3, MS4), as well as by their responses to questions in the Military-Specific Mediators of Eating Behaviors Survey:

7) Have you ever failed the body fat tape test/assessment?

9) Have you ever failed your Weigh-in/BMI measurement?

17) How do you typically feel the week prior to the record height and weight (including tape test if needed)? Responses ranged from “Not at all stressed” to “Extremely stressed”;

48) Did you PURPOSELY try to lose weight within the PAST 6 MONTHS?

Considering the break criteria above, a minimum of 16 cases were sought, with at least 2 male and 2 female participants per year group to achieve saturation (Malterud et al., 2016). Of the 34 cadets consenting to participate in the qualitative telephone interview, 27 cadets were contacted to schedule a telephone interview, and 18 cadets scheduled and conducted telephone interviews. Each participant was offered a $20 Amazon.com gift card for their participation in the study, which was emailed to each participant following the completion of telephone interviews.

As part of the larger study, participants completed various questionnaires containing demographic information, as well as surveys on eating behaviors and mediators of eating behaviors. Quantitative data were collected using face-to-face data collection. Qualitative in-depth interviews were conducted via telephone.

Due to the nature of the study content, eating behaviors, the ROTC context, and discussion on body image perceptions, as well as the busy schedules of ROTC cadets, telephone, in-depth responsive interviews were conducted. Use of telephone interviews allowed for greater flexibility for scheduling (Cachia & Millward, 2011; Carr & Worth, 2001; Sturges & Hanrahan, 2004) and increased privacy for respondents (Cachia & Millward, 2011; Lechuga, 2012). Selected ROTC cadets were contacted by telephone and were asked to select a telephone interview time that was convenient for their schedule.

After an interview time was selected, the participants were contacted by the lead researcher, a PhD student with previous experience and training in designing and conducting qualitative research studies. The interviews were conducted in the research lab by the lead researcher using semi-structured, in-depth interview questions from the interview guide, as well as follow-on and probing questions. All interviews lasted between 45 and 75 minutes. All

interviews were recorded using two digital recording devices. Recorded interviews were transcribed using oTranscribe by four trained undergraduate research assistants. The lead researcher proofed each transcript to verify the accuracy of the transcription (Poland, 1995).

4. Instruments

Interview Guide A semi-structured interview guide was created to allow for clarification and probing as necessary. All participants were asked the following questions:

1. Tell me about your eating. Can you please describe a typical day in terms of your eating?
2. How do you decide what to eat?
3. What is your eating like now that you are in ROTC?
4. If you have an Army Physical Fitness Test and body composition assessment, how do you prepare for those in terms of your eating behaviors?
5. What are your experiences related to body image in ROTC?
6. What is in place in ROTC that helps to support your eating behaviors?
7. What would you like to see in place within ROTC to help support your eating behaviors?

The full version of the interview guide, including probe questions, is available in Appendix M.

Demographics. Demographic characteristics were asked using the newly developed Military-Specific Demographics and Lifestyle Information Questionnaire, currently being piloted and validated by the US Army Research Institute of Environmental Medicine as part of their Development of a Military Specific Eating Behavior Survey Study (Cole, 2016). Demographic characteristics included: age, sex, race, ethnicity, and ROTC year.

Eating Behaviors and **Mediators of Eating Behaviors** (Cole, 2016). Additional questions regarding military-specific eating behaviors and mediators of eating behaviors were asked using the newly developed Military-Specific Eating Habits and Military-Specific

Mediators of Eating Behaviors Questionnaires, currently being piloted and validated by the US Army Research Institute of Environmental Medicine as part of their Development of a Military Specific Eating Behavior Survey Study (Cole, 2016). Specific eating behaviors assessed included: primary eating style over the past 30 days (low calorie, high calorie, high protein, low fat, etc.) and primary reason for the eating style (no special reason, weight loss, weight gain, performance, health, lifestyle, budget, etc.). Specific mediators of eating behaviors assessed included: ever failing a body fat assessment, ever failing a BMI screen, stress regarding the body composition assessment, weight perception, desire to weigh less/more, attempting to lose weight, purposely trying to lose weight, trying to lose weight for appearance or performance reasons, and exercising for appearance or weight loss reasons.

Eating Disorder Diagnostic Scale, DSM-IV (EDDS) (Stice et al., 2000). The EDDS is a self-report measure of eating disorder symptoms based on the diagnostic criteria for eating disorders in the *Diagnostic and Statistical Manual for Mental Disorders*, 4th edition (American Psychiatric Association, 1994). There were a total of 22 questions, including one question about current height, one question about current weight, and one question about birth control usage. The other 19 questions relate to eating disorder symptoms, such as body dissatisfaction (Has your weight influenced how you think about/judge yourself as a person), binge eating behaviors (During these episodes of overeating and loss of control did you eat alone because you were embarrassed by how much you were eating), binge eating frequency (How many times per week on average over the past 3 months have you eaten an unusually large amount of food and experienced a loss of control), and frequency of purging behaviors (How many times per week on average over the past 3 months have you engaged in excessive exercise specifically to counteract the effects of overeating episodes), such as vomiting, laxative/diuretic use, fasting,

and excessive exercise to counteract effects of overeating (Lee et al., 2007). Items are scored and summed to yield a total eating disorder symptoms score, with higher scores indicating greater levels of eating disorder symptoms (Stice et al., 2004b; Stice et al., 2000). Items can also be standardized and summed if using a risk classification cut-off score, with a cut-off score ≥ 16.5 indicating a positive screen for eating disorder risk (Krabbenborg et al., 2012). The items can also be used to determine a probable eating disorder diagnoses based on DSM-IV criteria (Stice et al., 2000). The authors reported a Cronbach's alpha of 0.89, and test-retest reliability of 0.87 for the total eating disorder symptoms score (Stice et al., 2000), as well as excellent criterion, convergent, and predictive validity (Stice et al., 2004b). The total eating disorder symptoms score was used to measure eating disorder symptoms and demonstrated good internal consistency in the current study ($\alpha = 0.82$).

Weight Status. Anthropometric measures included height, weight, and body circumferences using Army Regulation 600-9 (AR 600-9): The Army Body Composition Program procedures (Department of the Army, 2013). Height and weight were measured with participants wearing a physical fitness uniform without shoes, a combat uniform with empty pockets, and coat and boots removed, or civilian clothing without shoes. Height was measured using a Seca 213 portable stadiometer and was rounded to the nearest 0.1cm (seca GmbH, Hamburg, Germany). Weight was measured using a Seca 872 Digital medical scale (seca GmbH, Hamburg, Germany) and was rounded to the nearest 0.1 kg. Height and weight were used to compute body mass index (kg/m^2) (Janssen et al., 2002). Body circumferences were measured using the procedures in AR 600-9 using a Gulick measuring tape (5193, Richardson Products), and measurements were recorded to the nearest 0.1 cm at the following sites: neck (below the larynx, perpendicular to the neck), the waist for females (the point of minimal abdominal

circumference) or the navel for males, and the hips for females (around the greatest gluteal protrusion) (Appendix) (Department of the Army, 2013). Each measurement was taken in series at least three times by one research assistant and recorded by a second research assistant. If two measurements at one location were greater than 0.5 cm different, a fourth set of measurements was taken. The measurements were converted to inches and rounded according to AR 600-9, and entered into a sex-specific body fat equation for males, % body fat = [86.010 x Log10 (waist – neck)] – [70.041 x Log10 (height)] + 36.76, and females, % body fat = [163.205 x Log10 (waist + hip – neck)] – [97.684 x Log10 (height)] – 78.387. Percent body fat was recorded to the nearest whole % (Department of the Army, 2013).

5. Analysis

Quantitative data was analyzed using SPSS V. 25 (IBM Corp.; 2017. IBM SPSS Statistics for Windows: Armonk, NY). Independent samples t-tests were conducted to test results between qualitative participants and the rest of the sample. Data are reported as mean (standard deviation), unless indicated, and a p-value <0.05 was considered statistically significant.

Qualitative data analysis was conducted using NVivo V12 (NVivo qualitative data analysis software; QSR International Pty Ltd: London). Qualitative data was analyzed using thematic analysis. Data analysis was conducted by the lead researcher and one undergraduate researcher. The lead researcher and undergraduate researcher read through all the transcripts and developed a preliminary code book. The preliminary codes were then applied to all transcripts by both researchers, and all coded transcripts were reviewed by both researchers until consensus was achieved. Codes were grouped by themes which reflected the research questions. Coded data was extracted using NVivo. Extracted data was used to create matrices for all participants for each code. Matrices were then created to condense extracted data and to identify relevant factors

associated with each theme. Emergent themes and related factors were further synthesized, with representative quotes chosen to illustrate themes and factors.

CHAPTER 4 - Prevalence and correlates of eating disorder symptoms in US Army ROTC cadets in two Midwestern universities

A. Abstract

Objective: Young adults, 18-25 years of age, comprise the largest demographic of military services. They also experience the largest burden of eating disorders, with the average age of onset of 18-25 years for most eating disorders. Eating disorders are characterized by biological, psychological, and behavioral symptoms, such as overvaluation of weight and shape and adoption of binge eating and purging behaviors. While diagnosed eating disorders comprise specific combinations of biological, psychological, and behavioral symptoms, most individuals with eating disorder symptoms don't meet diagnostic criteria despite experiencing similar levels of symptoms and comorbidity as individuals with diagnosed eating disorders. Risk factors for eating disorder symptoms include biological, sociocultural, psychological, and behavioral risk factors that lead to the overvaluation of weight and shape and adoption of binge eating and purging behaviors to achieve an ideal body image. Etiological models of eating disorder symptom development, including the Stice Dual Pathway Model, suggest factors such as body dissatisfaction, dieting, negative affect, and affect regulation, result in the development of eating disorder symptoms. Military service members, including US Army ROTC cadets, must adhere to semi-annual physical fitness and body composition standards. Adherence to strict standards may increase the importance of weight and shape, leading to overvaluation of weight and shape and development of eating disorder symptoms. Studies in military populations report high rates of meeting eating disorder risk classification cut-off scores, with risk rates higher in service members that have increased body dissatisfaction and that engage in unhealthy weight control behaviors. However, these studies were conducted over 10-20 years ago in primarily female

samples. Therefore, the purpose of this study was to examine the prevalence and correlates of eating disorder risk classification and eating disorder symptoms in male and female US Army ROTC cadets recruited from two Midwestern universities.

Methods: The final analytic sample consisted of 199 of US Army ROTC cadets. Eating disorder risk classification and symptoms were determined using the Eating Disorder Diagnostic Scale, a valid and reliable measure of eating disorder symptoms and eating disorder risk classification. Standardized total eating disorder symptom scores ≥ 16.5 classified an individual as meeting eating disorder risk classification cut-off scores.

Results: The sample was primarily male (68.3%), identified as White/Caucasian (84.4%), non-Hispanic (92%), first year ROTC cadets (42.2%), and had a normal weight BMI of 18.5-24.9 kg/m^2 (53.3%). The mean age was 20.1 (2.0) years and the mean BMI was 24.6 (3.0) kg/m^2, 24.9 (2.9) kg/m^2 for males and 23.4 (3.2) kg/m^2 for females. Twenty participants (10.1%) met the eating disorder risk classification cut-off score ≥ 16.5, including 7.4% of males and 15.9% of females. Mean total eating disorder symptoms scores were 13.6 (12.0), and these were significantly higher in females, individuals identifying as Asian, third year ROTC cadets, and individuals with overweight and obesity. Several study variables were associated with greater likelihood of meeting eating disorder risk classification cut-off scores, including BMI, percent body fat, and other sociocultural (SC), dieting (DT), body dissatisfaction (BD), and military contextual factors (MC), such as desire for muscularity and leanness (SC), perceived overweight (BD), stress about body composition assessment (NA), attempting weight loss to meet body composition standards (MC), and peer comments about weight (MC). Several study variables were also associated with increased total eating disorder symptoms scores, including sex (B), desire for thinness (SC), and disliking one's body (BD).

Conclusions: Overall the findings suggest that there is a high rate of meeting eating disorder risk classification cut-off scores in US Army ROTC cadets. Additionally, correlates associated with greater likelihood of meeting eating disorder risk classification cut-off scores and higher eating disorder symptoms scores include traditional correlates, such as sex, BMI, dieting factors (e.g. attempting weight loss), body dissatisfaction factors (e.g. disliking one's body), and negative affect factors (e.g. worry about weight), as well as military contextual factors (e.g. failing a body composition assessment, dieting to prepare for body composition assessments, and peer comments about weight). Therefore, there is a need for future studies, including longitudinal and qualitative studies, to examine how and why these factors contribute to greater likelihood of meeting eating disorder risk classification cut-off scores and higher eating disorder symptoms in male and female ROTC cadets. Practitioners, such as registered dietitians, should continue to monitor for both traditional and military contextual factors, especially around body composition testing periods, when working with ROTC cadets.

B. Introduction

Young adults, 18-25 years of age, are one of the largest demographic of the military services, and also experience the largest burden of eating disorders (Department of Defense, 2015). Studies suggest 95% of diagnosed eating disorders are amongst adolescents and young adults, with an average onset of 18-25 years of age for most of the eating disorders (Hudson et al., 2007a). Eating disorders are psychological disorders characterized by abnormal concerns regarding food, body weight, and consequent abnormal eating behaviors (American Psychiatric Association, 1994, 2013). Eating disorders are associated with psychological impairment and increased morbidity and mortality (Arcelus et al., 2011; Herpertz-Dahlmann, 2009; Klump, Bulik, Kaye, Treasure, & Tyson, 2009), including increased risk of dieting, body dissatisfaction,

weight gain, and obesity onset (Loth et al., 2014; Neumark-Sztainer et al., 2006a; Neumark-Sztainer et al., 2006c; Neumark-Sztainer et al., 2012; Stice et al., 1999; Stice et al., 2005b), which would be detrimental to physical and mental health, military operational readiness, and national security.

Commonly diagnosed eating disorders include anorexia nervosa, bulimia nervosa, and binge eating disorder (American Psychiatric Association, 1994). The primary psychological symptoms include cognitive symptoms related to overvaluation of food, body weight, and shape. Behavioral symptoms include binge eating behaviors, defined by overeating and loss of control eating, that include feelings of guilt and shame. Other behavioral symptoms include purging behaviors, or behaviors to counteract weight gain from binge eating or to promote weight loss, such as dietary restraint, fasting or skipping meals, vomiting, use and abuse of laxatives and diuretics, and excessive exercise (American Psychiatric Association, 1994, 2013). However, most individuals with eating disorder symptoms do not meet eating disorder diagnostic criteria, although evidence indicates that individuals with subclinical or subthreshold eating disorder symptoms present with symptoms and comorbidity severity comparable to individuals with diagnosed eating disorders (American Psychiatric Association, 2013; Austin et al., 2008; Fairburn et al., 2007; Favaro et al., 2003), highlighting the importance of screening for eating disorder symptoms, especially among young adults 18-25 years of age.

There are many potential factors that contribute to the development of eating disorder symptoms (Culbert et al., 2015; Polivy & Herman, 2002; Stice, 2002). These include various biological, sociocultural, and psychological, and etiological risk factors for eating disorder symptoms (Culbert et al., 2015; Jacobi et al., 2004; Stice, 2002; Stice et al., 2011a; Striegel-Moore & Bulik, 2007). Biological risk factors include risk factors that are biologically

determined, such as genetics, sex, race/ethnicity, age, and weight status. For example, all studies suggest a higher prevalence of eating disorders amongst females compared to males (Jacobi et al., 2004; Striegel-Moore & Bulik, 2007). Similarly, studies also agree that adolescence and young adulthood are the highest age risk period for the onset of eating disorder symptoms and eating disorders (Hudson et al., 2007a; Jacobi et al., 2004; Stice et al., 2013b; Striegel-Moore & Bulik, 2007). However, studies are less consistent with regards to the role of weight status and race/ethnicity (Jacobi et al., 2004; Stice, 2002; Striegel-Moore & Bulik, 2007). For example, some studies report lower rates of eating disorders amongst Black/African-American individuals compared to Hispanic and White/Caucasian individuals, while others report the highest rates of binge eating among Black/African-American individuals (Jacobi et al., 2004; Striegel-Moore & Bulik, 2007). Findings related to weight status, as indicated by body mass index (BMI), suggest that while high BMI does not predict onset of eating disorder symptoms, it does predict other precursors for eating disorders, such as pressure to be thin, body dissatisfaction, and dieting, sociocultural factors that will be addressed next (Jacobi et al., 2004; Stice, 2002). Evidence from these reviews suggests that important biological risk factors include sex and age, particularly young adulthood (ages 18-25 years), with less clear findings for race/ethnicity and weight status, while weight status was associated with other precursors related to eating disorder symptoms.

Other prominent risk factors for eating disorders include sociocultural and psychological risk factors. Sociocultural risk factors include risk factors that are present as a result of sociocultural influences, such as media-portrayed body image ideals, internalization of body image ideals, and perceived pressures to achieve body image ideals. Evidence suggests that perceived pressure to achieve a body image ideal, which in Western societies includes thinness for females and leanness/muscularity for males, as well as internalization of this body image

ideal, both predicted increases in body dissatisfaction and dieting, as well as onset of eating disorder symptoms (Culbert et al., 2015; Stice, 2002; Striegel-Moore et al., 1986; Thompson & Cafri, 2007). One prominent psychological risk factor is negative affect, or the experience of negative emotions (Culbert et al., 2015). Negative affect was found to predict the onset of binge eating, bulimic symptoms, and eating disorders (Culbert et al., 2015; Stice, 2002). Evidence from these studies suggest that sociocultural and psychological risk factors also play an important role in the onset of eating disorder symptoms, which may result in onset of eating disorders.

While meta-analyses of eating disorder risk factors have identified important risk factors that predict the onset of eating disorder symptoms and eating disorders, these analyses are limited due to only examining single risk factors and their roles in predicting eating disorder and eating disorder symptom onset. Instead, multivariate models that examine how multiple risk factors work together and interact to predict the onset of eating disorders and eating disorder symptoms are needed. One of the most widely examined multivariate, etiologic model of eating disorders and eating disorder symptoms is the Stice Dual Pathway Model (1998). This multivariate, etiologic model proposes how the various identified risk factors arise and result in increased onset of eating disorder symptoms and eating disorders.

The Dual Pathway Model posits that BMI and perceived sociocultural pressures for body image ideals, which includes thinness for females and leanness/muscularity for males, promote internalization of the thin ideal (or body image ideal) (Stice et al., 1998). Together, these risk factors predict the onset of body dissatisfaction (Stice et al., 1998). Body dissatisfaction, or the discrepancy between one's body and their body image ideal, in turn predicts the onset of dieting and negative affect (Stice et al., 1998). Dieting, or the "adherence to a specified meal plan for the purposes of weight loss" (pg. 90)(Schaumberg et al., 2016), arises from the belief that dieting

can resolve body dissatisfaction because it is an effective way to change one's body (Stice, 1994). Negative affect arises from body dissatisfaction due to the experience of negative body image emotions (Stice et al., 1998). Dieting also results in the onset of eating disorder symptoms because it produces physiological and cognitive changes which are susceptible to disruption, leading to disinhibition and binge eating (Polivy & Herman, 1985). Since dieting efforts are often not successful (Lowe & Timko, 2004a), engaging in dieting has also been found to predict increases in negative affect and adoption of unhealthy dieting behaviors, such as fasting, laxative/diuretic use, and vomiting (Heatherton & Polivy, 1992). Increased negative affect, in turn, also predicts the onset of eating disorder symptoms due to the strategies adopted to regulate these negative emotions, which typically include binge eating and purging behaviors (Endler & Parker, 1994; Haedt-Matt & Keel, 2011; Hawkins et al., 1984; Spoor et al., 2007).

Evidence supporting the Dual Pathway Model comes from a variety of sources, including cross-sectional, prospective, and experimental trials in female adolescents and male and female college students (Dakanalis et al., 2014; Gagnon-Girouard et al., 2009; Mason & Lewis, 2015; Ouwens et al., 2009; Rohde et al., 2018; Stice, 2001; Stice et al., 2011b; Stice et al., 2007b; Stice et al., 1998). While the original Dual Pathway Model was initially tested in a prospective sample of adolescent females (Stice, 2001; Stice et al., 1998), the results have been replicated in overweight adult females (Gagnon-Girouard et al., 2009), and male and female college students (Mason & Lewis, 2015; Ouwens et al., 2009). Furthermore, randomized controlled trials of programs which target body dissatisfaction in adolescents and college students report that reductions in body image ideal internalization and body dissatisfaction resulted in decreases in dieting, negative affect, and eating disorder symptoms (Rohde et al., 2018; Stice, Butryn, Rohde, Shaw, & Marti, 2013a; Stice et al., 2011b; Stice et al., 2007b). The overall findings from

previous studies suggest body dissatisfaction, dieting, and negative affect, are etiologic risk factors, as well as important links between biological, sociocultural, and psychological factors and the onset of eating disorder symptoms and eating disorders. Therefore, it is important to determine if these factors also play a role in the presence of eating disorder symptoms, eating disorders, and eating disorder risk classification in military populations, given they share some risk factors with civilian populations.

Only one systematic review has summarized the point prevalence of eating disorders across young adults in military, college, and athletic settings. Bodell et al. (2014) reported on eating disorder diagnoses and self-reported eating disorder risk rates based on cut-off scores in active duty military populations, reserve officer training corps (ROTC) and US Military Academy cadets, college students, and college athletes. The authors noted that rates of eating disorder diagnoses, identified through medical records review or use of clinical interviews, were similar across populations, ranging 0.1-5% in active duty and ROTC/military academy cadets, compared to 0-5% in college students and college athletes (Antczak & Brininger, 2008; Beekley et al., 2009; Bodell et al., 2014; Forney & Ward, 2013; Hudson, Hiripi, Pope Jr, & Kessler, 2007b; Johnson et al., 1999; Lauder & Campbell, 2001). This finding may be explained due to potential underreporting in military populations, where diagnosis with an eating disorder may be ground for medical discharge (Department of the Army, 2016). Trends in self-report eating disorder risk rates, which range from 2-7% in active duty and ROTC/military academy males and 20-33% in active duty and ROTC/military academy females compared to 8.5-9.5% and 16-25% in college males and females, respectively, provide support to these findings (Beekley et al., 2009; Bodell et al., 2014; Forney & Ward, 2013; Hudson et al., 2007b; Johnson et al., 1999; Lauder & Campbell, 2001; Lauder et al., 1999; Warner et al., 2007), since self-report surveys

tend to be anonymous and not tied to a medical diagnosis with a potential detrimental outcome. The evidence suggests eating disorders are also prevalent in military populations. However, these studies were conducted over one to two decades ago using primarily female samples, so the current status of the problem in male and female samples is not known.

Military service members are required to adhere to physical fitness, body composition, and appearance standards that are enforced at least semi-annually (Department of the Army, 2013; US Department of Defense, 2002). Failure to meet these standards may result in disciplinary actions, including involuntary separation from the military services (Department of the Army, 2013; US Department of Defense, 2002). Pressure to meet these standards may, in turn, result in an overvaluation of weight, shape, and eating, leading to dieting, body dissatisfaction, and use of unhealthy weight control behaviors, all which increased risk for onset of eating disorders and eating disorder symptoms (Bodell et al., 2014; Johnson et al., 2014). No military studies have examined risk factors for eating disorders and eating disorder symptoms, since no prospective or experimental trials have been conducted in military samples. Some military studies have examined correlates of eating disorders and eating disorder symptoms using a wide variety of eating disorder screening tools and analytic methodologies. The majority of studies report that bulimia nervosa and symptoms of binge eating and purging behaviors are the most commonly reported eating disorders and eating disorder symptoms in military populations (Antczak & Brininger, 2008; Lauder & Campbell, 2001; Lauder et al., 1999; McNulty, 1997a, 1997b, 2001; Mitchell et al., 2016; Williams et al., 2018). Biological correlates investigated included: age, sex, race/ethnicity, and weight status. Three studies reported a significant association between eating disorder risk classification or level of eating disorder symptoms and age, with eating disorder symptoms most commonly reported in young adults (McNulty, 2001;

Mitchell et al., 2014; Williams et al., 2018). Four studies reported female sex was significantly associated with eating disorder risk classification or eating disorder symptoms (Antczak & Brininger, 2008; Carlton et al., 2005; Warner et al., 2007; Williams et al., 2018). Race and ethnicity were significantly associated with eating disorder risk classification in two studies, with eating disorders most commonly reported by individuals identifying as White/Caucasian (Antczak & Brininger, 2008; Williams et al., 2018). Only two studies examined self-reported weight status classification and found that an overweight BMI classification (>25 kg/m^2) was associated with eating disorder symptoms (Carlton et al., 2005; Warner et al., 2007). Therefore, there is some evidence for the association between biological correlates, eating disorder classification, and eating disorder symptoms in military populations.

A few studies have examined sociocultural correlates of eating disorder classification and eating disorder symptoms, such as drive for thinness. While some studies have reported on appearance pressures, these were mainly described as pressures to meet military weight requirements and will be discussed further when discussing military contextual factors. Only two studies reported on drive for thinness, measured using the Eating Disorder Inventory-2 (Garner et al., 1983), and found that drive for thinness scores were significantly higher in individuals classified as meeting eating disorder risk classification cut-off scores (Lauder & Campbell, 2001; Lauder et al., 1999). While drive for thinness appears to be a correlate of eating disorder classification, this was only examined in females.

Similarly, only a few studies have examined psychological correlates of eating disorder classification and eating disorder symptoms in military population. Two studies reported that having a diagnosis of PTSD or depression were significantly associated with eating disorder symptoms (Mitchell et al., 2016; Mitchell et al., 2014). At the same time, only a few studies have

examined etiologic factors, such as dieting, body dissatisfaction, and negative affect in association with eating disorder classification and eating disorder symptoms. For example, three studies reported that dieting was significantly higher in individuals meeting eating disorder risk classification or was found to be a correlate with eating disorder risk classification (Jacobson et al., 2009; Lauder & Campbell, 2001; Lauder et al., 1999). Three studies also reported that body dissatisfaction was more prevalent in individuals meeting eating disorder risk classification (Lauder & Campbell, 2001; Lauder et al., 1999; McNulty, 1997a), while only one study reported negative affect (measured as depression) as significantly associated with eating disorder classification (Mitchell et al., 2014). Very few studies have examined important risk factors for eating disorders and eating disorder symptoms, such as sociocultural factors, psychological factors, and other etiological factors, in military populations. Furthermore, many used instruments developed for eating disorder populations or researcher-developed tools and examined these factors primarily in female samples. None of these studies examined these factors in a sample including both male and female ROTC cadets.

Researchers have also sought to describe how military contextual factors may be associated with eating disorder risk classification and eating disorder symptoms. One challenge has been that the military context has not been adequately described by these studies. As a result, most studies investigate these factors using specific questions designed for each study sample, which may limit comparability across samples. The most commonly reported factors included rank, branch of service, and pressure to meet military weight requirements. For example, most studies reported that rank (enlisted vs. officer) was not significantly associated with eating disorder risk classification or eating disorder symptoms, while two studies found that these were more common in junior enlisted and junior officers, as well as female cadets in their second and

third years (Antczak & Brininger, 2008; Beekley et al., 2009; McNulty, 1997a, 1997b, 2001; Williams et al., 2018). Three studies examined rates of eating disorder risk classification and eating disorder symptoms across branch of service and reported the highest rates amongst female Marines (Antczak & Brininger, 2008; McNulty, 2001; Williams et al., 2018). While rank was not found to be significantly associated with eating disorder risk classification or symptoms for most studies, the studies that did report an association with rank may potentially be reflecting rank as an artifact of age, suggesting these are more common in military young adults, as previously hypothesized.

Several studies also described the role of military weight standards by asking participants specific questions about weight standards. For example, Lauder et al. (1999) asked about the most common external pressure for eating behaviors and reported that military pressure about weight was reported at a higher rate by females meeting eating disorder risk classification cut-off scores. Similarly, several studies reported a significant association between eating disorder risk classification and eating disorder symptoms and related questions about military weight standards (e.g. testing periods, being forced into a weight program, military weight standards, mandatory physical fitness, and worry about physical fitness assessments) (Carlton et al., 2005; McNulty, 1997b, 2001). Other studies also described factors such as: exercising for weight loss, the military environment, feeling overweight, stress, supervisor harassment for weight, fear of being kicked out, and no help available (Lauder et al., 1999; McNulty, 1997b, 2001). Overall, it is difficult to interpret these findings due to a lack of a clear definition of military contextual factors. Therefore, a working definition of the military context and military contextual factors will be explored next.

Just like the sociocultural context creates an environment in which sociocultural facets, such as body image ideals (e.g. thinness for females, and leanness/muscularity for males) and appearance-related comments communicated by the media, family, and peers, result in sociocultural risk factors, such as appearance pressure and body image ideal internalization, there is also likely a sociocultural context related to the military. However, unlike the sociocultural context that results in sociocultural risk factors, the military context has not been as well defined or described, at least in military studies on eating behaviors.

One population of young adults 18-25 years of age that may potentially be at risk for eating disorder symptoms is US Army ROTC cadets, who are college and university students in training to become officers in the US military (Today's Military, 2017). US Army ROTC cadets are required to adhere to body composition and physical fitness standards. The requirement and pressure to meet these standards, in turn may lead to an overemphasis on weight and shape, body dissatisfaction, and use of unhealthy weight control behaviors, in order to meet these standards and retain scholarship benefits, as well as be competitive for favorable officer commission opportunities (Bodell et al., 2014; Johnson et al., 2014; US Army Cadet Command, 2018). Indeed, one study in female US Army ROTC cadets reported a prevalence rate of 20% of cadets in the sample who met the eating disorder risk classification cut-off score based on a self-report measure of eating disorder symptoms (Lauder & Campbell, 2001). Cadets identified at risk had a higher prevalence of eating disorder symptoms (bingeing, purging, laxative/diet pill/diuretic use), as well as a higher prevalence of body dissatisfaction (Lauder & Campbell, 2001). However, the study did not include male ROTC cadets, nor did the authors report on other prominent risk factors for eating disorder symptoms.

Another study in male and female West Point cadets found a similar prevalence of cadets who met the criteria for eating disorder risk based on a self-report measure of eating disorder symptoms (~20%), but this study did not report on body dissatisfaction or the relation between eating disorder symptoms and other correlates of eating disorder risk and eating disorder symptoms (Beekley et al., 2009). A more recent study in a large sample of male and female ROTC cadets reported rates of overweight and obesity of 30.1% and 6.2%, respectively, with 24% of cadets dissatisfied to very dissatisfied with their weight, and with some cadets (11.6-14.9%) endorsing the use of unhealthy weight control behaviors (e.g. fasting using water or juices and skipping at least one meal to lose weight) (Wilson & James, 2018). Similar to previous studies, these studies did not examine correlates of eating disorder risk classification, eating disorder symptoms, and unhealthy weight control behaviors.

A more recent mixed methods thesis, which included qualitative focus groups, reported that struggling to meet body composition standards has an influence on ROTC cadets' eating behaviors and dietary intake (Nevarez, 2017). For example, Nevarez reported that some cadets reported engaging in unhealthy weight control behaviors, such as fasting for a day or doing excessive exercise in order to meet body composition standards (Nevarez, 2017). So, while ROTC cadets are military officers in training, and are expected to meet physical fitness and body composition standards, which may increase their risk for dieting and body dissatisfaction, both which are precursors for weight gain and eating disorder symptoms, few studies have examined the prevalence and correlates of eating disorder symptoms and eating disorder risk classification in this population, and no studies have examined samples with male and female ROTC cadets in the last 10-20 years.

The present study sought to contribute to the literature on eating disorder risk and eating disorder symptoms in military populations by examining the prevalence and correlates of eating disorder risk classification and eating disorder symptoms in a recent sample of male and female US Army ROTC cadets. First, we examined the rates of meeting eating disorder risk classification cut-off scores in a sample and population of US Army ROTC cadets at two Midwestern universities. Next, we described the levels of eating disorder symptoms in US Army ROTC cadets. Finally, we examined whether specific correlates, such as biological, sociocultural, psychological/etiological, behavioral characteristics, as well as military contextual factors, were associated with the presence of eating disorder risk and eating disorder symptoms in US Army ROTC cadets.

C. Methods

1. Participants and Procedures

Data for the present study were drawn from a cross-sectional study designed to examine eating behaviors and mediators of eating behaviors in a sample of US Army ROTC cadets. Because Michigan has a high rate of adult obesity among college students, a potential risk factor for eating disorders, a sample of US Army ROTC cadets were recruited from two Michigan universities (Yahia et al., 2017). A convenience sample of US Army ROTC cadets was recruited from US Army ROTC programs at two southcentral Michigan universities. Participants who were active members in the US Army ROTC programs, ages 18-35 years, were included. The study was approved by the appropriate institutional review boards, and participant consent was collected. Demographic characteristics, eating behaviors, and mediators of eating behaviors, including eating disorder symptoms and measures of eating disorder risk, were collected through participant self-reports. Participant anthropometric characteristics, including height, weight, body

mass index, waist circumference, and percent body fat were measures and computed using anthropometric measures. Eligible participants were provided a $10 grocery gift card for completing the approximately 90-minute long surveys and anthropometric measurements.

Two hundred and five ROTC cadets participated. Only participants missing data on all variables of interest were excluded. The final analytic sample consisted of 199 participants. When comparing participant demographic characteristics from two sites, participants differed only on age and ethnicity, which were not significant predictors of the main study variables, so data from both sites were pooled for further analyses. Participant ages ranged from 18-32 years. Most of the sample was male, White/Caucasian, non-Hispanic, and a first year ROTC cadet.

2. Measures

The measures below were selected to identify and measure specific biological, sociocultural, psychological/etiological, and military contextual factors that may potentially be associated with eating disorder risk classification and eating disorder symptoms in a military-related population. Since there are currently no validated instruments on these factors for military populations, single-item indicators were identified and selected from the measures below based on theoretical definitions of the constructs. For example, biological correlates included age, sex, race/ethnicity, ROTC year, measured BMI and percent body fat (%BF). Sociocultural correlates included single item indicators of desire for muscularity and desire for thinness. Dieting factors included weight loss as the primary reason for eating style and attempting to lose weight in the last 6 months. Body dissatisfaction factors included perceiving oneself as overweight, desiring to change weight (gain weight/lose weight), exercising primarily for weight loss, disliking one's body, and being willing to engage in extreme behaviors to change one's body. Negative affect factors included stress about the body composition process and worrying about one's weight.

Military contextual factors included failing a body fat assessment, failing a BMI screen, engaging in any dieting to meet body composition standards, attempting weight loss to meet body composition standards, leader concerns about weight, and peer comments related to weight. These items were selected from three military-specific questionnaires currently under development by the US Army Research Institute of Environmental Medicine (Cole, 2016).

Demographics. Demographic characteristics were asked using the newly developed Military-Specific Demographics and Lifestyle Information Questionnaire, currently being piloted and validated by the US Army Research Institute of Environmental Medicine as part of their Development of a Military Specific Eating Behavior Survey Study (Cole, 2016). Within these demographic characteristics, biological correlates included: age, sex, race, ethnicity, and ROTC year.

Weight Status. Anthropometric measures included height, weight, and body circumferences using Army Regulation 600-9 (AR 600-9): The Army Body Composition Program procedures (Department of the Army, 2013). Height and weight were measured with participants wearing a physical fitness uniform without shoes, a combat uniform with empty pockets, and coat and boots removed, or civilian clothing without shoes. Height was measured using a Seca 213 portable stadiometer and was rounded to the nearest 0.1cm (seca GmbH, Hamburg, Germany). Weight was measured using a Seca 872 Digital medical scale (seca GmbH, Hamburg, Germany) and was rounded to the nearest 0.1 kg. Height and weight were used to compute body mass index (kg/m2) (Janssen et al., 2002). Body circumferences were measured using the procedures in AR 600-9 using a Gulick measuring tape (5193, Richardson Products), and measurements were recorded to the nearest 0.1 cm at the following sites: neck (below the larynx, perpendicular to the neck), the waist for females (the point of minimal abdominal

circumference) or the navel for males, and the hips for females (around the greatest gluteal protrusion) (Department of the Army, 2013). Each measurement was taken in series at least three times by one research assistant and recorded by a second research assistant. If two measurements at one location were greater than 0.5 cm different, a fourth set of measurements was taken. The measurements were converted to inches and rounded according to AR 600-9, and input into a sex-specific body fat equation for males, % body fat = [86.010 x Log10 (waist – neck)] – [70.041 x Log10 (height)] + 36.76, and females, % body fat = [163.205 x Log10 (waist + hip – neck)] – [97.684 x Log10 (height)] – 78.387. Percent body fat was recorded to the nearest whole percent (Department of the Army, 2013; US Department of Defense, 2002). From these measures, the biological correlates of BMI and %BF were selected.

Eating Behaviors and **Mediators of Eating Behaviors.** Additional questions regarding military-specific eating behaviors and mediators of eating behaviors were asked using the newly developed Military-Specific Eating Habits and Military-Specific Mediators of Eating Behaviors Questionnaires, currently being piloted and validated by the US Army Research Institute of Environmental Medicine as part of their Development of a Military Specific Eating Behavior Survey Study (Cole, 2016).

Two questions were selected as single-item indicators of sociocultural correlates, “I need to be muscular to be in good shape” and “I want to be as thin as possible.” Both questions were rated on a five-point Likert scale ranging from “definitely disagree” to “definitely agree.” Two questions were selected as single-item indicators of dieting correlates, “What is your primary reason for the eating style noted above” and “Did you purposely try to lose weight within the past 6 months.” The eating style question was recoded to a binary item to indicate if weight loss

was the primary reason for eating style (yes/no). The attempting weight loss question was also recoded to a binary item to indicate if a participant had attempted weight loss (yes/no).

Five questions were selected as single item indicators of body dissatisfaction correlates, "I think I am: very underweight to very overweight," "I would like to weigh: more, stay the same, less," "Why did you exercise," "I don't like my body type or shape," and "I would go to extreme measures to avoid being viewed as overweight." The first question was recoded to a binary item to indicate if a participant perceived themselves as overweight (yes/no). The next question was recoded to a binary item to indicate if a participant would like to weigh more (yes/no) or weigh less (yes/no). The exercise question was recoded to a binary item to indicate if weight loss was the primary reason for exercise (yes/no). The last two questions were rated on a five-point Likert scale ranging from "definitely disagree" to "definitely agree."

Two questions were selected as single item indicators of negative affect correlates, "How do you typically feel the week prior to the record height and weight (body composition assessment)," and "I constantly worry about being or becoming fat." The first question was recoded to a binary item to indicate if a participant was stressed or not stressed about the body composition assessment (yes/no). The second question was rated on a five-point Likert scale ranging from "definitely disagree" to "definitely agree."

Six questions were selected as single item indicators of military contextual factors, "Have you ever failed the body fat assessment," "Have you ever failed your BMI measurement," "Did you use any of the following methods leading up to your last Height & Weight (body composition assessment)," "What is the one primary reason you tied to purposely lose weight in the past 6 months," "Leaders are more concerned about my weight than I am," "Other military personnel have made offensive comments about my weight." The first two items were recoded to

binary items (yes/no). The question about methods was recoded to a binary item to indicate if a participant had used any dieting/weight loss method leading up to the body composition assessment (yes/no). The question about attempting weight loss was recoded to a binary item to indicate if meeting the body composition standards was the primary reason for attempting weight loss (yes/no). The last two questions were rated on a five-point Likert scale ranging from "definitely disagree" to "definitely agree."

Eating Disorder Diagnostic Scale, DSM-IV (EDDS) (Stice et al., 2000). The EDDS is a self-report measure of eating disorder symptoms and eating disorder risk classification based on the diagnostic criteria for eating disorders in the *Diagnostic and Statistical Manual for Mental Disorders*, 4th edition (American Psychiatric Association, 1994). There are a total of 22 questions, including questions about current height, weight, and birth control usage (Stice et al., 2000). The other 19 questions relate to eating disorder symptoms, such as body dissatisfaction (Has your weight influenced how you think about/judge yourself as a person), binge eating behaviors (During these episodes of overeating and loss of control did you eat alone because you were embarrassed by how much you were eating), binge eating frequency (How many times per week on average over the past 3 months have you eaten an unusually large amount of food and experienced a loss of control), and frequency of purging behaviors (How many times per week on average over the past 3 months have you engaged in excessive exercise specifically to counteract the effects of overeating episodes), such as vomiting, laxative/diuretic use, fasting, and excessive exercise to counteract effects of overeating (Lee et al., 2007).

Participants with at least 80% of completed responses (18/22 questions) had their questionnaires scored and analyzed. Items are either scored and summed for a total eating disorder symptoms score, or they are standardized and summed to determine eating disorder risk

classification based on a standardized cut-off score ≥ 16.5 (Krabbenborg et al., 2012), with higher scores indicative of higher levels of eating disorder symptoms (Stice et al., 2004b; Stice et al., 2000). The items can also be used to determine probable eating disorder diagnoses based on DSM-IV criteria (Stice et al., 2000). The authors reported a Cronbach's alpha of 0.89, and test-retest reliability of 0.87 for the total eating disorder symptoms score (Stice et al., 2000), as well as excellent criterion, convergent, and predictive validity (Stice et al., 2004b).

The standardized total eating disorder symptoms score was used to classify individuals as meeting eating disorder risk cut-off scores based on a score of ≥ 16.5. The probable eating disorder algorithm was used to generate probable eating disorder diagnoses, based on DSM-IV criteria. The total eating disorder symptoms score was used to measure the level of eating disorder symptoms. The eating disorder symptoms score demonstrated good internal consistency in the current study ($\alpha = 0.82$).

3. Statistical Analysis

Data was examined for univariate and multivariate normality using SPSS statistical software (v. 25; SPSS Inc., Chicago, IL). Normality was assessed according to the values of skewness (Sk) and kurtosis (Ku), where values $Sk > |3|$ and $Ku > |10|$ indicate severe violations of normality (Kline, 2015). Potential differences in demographic characteristics by site were examined using Chi-Square Tests of Independence (McHugh, 2013).

The rate of meeting the eating disorder risk classification cut-off score was determined using the total number of subjects who completed and returned the questionnaires as well as the total available population at the two Michigan US Army ROTC Programs during the data collection from data provided by the US Army Cadet Command (Tatro, personal communication, December 4, 2018). Demographic characteristics were compared across sites

and determined not to be significantly different. Data from both sites was pooled for further analysis. Correlations between study variables were examined using Pearson, biserial, and point biserial correlations. Correlates of meeting eating disorder risk classification cut-off scores were determined using Chi-square tests of independence.

Differences between total eating disorder symptoms scores by various biological correlates were examined using t-tests and one-way analyses of variance (1-way ANOVA) for normally distributed variables, and independent samples Mann-Whitney U test for nonparametric variables. Association between biological, sociocultural, dieting, body satisfaction, negative affect, and military contextual factors and likelihood of meeting eating disorder risk classification cut-off scores were examined using univariate logistic regression models. Significant factors associated with a greater likelihood of meeting eating disorder risk classification cut-off scores were then examined using a multivariable logistic regression model. Factors with unreliable confidence intervals were excluded from the final model. The same biological, sociocultural, dieting, body dissatisfaction, negative affect, and military contextual factors were examined as predictors of the total eating disorder symptoms score in a multiple linear regression model. Data are reported as mean (standard deviation), unless indicated, and a p-value <0.05 was considered statistically significant.

D. Results

A total of 205 ROTC cadets out of a total available population of 288 ROTC cadets consented to participate in the study, resulting in a participation rate of 71% (Tatro, personal communication, December 4, 2018). After screening for participants missing >80% of responses to the Eating Disorder Diagnostic Scale (EDDS), the final analytic sample consisted of 199 participants. Preliminary analysis suggested that sites differed only on the proportions of

ethnicity and ROTC year group (Table 4.1). However, neither of these variables were significantly associated with the main study variables, eating disorder risk classification and total eating disorder symptoms scores. Therefore, data were pooled for further analysis.

Table 4.1. Demographic characteristics of ROTC cadets at two midwestern universities.

Characteristics	**Total Sample (n=205) n (%)**	**Site 1 (n=114) n (%)**	**Site 2 (n=91) n (%)**	**p-value**
Sex				0.120
Male	140 (68.3)	83 (72.8)	57 (62.6)	
Female	65 (31.7)	31 (27.2)	34 (37.4)	
Race				0.103
White/Caucasian	173 (84.4)	93 (81.6)	80 (87.9)	
Black/African American	16 (7.8)	12 (10.5)	4 (4.4)	
Native American, Alaskan Native	2 (1.0)	2 (1.8)	0 (0)	
Asian	8 (3.9)	5 (4.4)	8 (3.9)	
Other	6 (2.9)	2 (1.8)	4 (4.4)	
Ethnicity				**0.023***
Hispanic	17 (8.3)	5 (4.4)	12 (13.2)	
Non-Hispanic	188 (91.7)	109 (95.6)	79 (86.8)	
Race/Ethnicity				0.053
White/Caucasian, non-Hispanic	159 (77.6)	90 (78.9)	69 (75.8)	
Black/African American, non-Hispanic	16 (7.8)	12 (10.5)	4 (4.4)	
Asian, non-Hispanic	9 (4.4)	6 (5.3)	3 (3.3)	
Biracial, non-Hispanic	4 (2.0)	1 (0.9)	3 (3.3)	
Hispanic	17 (8.3)	5 (4.4)	12 (13.2)	
Race/Ethnicity				0.594
White/Caucasian, non-Hispanic	159 (77.6)	90 (78.9)	69 (75.8)	
Other	46 (22.4)	24 (21.1)	22 (24.2)	
ROTC Year Group				**<0.001***
MS1	90 (43.9)	53 (46.5)	37 (40.7)	
MS2	43 (21.0)	33 (28.9)	10 (11.0)	
MS3	41 (20.0)	13 (11.4)	28 (30.8)	
MS4	31 (15.1)	15 (13.2)	16 (17.6)	

Note: MS=Military Science (i.e. MS1=Military Science Student Year 1); Chi-Square Test of Independence Test; *$p<0.05$.

Table 4.1. (cont'd).

Characteristics	Total Sample (n=205) n (%)	Site 1 (n=114) n (%)	Site 2 (n=91) n (%)	p-value
BMI Status				0.799
Underweight, <18.5 kg/m^2	2 (1.0)	1 (1.0)	1 (1.1)	
Normal Weight, 18.5-24.9 kg/m^2	107 (55.2)	60 (56.7)	49 (53.3)	
Overweight, 25-29.9 kg/m^2	76 (39.2)	38 (36.5)	38 (42.2)	
Obesity, ≥ 30 kg/m^2	9 (4.6)	6 (5.8)	3 (3.3)	

Note: MS=Military Science (i.e. MS1=Military Science Student Year 1); Chi-Square Test of Independence Test; *p<0.05.

The total population consisted of 288 ROTC cadets between the two sites, of which 71.9% were male, 80.9% were White/Caucasian, 5.9% were Black/African American, 4.2% were Asian, and 4.5% identified as other, and 4.5% identified as Hispanic (Tatro, personal communication, December 4, 2018). The majority of the sample of ROTC cadets included in the study was male (68.3%), identified as White/Caucasian (84.4%), non-Hispanic (92%), was a first year ROTC cadet (42.2%), and was classified as having a normal weight BMI of 18.5-24.9 kg/m^2 (53.3%) (Table 4.2). The mean age was 20.1 (2.0) years and the mean BMI was 24.6 (3.0) kg/m^2, 24.9 (2.9) kg/m^2 for males and 23.4 (3.2) kg/m^2 for females. The mean percent body fat (%BF) was 19.5 % (8.1), 15.2 % (4.6) for males and 28.6 % (6.0) for females (Table 4.3).

Table 4.2. Demographic characteristics for the final analytic sample (n=199).

Characteristics	Total Sample, (n=199) n (%)
Sex	
Male	136 (68.3)
Female	63 (31.7)

Note: MS=Military Science (i.e. MS1=Military Science Student Year 1).

Table 4.2. (cont'd).

Characteristics	Total Sample, (n=199) n (%)
Race	
White/Caucasian	168 (84.4)
Black/African American	15 (7.5)
Native American, Alaskan Native	2 (1.0)
Asian	9 (4.5)
Other	5 (2.5)
Ethnicity	
Hispanic	16 (8.0)
Non-Hispanic	183 (92.0)
Race/Ethnicity	
White/Caucasian, non-Hispanic	155 (77.9)
Other	44 (22.1)
ROTC Year Group	
MS1	84 (42.2)
MS2	43 (21.6)
MS3	41 (20.6)
MS4	31 (15.6)
BMI, measured (n=193)	
Underweight, <18.5 kg/m^2	2 (1.0)
Normal Weight, 18.5-24.9 kg/m^2	106 (53.3)
Overweight, 25-29.9 kg/m^2	76 (38.2)
Obesity, ≥ 30 kg/m^2	9 (4.5)

Note: MS=Military Science (i.e. MS1=Military Science Student Year 1).

Twenty participants met the eating disorder risk classification cut-off score ≥ 16.5, resulting in an eating disorder risk rate of 10.1% of the study sample, and 6.9% of the total population at the two sites (Table 4.3). Of the 199 participants with >80% of data for the EDDS, eighteen (9.0%) were identified as having a probable eating disorder diagnosis based on the EDDS diagnosis algorithm (Table 4.3). The most common probable EDDS diagnoses included full threshold bulimia (4%) and subthreshold bulimia (4%) (Table 4.3). More than half the sample (58.7%) endorsed engaging in at least one binge behavior, while 23.1% of the sample endorsed engaging in at least one purging behavior, which included vomiting, diuretic/laxative

use and abuse, fasting/skipping meals, and excessive exercise to prevent weight gain (Table 4.3). The most commonly endorsed purging behavior was excessive exercise which was endorsed by 19.6% of participants.

Participants also reported various sociocultural, dieting, body dissatisfaction, negative affect, and military contextual factors. Thirty-six percent of participants reported attempting weight loss in the last six months while 28.1% reported perceiving themselves as overweight. Sixty-six percent of participants reported desiring weight change, with a similar distribution amongst participants that wanted to weigh less (34.5%), weight more (33%), and weigh the same (32.5%). Only 8.5% and 14.6% of participants reported every failing a body composition assessment or a BMI screen, respectively, while 33.2% reported being stressed bout the body composition assessment and 41.7% reported engaging in any dieting/weight control behavior to meet the standards (Table 4.3).

Table 4.3. Biological, sociocultural, psychological, and behavioral characteristics.

Characteristics	Mean (SD)
Age, years (n=197)	20.1 (2.0)
BMI, kg/m^2 (n=193)	24.6 (3.0)
Males	24.9 (2.9)
Females	23.4 (3.2)
Percent body fat, % (n=192)	19.5 (8.1)
Males	15.2 (4.6)
Females	28.6 (6.0)
Total eating disorder symptom score (ED) (n=199)	13.6 (12.0)
Desire muscularity (SC) (n=194)	3.2 (1.1)
Desire thinness (SC) (n=195)	1.8 (1.0)
Dislike body type/shape (BD) (n=192)	2.5 (1.2)

Note: Body mass index (BMI); ED, related to eating disorder risk cut-off score, probable eating disorder diagnoses, or total eating disorder symptoms score; SC, sociocultural correlate; DT, dieting correlate; BD, body dissatisfaction correlate; NA, negative affect correlate; MC, military contextual factor; and EB, eating behavior correlate.

Table 4.3. (cont'd).

Characteristics	Mean (SD)
Extreme body change measures (BD) (n=196)	2.5 (1.2)
Worry about weight (NA) (n=196)	2.6 (1.3)
Leaders weight concern (MC) (n=196)	2.2 (2.0)
Peer weight comments (MC) (n=196)	1.6 (1.0)
	n (%)
Weight loss eating style (DT) (n=194)	17 (8.5)
Attempted weight loss (DT) (n=196)	73 (36.7)
Perceive self as overweight (BD) (n=197)	56 (28.1)
Desire weight change (BD) (n=197)	133 (66.8)
Exercise for weight loss (BD) (n=196)	47 (23.6)
Stressed about body composition assessment (NA) (n=197)	66 (33.2)
Ever failed a body fat assessment (MC) (n=197)	17 (8.5)
Ever failed a BMI screen (MC) (n=197)	29 (14.6)
Engaged in any dieting to meet standards (MC) (n=196)	86 (41.7)
Attempted weight loss to meet standards (MC) (n=196)	17 (8.5)
Meet eating disorder risk score cut off ≥ 16.5 (ED) (n=199)	20 (10.1)
Probable eating disorder diagnosis (ED) (n=199)	18 (9.0)
Probable full threshold bulimia nervosa	8 (4.0)
Probable full threshold binge eating disorder	1 (0.5)
Probable subthreshold bulimia nervosa	8 (4.0)
Probable subthreshold binge eating disorder	1 (0.5)
At least one binge eating episode (EB) (n=196)	115 (58.7)
At least one purging behavior episode (EB) (n=199)	46 (23.1)

Note: Body mass index (BMI); ED, related to eating disorder risk cut-off score, probable eating disorder diagnoses, or total eating disorder symptoms score; SC, sociocultural correlate; DT, dieting correlate; BD, body dissatisfaction correlate; NA, negative affect correlate; MC, military contextual factor; and EB, eating behavior correlate.

Table 4.4 presents correlations among study variables. Sex was positively correlated with %BF, attempting weight loss, stress about the body composition assessment, worrying about weight, failing a body composition assessment, and attempting weight loss to meet the standards ($p<0.05$). Sex was also negatively associated with BMI and desire for muscularity. Race/ethnicity was positively associated with %BF ($p<0.05$). BMI and %BF were positively associated with most study variables ($p<0.05$). Meeting eating disorder risk cut-off scores and

Table 4.4. Correlations among study variables. Presented as six tables with twenty six variables.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. Age (B)	-												
2. Sex (B)	0.08	-											
3. Race/ Ethnicity (B)	0.12	0.13	-										
4. ROTC year (B)	0.56*	-0.03	-0.08	-									
5. BMI (B)	0.17*	0.15*	0.14	0.09	-								
6. %BF (B)	0.17*	0.78*	0.15*	-0.01	0.40*	-							
7. Desire muscularity (SC)	0.06	-0.17*	-0.17*	-0.01	0.12	-0.09	-						
8. Desire thinness (SC)	0.05	0.03	-0.03	-0.01	0.09	0.09	0.18*	-					

*p<0.05, Pearson, biserial, and point-biserial correlations. *(cont.)*

Note: B=biological correlate, SC=sociocultural correlate, DT=dieting correlate, BD=body dissatisfaction correlate, NA=negative affect correlate, MC=military contextual factor; ROTC=reserve officer training corps; BMI=body mass index; %BF=percent body fat; Wt=weight

Table 4.4. (cont'd).

	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.
1. Age (B)													
2. Sex (B)													
3. Race/ Ethnicity (B)													
4. ROTC year (B)													
5. BMI (B)													
6. %BF (B)													
7. Desire muscularity (SC)													
8. Desire thinness (SC)													

*p<0.05, Pearson, biserial, and point-biserial correlations. *(cont.)*

Note: B=biological correlate, SC=sociocultural correlate, DT=dieting correlate, BD=body dissatisfaction correlate, NA=negative affect correlate, MC=military contextual factor; ROTC=reserve officer training corps; BMI=body mass index; %BF=percent body fat; Wt=weight;

Table 4.4. (cont'd).

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
9. Wt loss eating style (DT)	0.07	0.06	0.06	-0.03	0.30*	0.25*	0.11	0.26*	-			
10. Attempted wt loss (DT)	0.12	0.25*	0.09	0.04	0.53*	0.50*	0.11	0.22*	0.40*	-		
11. Perceive overweight (BD)	0.14	0.13	0.12	-0.08	0.57*	0.39*	0.22*	0.25*	0.45*	0.56*	-	
12. Desire wt change (BD)	-0.03	-0.02	0.03	-0.12	0.13	0.06	0.24*	0.24*	0.21*	0.26*	0.32*	-
13. Exercise for wt loss (BD)	-0.01	0.11	0.1	-0.01	0.36*	0.32*	0.13	0.19*	0.51*	0.60*	0.54*	0.31*
14. Dislike body (BD)	0.15*	0.09	0.07	-0.04	0.26*	0.27*	0.28*	0.39	0.31*	0.37	0.52*	0.36*
15. Extreme body changes (BD)	0.16*	0.02	0.06	0.02	0.30*	0.16*	0.17*	0.36*	0.23*	0.28*	0.28*	0.05
16. Stress Body Comp (NA)	0.11	0.26*	0.08	0.02	0.33*	0.42*	0.14	0.25*	0.20*	0.50*	0.43*	0.38*
17. Worry about wt (NA)	0.18*	0.25*	0.08	0.02	0.31*	0.39*	0.21*	0.32*	0.36*	0.54*	0.51*	0.21*

*p<0.05, Pearson, biserial, and point-biserial correlations. *(cont.)*

Table 4.4. (cont'd).

	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.
9. Wt loss eating style (DT)														
10. Attempted wt loss (DT)														
11. Perceive overweight (BD)														
12. Desire wt change (BD)														
13. Exercise for wt loss (BD)	-													
14. Dislike body (BD)	0.34*	-												
15. Extreme body changes (BD)	0.29*	0.34*	-											
16. Stress Body Comp (NA)	0.36*	0.38*	0.31*	-										
17. Worry about wt (NA)	0.45*	0.61*	0.43*	0.42*	-									

*p<0.05, Pearson, biserial, and point-biserial correlations. *(cont.)*

Table 4.4. (cont'd).

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
18. Failed BF (MC)	0.17*	0.18*	0.10	0.03	0.39*	0.42*	0.04	0.15*	0.29*	0.40*	0.41*	0.14
19. Fail BMI screen (MC)	0.20*	0.09	0.02	0.1	0.41*	0.29*	0.19*	0.21*	0.28*	0.30*	0.37*	0.01
20. Dieting for standards (MC)	0.03	0.13	0.01	-0.03	0.11	0.19*	0.07	0.14	0.14	0.32*	0.21*	0.31*
21. Weight loss for standards (MC)	0.14	0.26*	0.1	0.1	0.33*	0.44*	-0.02	0.16*	0.35*	0.40*	0.41*	0.21*
22. Leaders weight concern (MC)	0.21*	0.07	0.01	-0.04	0.08	0.12	0.15*	0.25*	0.07	0.15*	0.22*	0.08
23. Peer weight comments (MC)	0.12	0.04	-0.01	0.02	0.11	0.15*	0.09	0.35*	0.20*	0.23*	0.22*	0.18*
24.Meet ED risk cut-off score	0.12	0.13	0.14*	-0.01	0.24*	0.25*	0.22*	0.33*	0.25*	0.33*	0.38*	0.23*
25.Probable ED diagnosis	0.07	0.07	0.05	-0.08	0.17*	0.13	0.17*	0.09	0.02	0.28*	0.30*	0.15*
26. Total ED symptoms score	0.04	0.19*	0.14*	-0.1	0.35*	0.36*	0.22*	0.38*	0.38*	0.53*	0.52*	0.33

*p<0.05, Pearson, biserial, and point-biserial correlations. *(cont.)*

Table 4.4. (cont'd).

	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.
18. Failed BF (MC)	0.34*	0.30*	0.21*	0.28*	0.38*	-								
19. Fail BMI screen (MC)	0.24*	0.31*	0.16*	0.31*	0.33*	.048*	-							
20. Dieting for standards (MC)	0.24*	0.34*	0.13	0.48*	0.23*	0.21*	0.22*	-						
21. Weight loss for standards (MC)	0.34*	0.25*	0.05	0.36*	0.28*	0.55*	0.38*	0.25*	-					
22. Leaders weight concern (MC)	0.06	0.22*	0.30*	0.27*	0.19*	0.15*	0.26*	0.07	0.19*	-				
23. Peer weight comments (MC)	0.12	0.32*	0.25*	0.32*	0.29*	0.35*	0.33*	0.14	0.17*	0.32*	-			
24.Meet ED risk cut-off score	0.40*	0.40*	0.33*	0.33*	0.37*	0.20*	0.24*	0.155*	0.20*	0.13	0.33*	-		
25.Probable ED diagnosis	0.16*	0.25*	0.18*	0.25*	0.31*	0.21*	0.08	0.17*	0.05	0.07	0.23*	0.50*	-	
26. Total ED symptoms score	0.489	0.58*	0.43*	0.48*	0.59*	0.31*	0.31*	0.32*	0.25*	0.17*	0.29*	0.70*	0.45*	-

total eating disorder symptoms score were also positively associated with most study variables ($p<0.05$) (Table 4.4).

Table 4.5 presents eating disorder risk classification by demographic characteristic. Ten (15.9%) females were identified as meeting the eating disorder risk cut-off score ≥ 16.5, compared to ten (7.4%) males, which was not significantly different (p=0.063). Eating disorder risk classification was highest in individuals identifying as Asian (33.3%), Hispanic (18.8%), MS3 ROTC cadets (19.5%), and individuals with a BMI in the obesity category (44.4%). Chi-Square Tests of Independence were used to test the association between demographic characteristics and eating disorder risk classification (Table 4.5). Only race and BMI category were significantly associated with eating disorder risk classification (p=0.002 and p=0.005, respectively), while race/ethnicity combined was not (p=0.051) (Table 4.5).

Table 4.5. Eating disorder risk classification by demographic characteristic (biological correlates).

Characteristic	Total n (%)	Not at risk	At risk	p-value
Site				0.380
Site 1	108 (54.3)	99 (91.7)	9 (8.3)	
Site 2	91 (45.7)	80 (87.9)	11 (12.1)	
Sex				0.063
Male	136 (68.3)	126 (92.6)	10 (7.4)	
Female	63 (31.7)	53 (84.1)	10 (15.9)	
Race				**0.002***
White/Caucasian	168 (84.4)	155 (92.3)	13 (7.7)	
Black/African American	15 (7.5)	14 (93.3)	1 (6.7)	
Native American/Alaskan Native	2 (1.0)	0 (0)	2 (100)	
Asian	9 (4.5)	6 (66.7)	3 (33.3)	
Biracial-White/Asian	2 (1.0)	2 (100)	0 (0)	
Biracial-White/Black	3 (1.5)	2 (66.7)	1 (33.3)	

Note: MS=Military Science (i.e. MS1=Military Science Student Year 1); Chi-Square Test of Independence Test; *$p<0.05$.

Table 4.5. (cont'd).

Characteristic	Total n (%)	Not at risk	At risk	p-value
Ethnicity				0.207
Hispanic	16 (8.0)	13 (81.3)	3 (18.8)	
Non-Hispanic	183 (92.0)	166 (90.7)	17 (9.3)	
Race/Ethnicity				0.051
White/Caucasian, non-Hispanic	155 (77.9)	143 (92.3)	12 (7.7)	
Other	44 (22.1)	36 (81.8)	8 (18.2)	
ROTC Year Group				0.086
MS1	84 (42.2)	75 (89.3)	9 (10.7)	
MS2	43 (21.6)	41 (95.3)	2 (4.7)	
MS3	41 (20.6)	33 (80.5)	8 (19.5)	
MS4	31 (15.6)	30 (96.8)	1 (3.2)	
BMI Category				**0.005***
Underweight, <18.5 kg/m^2	2 (1.0)	2 (100)	0 (0)	
Normal weight, 18.5-24.9 kg/m^2	106 (54.9)	101 (95.3)	5 (4.7)	
Overweight, 25-29.9 kg/m^2	76 (39.4)	68 (89.5)	8 (10.5)	
Obesity, ≥ 30.0 kg/m^2	9 (4.7)	5 (55.6)	4 (44.4)	

Note: MS=Military Science (i.e. MS1=Military Science Student Year 1); Chi-Square Test of Independence Test; *p<0.05.

In addition to examining cadets meeting eating disorder risk classification cut-off scores, total eating disorder symptom scores were also examined (Table 4.6). Females had significantly higher total eating disorder symptom scores compared to males, 17.1 (11.8) vs. 12.1 (11.8), p=0.006. Total eating disorder symptom scores were significantly higher in participants identifying as Asian compared to participants identifying as White/Caucasian, 25.1 (13.0) vs. 12.9 (11.7), p=0.003. Total eating disorder symptom scores were also significantly higher in participants identifying as MS3 cadets compared to MS4 cadets, 16.9 (13.2) vs. 8.6 (8.3), p=0.016 (Table 4.6). Total eating disorder symptom scores were significantly higher in participants with a BMI classified as obese, 29.6 (6.7), compared to participants with a BMI classified as overweight, 15.9 (13.2), and normal weight, 10.3 (9.4), p<0.001. Additionally, total eating disorder symptom scores were also significantly higher in participants with a BMI

classified as overweight, 15.9 (13.2) compared to participants with a BMI classified as normal weight, 10.3 (9.4), p=0.006 (Table 4.6). Binge eating and all purging behaviors were significantly higher in participants meeting the eating disorder risk classification cut-off scores compared to participants not meeting the eating disorder risk classification cut-off scores (Table 4.7).

Table 4.6. Total eating disorder symptoms scores by demographic characteristic (biological correlates).

Characteristic	n	Mean (SD)	p-value
Site			0.587
Site 1	108	13.2 (12.2)	
Site 2	91	14.1 (11.9)	
Sex			**0.006***
Male	136	12.1 (11.8)	
Female	63	17.1 (11.8)	
Race			**0.003****
White/Caucasian	168	12.9 (11.7)[b]	
Black/African American	15	11.7 (11.5)	
Native American/Alaskan Native	2	34.5 (2.1)	
Asian	9	25.1 (13.0)[a]	
Biracial-White/Asian	2	6.5 (2.1)	
Biracial-Black/Asian	3	21.3 (10.2)	
Ethnicity			0.220
Non-Hispanic	183	13.3 (12.1)	
Hispanic	16	16.8 (12.4)	
Race/Ethnicity			**0.049***
White/Caucasian, non-Hispanic	155	12.7 (11.8)	
Other	44	11.7 (11.5)	
ROTC Year			**0.016****
MS1	84	14.8 (13.3)	
MS2	43	11.9 (8.9)	
MS3	41	16.9 (13.2)[a]	
MS4	31	8.6 (8.3)[b]	

Note: *p<0.05, t-test; **p<0.05, 1-way ANOVA; MS=Military Science.

Table 4.6. (cont'd).

Characteristic	n	Mean (SD)	p-value
Body Mass Index			**<0.001****
Underweight, <18.5 kg/m^2	2	9.0 (1.4)	
Normal Weight, 18.5-24.9 kg/m^2	106	10.3 (9.4)[c]	
Overweight, 25-29.9 kg/m^2	76	15.9 (13.2)[b]	
Obesity, 30.0 kg/m^2	9	29.6 (6.7)[a]	

Note: *p<0.05, t-test; **p<0.05, 1-way ANOVA; MS=Military Science.

Table 4.7. Binge eating and purging behavior frequency by eating disorder risk classification.

Symptom	Total	Not at Risk n=179	At Risk n=20	p-value
Binge Frequency				
Binge days/week in last 6 months (n=196)	1.1 (1.5)	1.0 (1.5)	2.1 (1.9)	**0.002***
Binge times/week in last 3 months (n=196)	1.5 (2.4)	1.2 (1.9)	4.2 (4.4)	**0.009***
Purging Behavior Frequency				
Vomiting times/week in last 3 months (n=199)	0.1 (0.6)	0.0 (0.1)	0.7 (1.7)	**<0.001****
Laxative/Diuretic use times/week in last 3 months (n=198)	0.1 (0.6)	0.0 (0.1)	1.0 (1.9)	**<0.001****
Skipping meals/Fasting times/week in last 3 months (n=198)	0.4 (1.7)	0.2 (0.8)	2.8 (4.1)	**<0.001****
Excessive exercise times/week in last 3 months (n=199)	0.8 (2.1)	0.5 (1.6)	3.5 (3.5)	**<0.001****

Note: * p<0.05, t-test; **p<0.05, Independent-Samples Mann-Whitney U Test.

Univariate logistic regression was conducted to determine which biological, sociocultural, dieting, body dissatisfaction, negative affect, and military contextual factors were associated with likelihood of meeting eating disorder risk classification cut-off scores (Table 4.8). Race/ethnicity (OR 2.65), BMI (OR 1.33), and %BF (OR 1.11), along will all other

sociocultural, dieting, body dissatisfaction, negative affect, and military contextual factors, were all associated with increased likelihood of meeting eating disorder risk classification cut-off scores (Table 4.8).

Table 4.8. Association between likelihood of meeting eating disorder risk classification cut-off scores and biological, sociocultural, dieting, body dissatisfaction, negative affect, and military contextual factors using univariate logistic regression.

Variable	Odds Ratio	p-value	95% Confidence Interval
Biological Factors			
Age (n=197)	1.16	0.093	[0.975, 1.385]
Sex (Female) (n=199)	2.38	0.069	[0.935, 6.046]
Race/Ethnicity (Other) (n=199)	2.65	**0.048***	[1.008, 6.960]
ROTC Year Group (n=199)			
MS1	3.60	0.234	[0.437, 29.662]
MS2	1.46	0.760	[0.127, 16.894]
MS3	7.27	0.069	[0.858, 61.619]
MS4 (Reference)	-	-	-
Measured BMI (n=193)	1.33	**0.001***	[1.118, 1.588]
Measured %BF (n=192)	1.11	**0.001***	[1.042, 1.175]
Sociocultural Factors			
Desire muscularity (n=194)	2.08	**0.003***	[1.25, 3.411]
Desire thinness (n=195)	2.46	**<0.001***	[1.604, 3.787]
Dieting Factors			
Weight loss eating style (n=194)	6.35	**0.001***	[2.042, 19.751]
Attempting weight loss (n=196)	12.14	**<0.001***	[3.418, 43.140]
Body Dissatisfaction Factors			
Perceived overweight (n=197)	13.7	**<0.001***	[4.334, 43.305]
Desire weight change (loss) (n=197)	14.00	**<0.001***	[3.933, 49.839]
Exercise for weight loss (n=196)	13.5	**<0.001***	[4.575, 39.840]
Dislike body (n=192)	3.498	**<0.001***	[2.081, 5.882]
Extreme body changes (n=196)	2.490	**<0.001***	[1.613, 3.844]
Negative Affect Factors			
Stress about body composition assessment (n=197)	10.16	**<0.001***	[3.238, 31.879]
Worry about weight (n=196)	2.91	**<0.001***	[1.813, 4.673]

Note: *p<0.05, univariate logistic regression with eating disorder risk classification as dependent variable. MS=Military Science; BMI=body mass index; %BF=percent body fat.

Table 4.8. (cont'd).

Variable	Odds Ratio	p-value	95% Confidence Interval
Military Contextual Factors			
Failed BF assessment (n=197)	4.58	**0.011***	[1.423, 14.760]
Failed BMI screen (n=197)	4.95	**0.002***	[1.815, 13.515]
Dieting for standards (n=196)	2.81	**0.036***	[1.069, 7.397]
Weight loss for standards (n=196)	4.56	**0.011***	[1.414, 14.672]
Leader weight concern (n=196)	1.46	0.069	[0.970, 2.204]
Peer weight comments (n=196)	2.12	**<0.001***	[1.472, 3.046]

Note: *p<0.05, univariate logistic regression with eating disorder risk classification as dependent variable. MS=Military Science; BMI=body mass index; %BF=percent body fat.

Multivariable logistic regression was then conducted to test which biological, sociocultural, dieting, body dissatisfaction, negative affect, and military contextual factors were associated with likelihood of meeting eating disorder risk classification cut-off scores in a multivariate model (Table 4.9). One body dissatisfaction variable, exercise for weight loss, was excluded from the model due to unreliable confidence intervals. Only peer comments about weight (OR 1.89, p=0.046), a military contextual factor, was significantly associated with increased likelihood of meeting eating disorder risk classification cut-off scores, $\chi 2$=55.325, *df*=18, n=181 p<0.001, Nagelkerke R-Square = 0.568 (Table 4.9).

Multiple linear regression was conducted to determine which biological, sociocultural, dieting, body dissatisfaction, negative affect, and military contextual factors significantly predicted total eating disorder symptom scores. When all predictor variables were considered together, only sex (B) (*B*=3.79, *SE*=1.22, p=0.038), desiring thinness (SC) (*B*=1.50, *SE*=0.74, p=0.046), and disliking one's body (BD) (*B*=1.89, *SE*=0.79, p=0.017) significantly predicted total eating disorder symptoms scores, $F_{22,179}$=10.09, p<0.001, adjusted R-square=0.528 (Table 4.10).

Table 4.9. Multivariable logistic regression examining likelihood of meeting eating disorder risk classification cut-off scores based on biological, sociocultural, dieting, body dissatisfaction, negative affect, and military contextual factors (n=181).

	B	S.E.	Wald (df)	p-value	Exp(B)	95% CI for Exp(B)
Biological Factors						
Race/Ethnicity (Other)	1.08	0.88	1.53 (1)	0.216	2.95	[0.53, 16.44]
Measured BMI	-0.06	0.17	0.13 (1)	0.723	0.94	[0.68, 1.31]
Measured %BF	0.05	0.07	0.60 (1)	0.440	1.05	[0.92, 1.20]
Sociocultural Factors						
Desire muscularity	0.50	0.44	1.29 (1)	0.257	1.65	[0.69, 3.90]
Desire thinness	0.28	0.34	0.66 (1)	0.417	1.32	[0.67, 2.58]
Dieting Factors						
Weight loss eating style	-0.11	0.92	0.1 (1)	0.903	0.89	[0.15, 5.40]
Attempting weight loss	0.46	1.30	0.12 (1)	0.726	1.58	[0.12, 20.26]
Body Dissatisfaction Factors						
Perceived overweight	1.12	1.31	0.73 (1)	0.392	3.07	[0.23, 40.16]
Desire weight change (loss)	0.19	1.60	0.01 (1)	0.906	1.21	[0.05, 27.59]
Dislike body	0.82	0.50	2.61 (1)	0.106	2.2	[0.84, 6.09]
Extreme body changes	0.42	0.39	1.18 (1)	0.277	1.53	[0.71, 3.28]
Negative Affect Factors						
Stress about body composition	0.77	1.19	0.42 (1)	0.518	2.15	[0.21, 22.04]
Worry about weight	-0.08	0.54	0.02 (1)	0.879	0.92	[0.32, 2.67]
Military Contextual Factors						
Failed BF assessment	-1.54	1.41	1.19 (1)	0.276	0.21	[0.01, 3.42]
Failed BMI screen	-0.04	0.99	0.00 (1)	0.964	0.96	[0.14, 6.66]
Dieting for body composition assessment	-0.62	1.04	0.35 (1)	0.552	0.54	[0.07, 4.16]
Weight loss for body composition assessment	0.56	1.12	0.26 (1)	0.613	1.76	[0.20, 15.68]
Peer comments about weight	0.64	0.32	3.99 (1)	**0.046***	1.89	[1.01, 3.54]

Note: *p<0.05, Nagelkerke R-Square=0.568. Variables excluded due to unacceptable confidence intervals: Exercise for weight loss (BD). BMI= body mass index; %BF=percent body fat.

Table 4.10. Multiple linear regression examining prediction of total eating disorder symptoms score from biological, sociocultural, dieting, body dissatisfaction, negative affect, and military contextual factors (n=180).

Variables	B (SE)	Beta	p-value
Constant	-6.85 (10.6)	-	0.52
Biological Factors			
Age	-0.21 (0.40)	-0.04	0.607
Sex	3.79 (1.51)	0.15	**0.038***
Race/ethnicity	1.90 (1.61)	0.07	0.241
ROTC Year	-0.85 (0.71)	-0.08	0.232
BMI	0.33 (0.35)	0.08	0.348
Sociocultural Factors			
Desire muscularity	0.19 (0.61)	0.02	0.752
Desire thinness	1.50 (0.74)	0.13	**0.046***
Dieting Factors			
Weight loss eating style	1.60 (2.71)	0.04	0.554
Attempting weight loss	2.54 (2.11)	0.10	0.231
Body Dissatisfaction Factors			
Perceived overweight	4.10 (2.36)	0.15	0.084
Desire weight change (loss)	-3.36 (2.62)	-0.13	0.202
Exercise for weight loss	4.12 (2.20)	0.15	0.063
Dislike body	1.89 (0.79)	0.18	**0.017***
Extreme body changes	1.04 (0.62)	0.11	0.095
Negative Affect Factors			
Stress about body composition	2.94 (1.86)	0.11	0.115
Worry about weight	1.34 (0.72)	0.14	0.064
Military Contextual Factors			
Failed BF assessment	-2.44 (3.03)	-0.06	0.421
Failed BMI screen	1.07 (2.21)	0.03	0.629
Dieting for body composition assessment	1.80 (1.56)	0.07	0.251
Weight loss for body composition assessment	-3.23 (2.93)	-0.08	0.271
Leader weight concern	-1.03 (0.69)	-0.09	0.134
Peer comments about weight	0.97 (0.80)	0.08	0.225

Note: *p<0.05, F(179)= 10.09, p<0.001; R-Square= 0.586, Adjusted R-Square = 0.528. BMI=body mass index; BF=percent body fat.

E. Discussion

In this sample of US Army ROTC cadets from two Midwestern universities, twenty participants met the eating disorder risk classification cut-off scores, resulting in a rate of meeting eating disorder risk classification cut-off scores of 10.1% of the study sample, and 6.9%

of the total ROTC cadet population at the two sites. Additionally, 7.4% of males and 15.9% of females were identified as meeting the eating disorder risk classification cut-off score. For females, these results are similar to lower than rates of meeting eating disorder risk classification cut-off scores reported in previous studies of female ROTC cadets, which reported that 19-20% of female ROTC and West Point cadets met eating disorder classification cut-off scores (Beekley et al., 2009; Lauder & Campbell, 2001). Lauder and Campbell reported that of the 310 female-only sample of ROTC cadets, 20% met eating disorder risk cut-off score (Lauder & Campbell, 2001). This rate may be higher than the current study given the study by Lauder and Campbell was conducted in a larger sample consisting only of female ROTC cadets at a summer training event, which brings together female ROTC cadets from across the country (Lauder & Campbell, 2001). Additionally, while Beekley et al. also reported a higher rate of females meeting eating disorder risk classification cut-off scores, their survey was conducted over a 7-year period and distributed to all female West Point cadets, so the 19% of the total female population identified as meeting eating disorder risk classification cut-off scores may have included females who took the survey more than once (Beekley et al., 2009).

For males, 7.4% were identified as meeting eating disorder risk classification cut-off scores. This rate is higher than the 2% rate reported by Beekley et al. in a sample of male West Point cadets (Beekley et al., 2009). While the study by Beekley et al. had a sample of 5,587 male respondents over the 7-year period, this only included a randomly selected sample of 200 male cadets each year of the study, as well as some cadets who voluntarily participated in the study outside of sample selection, with some cadets possibly taking the survey more than once, the present study recruited 136 (65.7%) of the total male population at the two ROTC programs (Beekley et al., 2009). Therefore, while the rate of 15.9% reported in the current study for

females is lower than that reported in previous studies of military cadets, and the rate of 7.4% for males is higher than previously reported, these rates are still higher than rates previously reported in college students and community samples, suggesting eating disorder risk continues to be a problem amongst both male and female ROTC cadets (Bodell et al., 2014; Forney & Ward, 2013; Hudson et al., 2007a; Johnson et al., 1999). Supporting this notion, there were no significant differences in rates of meeting eating disorder risk classification cut-off scores between males and females in the sample, and sex was not significantly associated with increased likelihood of meeting eating disorder risk classification cut-off scores.

Of the 199 participants with >80% data for the EDDS, eighteen were identified as having a probable eating disorder diagnosis, which included 4% full threshold bulimia nervosa, 0.5% full threshold binge eating disorder, 4% subthreshold bulimia nervosa, and 0.5% subthreshold binge eating disorders. These findings are comparable to previous studies in military populations reporting on eating disorder diagnoses. In a sample of female military service members, Lauder et al. diagnosed eating disorder using a clinical interview and reported rates of anorexia nervosa of 0.2%, rates of bulimia nervosa of 0.7%, rates of binge eating disorder of 2.4%, and rates of situational eating disorders of 2.6% (Lauder et al., 1999). In contrast, McNulty screened for probable eating disorder diagnoses in samples of male and female military service members using a modified version of the Eating Disorder Inventory-2, a self-report measure (McNulty, 1997a, 1997b, 2001). McNulty reported rates of anorexia nervosa of 1.1-2.5%, rates of bulimia nervosa of 6.8-12.4%, and rates of eating disorder not otherwise specified, or EDNOS, of 35.8-62.8% (McNulty, 1997a, 1997b, 2001). While the EDDS also uses self-report data to generate probable eating disorder diagnoses, the diagnostic algorithm was developed using DSM-IV diagnostic criteria, and tested and validated against the Eating Disorder Examination and the

Structured Clinical Interview for DSM (Stice et al., 2000). The reported rates are also comparable to rates reported in community samples of 0.3% bulimia nervosa, 1.2% binge eating disorder, and 0.6% subthreshold binge eating disorder, in which participants completed both an eating disorder risk classification screen and a structured interview (Hudson et al., 2007a), suggesting that some ROTC cadets may likely be diagnosed with eating disorders.

Eating disorder behavioral symptoms were also reported in the current study. Over half of the sample (58.7%), endorsed engaging in at least one binge eating behavior, while 23.1% of the sample endorsed engaging in at least one purging behavior. The most commonly reported purging behaviors were excessive exercise and fasting/skipping meals, which were endorsed by 19.6% and 10.6% of participants, respectively. All purging behaviors were significantly higher in participants meeting the eating disorder risk classification cut-off scores. One study examined binge and purging behaviors in female ROTC cadets, with 10.9% of participants engaging in binge eating, while 21.2% of participants used diet pills/diuretics/laxatives, and 5.2% of participants endorsed purging behaviors (Lauder & Campbell, 2001). Similar to the current study, binge and purging behaviors were significantly higher individuals meeting eating disorder risk classification cut-off scores (Lauder & Campbell, 2001). Another study by Lauder et al. also reported higher binge and purge behaviors in individuals meeting eating disorder risk classifications cut-off scores, with diet pill/laxative/diuretic use as the most endorsed purging behavior (Lauder et al., 1999). Similar to the findings by Lauder and colleagues, previous studies in military samples have reported the following rates of binge and purging behaviors: 14-34% binge eating, 3.3-5% vomiting, 9-34.8% diet pill/laxative/diuretic use, and 14.7-32.8% fasting (Carlton et al., 2005; Lauder & Campbell, 2001; Lauder et al., 1999; McNulty, 1997a, 1997b, 2001). Only one study reported on excessive exercise, with 15% of the sample endorsing

excessive exercise for weight loss (Carlton et al., 2005). Binge eating behavior appears to be higher in the current sample, although previous studies have reported challenges with the accuracy of assessing binge eating behaviors and frequency (Stice et al., 2004b; Stice et al., 2000). Rates of excessive exercise appear to be comparable to the findings reported by Carlton et al., while overall rates of diet pill/laxative/diuretic use appear to be higher amongst active duty military service members, while rates of fasting are comparable to the current study (Carlton et al., 2005). Despite a rate of 10.1% of participants meeting eating disorder risk classification cut-off scores, many more participants are engaging in eating disorder symptom behaviors or unhealthy weight control behaviors, including binge eating and purging behaviors, which may increase future risk of eating disorder development.

Previous studies have examined correlates of eating disorder risk in samples of male and female active duty service members using multivariable logistic regression models. Studies report that biological risk factors, such as sex and body mass index, as well as sociocultural, dieting, body dissatisfaction, negative affect, military contextual factors, and unhealthy weight control behaviors, such as worrying about weight, feeling overweight, body satisfaction, and stress related to testing periods all significantly predicted the presence of eating disorder risk (Garber, Boyer, Pollack, Chang, & Shafer, 2008; McNulty, 1997a, 1997b, 2001; Warner et al., 2007).

In the current study, univariate logistic regression analyses of biological (B), sociocultural (SC), dieting (DT), body dissatisfaction (BD), negative affect (NA), and military contextual (MC) factors were examined. These included: age (B), sex (B), race/ethnicity (B), ROTC year group (B), measured BMI (B), measured %BF (B), desire to be muscular (SC), desire to be thin (SC), adopting a weight loss eating style (DT), attempting weight loss (DT),

perceiving oneself as overweight (BD), desiring weight change (BD), exercising for weight loss (BD), disliking one's body (BD), extreme body changes (BD), stress about body composition assessments (NA), worrying about weight (NA), failing a body fat assessment (MC), failing a BMI screen (MC), dieting to meet body composition standards (MC), attempting weight loss to meet body composition standards (MC), leaders weight concern (MC), and peer comments about weight (MC). Race/ethnicity (B), measured BMI (B), measured %BF (B), and all sociocultural, dieting, body dissatisfaction, negative affect, and military contextual factors were significantly associated with increased likelihood of eating disorder risk classification cut-off scores. However, when all significant variables were examined in a multivariable logistic regression model, only peer comments about weight, a military contextual factor, was significantly associated with increased likelihood of eating disorder risk classification. These findings are in agreement with previous studies that reported an association between military contextual factors and greater likelihood of eating disorder risk classification (Garber et al., 2008; McNulty, 1997a, 1997b). Furthermore, they are supported by a more recent examination of weight stigma among military personnel, which found that nearly half (49%) of service members with overweight/obesity had at least one weight/shape based stigmatizing experience, and that experiencing weight-based stigma was associated with the use of binge eating and purging behaviors to cope with weight-based stigma (Schvey et al., 2017).Therefore, both traditional correlates, such as biological factors, dieting, body dissatisfaction, and negative affect, as well as military contextual factors continue to persist in military environments and continue to contribute to greater likelihood of meeting eating disorder risk classification cut-off scores, at least in ROTC cadets.

Finally, the study examined correlates that predicted total eating disorder symptoms scores to determine which predictor variables predicted increases in eating disorder symptoms. When all factors, including biological (B), sociocultural (SC), dieting (DT), body dissatisfaction (BD), negative affect (NA), and military contextual (MC) factors were considered together, only sex (B), desire for thinness (SC), and disliking one's body (BD) significant predicted higher total eating disorder symptom scores. Findings regarding sex are in agreement with previous studies in military service members that identified sex (B) as associated with eating disorder risk classification or eating disorder symptoms (Antczak & Brininger, 2008; Carlton et al., 2005; Warner et al., 2007; Williams et al., 2018). Similarly, drive for thinness (SC) and body dissatisfaction (BD) were also previously found to be higher in individuals meeting eating disorder risk classification cut-off scores (Lauder & Campbell, 2001; Lauder et al., 1999). Surprisingly, none of the military contextual factors were found to be associated with increased eating disorder symptoms in multivariable analyses, which is, however, in agreement with one previous theses that examined a multivariable model for predicting use of unhealthy weight control behaviors and found that including multiple factors resulted in a poorly fitting model (Seibert, 2007). These findings suggest that in addition to identifying which factors are associated with greater likelihood of eating disorder risk classification and eating disorder symptoms, it may also be necessary to identify, adapt, and develop measures of dieting, body dissatisfaction, and negative affect for military populations since they may not be understood and expressed in similar manners to civilian populations. Additionally, qualitative approaches within military populations may assist in understanding how and why these specific factors, including the military context, are experienced and how they may contribute to eating disorder risk and symptoms.

While the findings of this study agree with much of the current literature on eating disorder risk in military populations, this study is not without limitations. While the rate of meeting eating disorder risk classification was comparable to previous military studies, this study relied on the use of a convenience sample at only two Michigan universities. However, the study did have a high participation rate across sites (~70%). Additionally, the use of a self-report measures of eating disorder symptoms and risk may result in inaccurate classification of individuals. However, previous studies have reported an internal consistency reliability = 0.89, kappa coefficient with clinical interview=0.78, sensitivity=0.88, specificity=0.98, positive predictive value=0.74, and negative predictive value=0.98 (Stice et al., 2004b; Stice et al., 2000). The internal consistency reliability of the current sample=0.82, which is comparable to previous studies. Additionally, the kappa coefficient between the probable eating disorder diagnosis and the eating disorder risk cut-off score classification was 0.69, which indicates moderate levels of agreement. Similarly, studies in male and female military veterans using the EDDS as an eating disorder risk screening tool identified rates of eating disorders of 4.1% in males and 14.5% in females, and probable eating disorder diagnosis rates of 3.3% for bulimia and 2.9% for binge eating disorder, which are comparable to the current study (Arditte Hall, Bartlett, Iverson, & Mitchell, 2017a; Arditte Hall, Bartlett, Iverson, & Mitchell, 2017b; Mitchell et al., 2016). While the findings of the current study on factors associated with greater likelihood of meeting eating disorder risk classification cut-off scores and eating disorder symptoms are similar to previous studies, all the reported studies in military samples have been conducted in cross-sectional samples. The use of cross-sectional convenience samples precludes determination of causal relationships to eating disorder risk, as well as generalizability to military populations. Given the similarity in findings across military populations, suggesting this is a persistent and ongoing

problem, future studies are needed that include a diagnostic clinical interview to further establish the reliability and validity of the EDDS in military samples, as well as studies that include randomized, longitudinal samples to examine potential causal risk factors of eating disorder risk and symptoms in military populations. Studies are also needed that test validated measures of these factors developed for military-related populations. Finally, qualitative studies in military service members would allow examining how and why various factors, including biological, sociocultural, dieting, body dissatisfaction, negative affect, and military contextual factors, develop and contribute to eating disorder risk and symptoms, as well as how service members define and experience these factors.

F. Conclusion

This is the first study to examine the rate of meeting eating disorder risk classification cut-off scores in a sample of male and female US Army ROTC cadets. The present study showed that eating disorder risk classification and eating disorder symptoms are prevalent in samples of male and female US Army ROTC cadets from two Midwestern universities. The findings suggest that eating disorder symptoms, especially binge and purging behaviors, are still frequently used in military populations, including US Army ROTC cadets. Furthermore, the findings suggest that common correlates of eating disorder risk, such as sex, dieting, and body dissatisfaction, as well as military contextual factors, such as failing body composition assessments, attempting dieting and weight loss to meet body composition standards, and peer weight comments, all were significantly associated with a greater likelihood of meeting eating disorder risk classification cut-off scores or having higher levels of eating disorder symptoms. Future studies, including longitudinal and qualitative studies, are needed to determine how and why these factors may potentially contribute to eating disorder risk and symptoms within a

military context. Practitioners, including registered dietitian nutritionists, working with military service members, such as ROTC cadets, should monitor military service members for eating behaviors such as binge eating and purging, as well as traditional and military contextual factors, such as dieting, body dissatisfaction, and negative affect, especially around body composition testing periods, in order to mitigate the development of eating disorder symptoms in military service members.

CHAPTER 5 - Association between eating disorder symptoms and weight status in US Army ROTC cadets in two Midwestern universities

A. Abstract

Objective: Young adults, 18-25 years of age, comprise the largest demographic of the military services. They also experience the largest burden of obesity and eating disorders. Despite an emphasis on physical fitness, body composition, and operational readiness, military service members also experience high rates of obesity and eating disorders. While traditionally eating disorders and obesity are treated as two separate conditions, they may actually represent two ends of a *weight-related disorders* spectrum. Furthermore, weight gain and obesity may result as a consequence of eating disorder symptoms. Etiologic models, including the Dual Pathway Model, suggest body dissatisfaction, dieting, negative affect, and affect regulation are important factors in the onset of eating disorder symptoms. Furthermore, prospective studies suggest these factors also increase the risk for weight gain and obesity onset. As a result, eating disorder symptoms and obesity may be linked, although few studies have examined potential mechanisms linking this pathway. One factor, psychological inflexibility, a type of affect regulation strategy, has been associated with both eating disorder symptom onset as well as weight gain and obesity. Two related factors, psychological inflexibility related to body dissatisfaction and dieting, may therefore represent important pathways linking eating disorder symptoms and obesity. However, these pathways and the shared association between eating disorder symptoms and obesity have not been examined in military-related populations. One specific military population, US Army ROTC cadets, represent a military population of young adults potentially susceptible to both eating disorder symptoms and obesity. Therefore, the purpose of this study was to examine the association between eating disorder symptoms and

weight status and to determine if psychological inflexibility related to body dissatisfaction and dieting mediate this association in US Army ROTC cadets recruited from two midwestern universities.

Methods: The final analytic sample consisted of 205 of US Army ROTC cadets. Eating disorder symptoms were determined using the Eating Disorder Diagnostic Scale, a valid and reliable measure of eating disorder symptoms. Weight status, as indicated by waist circumference, percent body fat (%BF), and body mass index (BMI), were determined from measured anthropometrics, including height, weight, and body circumferences. Psychological inflexibility related to body dissatisfaction was determined by using the total score of the Body Image Action and Acceptance Questionnaire. Psychological inflexibility related to dieting was determined by using the total score from the Inflexible Eating Questionnaire. Mediational path analysis was used to determine the direct effects of eating disorder symptoms on weight status, as well as the indirect effects mediated by psychological inflexibility related to body dissatisfaction and dieting.

Results: The sample was primarily male (68.3%), identified as White/Caucasian (84.4%), non-Hispanic (91.7%), was a first year ROTC cadet (43.9%), and was classified as having a normal weight BMI of 18.5-24.9 kg/m^2 (55.2%). The mean age was 20.1 (2.0) years, the mean BMI was 24.6 (3.0) kg/m^2, the mean waist circumference was 80.3 (8.8) cm, and the mean %BF was 19.4 (8.0) %. The mean total eating disorder symptoms score was 13.6 (12). The mean psychological inflexibility related to body dissatisfaction and dieting scores were 26.2 (14.9) and 30.4 (10.2), respectively. Results from the two path analyses model suggest a moderate to good fit to the data. Model 1 examining the association between total eating disorder symptoms and weight status through psychological inflexibility related to body dissatisfaction showed a

positive association between eating disorder symptoms, weight status, and psychological inflexibility related to body dissatisfaction. Analyses of the indirect effects suggest that the path between psychological inflexibility related to body dissatisfaction and weight status was moderated by sex, so that the overall indirect effects of total eating disorder symptoms on weight status through psychological inflexibility related to body dissatisfaction were significant only for males. Model 2 examining the association between total eating disorder symptoms and weight status through psychological inflexibility related to dieting also showed a positive association between eating disorder symptoms, weight status, and psychological inflexibility related to dieting. Analyses of the indirect effects suggest that the overall indirect effects of total eating disorder symptoms on weight status are partially mediated by psychological inflexibility related to dieting for males and females.

Conclusions: Overall, the findings suggest that eating disorder symptoms are associated with weight status. Additionally, the association between eating disorder symptoms and weight status is partially mediated by psychological inflexibility related to body dissatisfaction, but only for males. The association between eating disorder symptoms and weight status is also partially mediated by psychological inflexibility related to dieting. Therefore, two facets of affect regulation, psychological inflexibility related to body dissatisfaction to body dissatisfaction and dieting, are potential mechanisms that explain the association between eating disorder symptoms and weight status. However, future studies examining these factors in longitudinal and experimental studies are needed to confirm these findings in US Army ROTC cadets and other military-related populations. Given that military-related populations will continue to be exposed to factors that may increase dieting and body dissatisfaction, such as enforcement of semi-annual physical fitness standards and enrollment in mandatory weight management programs, it may be

beneficial to develop monitoring, prevention, and treatment programs that also include facets of affect regulation, such as psychological inflexibility related to body dissatisfaction and dieting, in order to mitigate risks related to development of eating disorder symptoms and weight gain/obesity onset.

B. Introduction

Obesity and eating disorders are two public health concerns related to body weight and eating behaviors in US young adults 18-25 years of age (Eisenberg et al., 2011; Racette et al., 2008). Between 1988-2000, rates of obesity nearly doubled in young adults 18-29 years of age, from 7.1-12.1% (Flegal et al., 2010; Mokdad et al., 1999) These rates have continued to increase among adults 20-39 years of age, with 34% of adults 20-39 years of age classified as obese in a more recent National Center for Health Statistics survey (Flegal et al., 2016; Hales et al., 2018). Young adults also experience the largest burden of eating disorders, with 95% of eating disorders diagnosed among adolescents and young adults (12-25 years of age), and an average age of onset between 18-25 years of age for most eating disorders (Hudson et al., 2007a). Therefore, young adults experience a significant burden of the ongoing problems with obesity and eating disorders.

Young adults also comprise an important demographic in the military services. Currently, nearly half of all service members in all the military services are between 18-25 years of age (Department of Defense, 2015). Surveys examining the eligibility to serve amongst US young adults have determined that 25-50% of young adults in this age range are ineligible to serve due to weight, health, and fitness related problems (Christeson et al., 2009). This means that problems related to weight and health, including eating disorders and obesity, have the potential to impact military recruitment, operational readiness, and national security.

Despite emphasis on physical fitness, body composition standards, and operational readiness, the military is not immune to concerns related to eating disorders and obesity. A recent study examining the prevalence and trends of overweight and obesity from Department of Defense population-based health behavior surveys conducted between 1995-2008 noted that the overall prevalence of obesity has more than doubled from 5% to 12%, with a similar trend across all the services, age groups, and demographics (Reyes-Guzman et al., 2015). The findings are comparable to trends observed in young adults, where, obesity rates nearly doubled over the last few decades from 7-12%, with 34% of adults 20-39 years of age currently classified as obese (Flegal et al., 2010; Flegal et al., 2016; Hales et al., 2018; Mokdad et al., 1999). These trends are surprising given the military emphasis on physical fitness and body composition standards.

Similar trends are observed in eating disorder diagnoses and self-report eating disorder risk rates. A systematic review by Bodell and colleagues reported on studies of eating disorder diagnoses and self-report surveys of eating disorders using risk cut-off scores and summarized findings for studies conducted in active duty military populations, reserve officer training corps (ROTC) and US Military Academy cadets, college students, and college athletes (Bodell et al., 2014). The authors noted that rates of eating disorder diagnoses, identified through medical records review or use of clinical interviews, were similar across populations, ranging 0.1-5% in military-related populations, compared to 0-5% in college students and college athletes (Antczak & Brininger, 2008; Beekley et al., 2009; Bodell et al., 2014; Forney & Ward, 2013; Hudson et al., 2007b; Johnson et al., 1999; Lauder & Campbell, 2001). One reason for similar findings across populations is the potential for underreporting in military populations, where diagnoses of an eating disorder may be grounds for medical discharge (Department of the Army, 2016). Trends in self-report eating disorder risk rates, which range from 2-7% in military-related males,

and 20-33% in military-related females, compared to 8.5-9.5% and 16-25% in college males and females, respectively, provide support to these findings (Beekley et al., 2009; Bodell et al., 2014; Forney & Ward, 2013; Hudson et al., 2007b; Johnson et al., 1999; Lauder & Campbell, 2001; Lauder et al., 1999; Warner et al., 2007). Rates from self-report measures tend to be higher since self-report surveys are generally anonymous and not tied to a medical diagnosis with a potential detrimental outcome. The evidence suggests that eating disorders and obesity are also prevalent in military populations.

While eating disorders and obesity are often treated as two separate conditions, Neumark-Sztainer et al. (2002) have suggested that eating disorders and obesity are actually two ends of the spectrum of *weight-related disorders* (Haines & Neumark-Sztainer, 2006; Neumark-Sztainer et al., 2002). Evidence supporting the concept of weight-related disorders includes the co-occurrence of eating disorders and obesity (Flament et al., 2015; Neumark-Sztainer et al., 2002), crossover across conditions (Fairburn et al., 1998; Lebow et al., 2015; Neumark-Sztainer et al., 2006c), sharing of risk factors (Haines et al., 2010; Loth et al., 2015; Neumark-Sztainer et al., 2007; Stice et al., 2005b), and resistance to treatment for eating disorders and obesity, especially when they co-occur (Agras, 2001; Balantekin et al., 2017; Pi-Sunyer, 2002; Wilfley & Cohen, 1997). Though eating disorders/eating disorder symptoms and obesity represent two distinct, although interrelated conditions, eating disorder symptoms may represent another way to screen for weight gain and obesity onset in order to identify individuals at greater risk for treatment-resistance to target earlier for interventions. Therefore, there is a need to understand the circumstances that lead to the onset of both eating disorders and obesity.

One potential explanation is that obesity is a consequence of eating disorders and eating disorder symptoms. Eating disorders are psychological disorders characterized by abnormal

concerns regarding food, body weight, and consequent abnormal eating behaviors that significantly impair physical health or psychosocial functioning (American Psychiatric Association, 1994, 2013). The primary psychological symptoms of eating disorders include overvaluation of food, body weight, and shape. Behavioral symptoms include binge eating behaviors and purging behaviors, such as vomiting, excessive exercise, and diuretic laxative use and abuse. Physical symptoms include weight status and the presence of amenorrhea (American Psychiatric Association, 1994). Although eating disorders are typically classified and diagnosed based on a combination and severity of symptoms, there is significant overlap amongst the eating disorder symptoms (American Psychiatric Association, 1994, 2013; Culbert et al., 2015). Furthermore, most individuals with eating disorder symptoms do not meet eating disorder diagnostic criteria, although evidence indicates that individuals with subclinical or subthreshold eating disorder symptoms present with symptoms and comorbidity severity comparable to individuals with diagnosed eating disorders (American Psychiatric Association, 2013; Austin et al., 2008; Fairburn et al., 2007; Favaro et al., 2003). Therefore, the focus will be on how eating disorder symptoms and risk factors for their development consequently result in obesity.

Eating disorder symptoms are purported to result in weight gain and obesity onset through a combination of biological, sociocultural, psychological, and behavioral risk factors that increase the risk of eating disorder symptoms (Culbert et al., 2015; Polivy & Herman, 2002; Stice, 2002). One etiologic model of eating disorder symptom development, the Dual Pathway Model, purports to explain how various risk factors interact to produce eating disorder symptoms (Stice, 1994, 2001; Stice et al., 1998). The Dual Pathway Model suggests that two sociocultural factors, body image ideal internalization and pressure to achieve an ideal body image, which for most Western societies represents thinness for females and leanness/muscularity for males,

interact with a person's body status to produce body dissatisfaction (Stice, 1994, 2001; Stice et al., 1998; Striegel-Moore et al., 1986; Thompson & Cafri, 2007). Body dissatisfaction is the general feeling of dissatisfaction that arises when one's appearance is not congruent with one's body image ideal (Cash, 2011, 2012). Body dissatisfaction, in turn, is found to be higher in individuals with eating disorder symptoms and obesity (Cash & Deagle III, 1997; Weinberger et al., 2017).

Stice's Dual Pathway Model then posits that increases in body dissatisfaction result in increases in both dieting and negative affect (Stice, 1994, 2001; Stice et al., 1998). For example, Cash suggested that increases in body dissatisfaction in individuals with overvaluation or over importance of weight and shape result in increased negative affect, or negative emotions, related to body image (Cash, 2012). In turn, individuals engage in behavioral strategies to regulate, or cope, with negative affect arising from body dissatisfaction (Cash, 2012). Cash identified three types of body image-related coping behaviors: experiential avoidance, appearance fixing, and positive rational acceptance (Cash et al., 2005). Experiential avoidance was defined as engaging in behaviors to avoid threatening body image-related situations, thoughts, or beliefs (such as tuning out thoughts, overeating, or withdrawing), while appearance fixing was defined as efforts used to alter or correct perceived body image-related deficits (such as spending extra time to fix looks) (Cash, 2011, 2012; Cash et al., 2005). Therefore, dieting is proposed to arise as an appearance-fixing behavior because of the belief that it is an effective strategy to change weight and shape (Stice, 1994, 2001; Stice et al., 1998). Studies support the role of body dissatisfaction in predicting increased dieting and eating disorder symptoms (Shagar et al., 2017; Stice, 2002; Stice & Shaw, 2002). These findings suggest that body dissatisfaction is an important predictor of dieting, negative affect, and eating disorder symptoms.

The Dual Pathway Model also suggests that dieting then links body dissatisfaction and eating disorder symptoms through two pathways, a restraint pathway and an affect regulation pathway (Stice, 1994). According to Restraint Theory, dieting, or cognitive control of eating behavior to produce weight change, may results in physiological changes that result in increased cravings, as well as susceptibility to disruption, leading to disinhibition and binge eating (Polivy & Herman, 1985). Furthermore, since most dieting attempts are not successful at producing desired weight change, dieting also results in increased use of unhealthy weight control behaviors, onset of eating disorder symptoms, negative affect, and potentially weight gain (Curry et al., 1987; Heatherton & Polivy, 1992; McCarthy, 1990; Polivy & Herman, 1985; Stice, 1994; Westenhoefer et al., 1994). Data from prospective studies supports the role of dieting in predicting increases in negative affect and onset of eating disorder symptoms (Goldschmidt et al., 2012; Neumark-Sztainer et al., 2006c; Neumark-Sztainer et al., 2011; Stice, 2001; Stice et al., 2002), with negative affect mediating this association in at least some studies (Goldschmidt et al., 2012; Stice, 2001). Other prospective studies suggested that dieting also predicts weight gain and obesity onset (Drapeau et al., 2003; Goldschmidt et al., 2016; Goldschmidt et al., 2012; Neumark-Sztainer et al., 2006c; Neumark-Sztainer et al., 2012; Stice et al., 1999; Stice et al., 2005b), with negative affect also mediating this association (Goldschmidt et al., 2016). Both dieting and body dissatisfaction result in increases in negative affect (McCarthy, 1990).

Negative affect, or the tendency to experience negative emotions (e.g. anger, disgust, guilt, fear, sadness) (Watson & Clark, 1984), links body dissatisfaction to dieting and eating disorder symptom onset, as well as dieting to eating disorder symptom onset and weight gain. The affect-regulation pathway of negative affect and eating disorder symptoms proposes that the association between negative affect and eating disorder symptoms, and subsequently weight gain

and obesity, is mediated by the use of affect regulation strategies (Hawkins et al., 1984; Heatherton & Baumeister, 1991; Stice, 1994). Theories of affect regulation suggest binge eating is used as a way to avoid or deal with negative affect due to the belief that eating reduces negative feelings (Evers et al., 2010; Gianini et al., 2013; Hawkins et al., 1984; Heatherton & Baumeister, 1991; Oliver et al., 2000; Spoor et al., 2007; van Strien & Ouwens, 2003). Instead, binge eating tends to increase negative affect and body dissatisfaction due to fear of weight gain from binge eating (Haedt-Matt & Keel, 2011; Hawkins et al., 1984). In this case, purging behaviors, such as vomiting, laxative, and diuretic use, are sometimes then used to deal with negative affect that arises as a result of binge eating and consequent increases in body dissatisfaction and negative affect (Haedt-Matt & Keel, 2011; Hawkins et al., 1984). Accordingly, binge eating and purging are used to regulate affect and avoid dealing with difficult thoughts and emotions, making them maladaptive affect regulation strategies, which are strongly associated with higher levels of eating disorder symptoms (Endler & Parker, 1994; Spoor et al., 2007). Additionally, while use of maladaptive affect regulation strategies provide temporary relief from feelings of negative affect, body dissatisfaction, and fear of weight gain, they also increase the salience of food, weight, and shape, increasing the likelihood that individuals will continue to rely on these strategies to cope with negative affect (Hawkins et al., 1984; Stice, 1994).

Evidence appears to support the role of affect regulation as a mediator dieting and body dissatisfaction, and the potential outcomes of eating disorder symptoms and obesity onset (Dakanalis et al., 2014; Gianini et al., 2013; Goldschmidt et al., 2017; Goldschmidt et al., 2014; Haedt-Matt & Keel, 2011; Harrison et al., 2016; Lavender & Anderson, 2010; Lillis et al., 2011; Sim & Zeman, 2005; Sulkowski et al., 2011; Whiteside et al., 2007). For example, meta-analytic

evidence examining the antecedents and consequences of binge eating reported that negative affect preceded onset of binge and purge behaviors (Haedt-Matt & Keel, 2011), which has been replicated in a study examining stress and negative affect as antecedents to binge and purge behaviors (Goldschmidt et al., 2014). Similarly, Whiteside et al. (2007) reported that while overvaluation of weight and shape and food restriction both predicted binge eating, affect regulation difficulties predicted binge eating beyond these effects, supporting the notion that affect regulation mediates these effects (Whiteside et al., 2007). Maladaptive affect regulation strategies were also found to mediate the association between stress and binge eating in college females (Sulkowski et al., 2011). Furthermore, interventions targeting affect regulation strategies reported significant decreases in binge eating behaviors and body mass index (Godfrey et al., 2015; Rogers et al., 2018; Ruffault et al., 2017). These findings suggest that affect regulation likely represent an important mediating pathway linking eating disorder symptoms and their precursors, such as dieting, body dissatisfaction, and negative affect, to weight gain and obesity onset.

Cognitive behavioral theories and therapies arose in order to address the role of problematic thoughts and feelings, such as body dissatisfaction and negative affect, in the onset and maintenance of eating disorder symptoms and obesity (Beck, 1993; Hayes, 2004). For example, Fairburn et al. (2003) suggest that individuals with eating disorders judge themselves on the basis of their weight, shape, and eating behaviors, which in turns leads to an overemphasis of eating, weight, and shape (Fairburn et al., 2003). The over importance or overvaluation of weight, shape, and eating behaviors, consequently, represents the maintenance mechanism, or core psychopathology, of eating disorders (Fairburn et al., 2003). Other aspects of eating disorders include body checking/avoidance and body dissatisfaction, and unhealthy weight

control behaviors such as dietary restraint, self-induced vomiting, use and abuse of laxative/diuretics, and over exercising (Fairburn et al., 2003). Binge eating, then, is explained as arising as a response to dietary restraint, or the use of rigid cognitive rules to control eating (Fairburn et al., 2003). When there is a violation of these rules, the result is complete abandon of dietary restriction, a form of disinhibition from overreliance on cognitive control of dietary intake vs. physiological hunger/satiety cues (Fairburn et al., 2003). The overvaluation of eating, shape, and weight, as the driver of body dissatisfaction, unhealthy weight control, and binge eating, then, is targeted by engaging in therapies and exercises that challenge and modify the content of those thoughts (Fairburn et al., 2003). Similar theories have been developed for obesity.

Another cognitive behavioral theory was developed for obesity to explain the lack of success of current obesity management problems with producing and sustaining weight loss (Cooper & Fairburn, 2001). Cooper and Fairburn (2001) proposed that individuals with obesity fail to manage weight successfully due to weight loss goals and weight maintenance skills (pg. 503) (Cooper & Fairburn, 2001). They suggested individuals with obesity desire to lose 20-30% of body weight, which is in line with societal expectations of thinness (Cooper & Fairburn, 2001). Additionally, individuals with obesity are trying to lose weight for reasons other than health, such as improving appearance or improving self-confidence, which do not necessarily require weight loss (Cooper & Fairburn, 2001). As a result, when individuals are not successful at achieving personal weight loss and appearance goals, individuals gradually abandon weight loss efforts, resulting in gradual weight regain (Cooper & Fairburn, 2001). Therefore, Cooper and Fairburn suggested that failure from obesity treatments results from failure to address weight loss goals and weight maintenance strategies (Stice, 2002; Stice et al., 2011a; Stice & Shaw,

2002). In support of this theory, one prospective study of participants that had completed a weight management program suggested that individuals who regained weight had desired more weight loss, were less satisfied with the weight loss they achieved, judged self-worth in terms of weight and shape, adopted a more dichotomous thinking style, and tended to use more maladaptive affect regulation strategies than those who lost or maintained weight loss (Byrne et al., 2003; Byrne et al., 2004). Similar to cognitive behavior therapies of eating disorders, cognitive behavior therapies of obesity have as a target overvaluation of eating, shape, and weight, that drives unrealistic weight loss and appearance goals.

While current guidelines suggest that cognitive behavioral therapy (CBT) is the suggested choice for treatment of eating disorders (Wilson & Shafran, 2005), some researchers are bringing attention to the limitations of these approaches. For example, a large proportion (30-50%) of individuals with bulimia nervosa and binge eating disorder who receive CBT still remain symptomatic, including experiencing binge eating episodes post-treatment (Brownly et al., 2007; Fairburn et al., 2009; Juarascio et al., 2013b; Wilson et al., 2007). Similarly, only 50-80% of binge eating disorder patients receiving CBT maintain abstinence from binge eating at least 1-year post treatment (Mitchell et al., 2008). Furthermore, evaluations of CBT for anorexia nervosa suggest the treatment has limited efficacy in reducing the eating pathology (Juarascio et al., 2013a; Juarascio et al., 2010; Wilson et al., 2007; Wilson & Shafran, 2005), with few patients agreeing to start treatment (Byrne et al., 2011; Fairburn et al., 2009; Juarascio et al., 2013a; Juarascio et al., 2013b). Evidence also indicates that CBT has not provided improvements in weight loss outcomes in individuals with obesity (Cooper et al., 2010).

There are many suggested reasons that CBT may not be effective in the long run. Primarily, individuals with eating disorders may be reluctant to give up these behaviors due to

the presence of overvaluation of food, weight, and shape, and also due to the possibility that these behaviors have helped them achieve weight loss goals (Juarascio et al., 2010; Vanderlinden, 2008). Another possibility is that the use of treatment strategies such as self-monitoring of food intake and body image thoughts may reinforce the importance of food, weight, and shape (Fairburn et al., 2015; Fairburn et al., 2003; Fairburn & Wilson, 2013). Additionally, some patients may find it difficult to successfully and consistently engage in behaviors, resulting in increases in stress and negative affect, which are known antecedents to binge eating behaviors (Juarascio et al., 2017; Wilson et al., 2002; Zendegui et al., 2014). So, while CBT is the gold standard treatment for eating disorders, the treatment is not effective for all and may create further issues for some related to affect regulation.

Affect regulation is believed to play an important role in treatment outcome, with some studies suggesting that higher levels of emotional eating (maladaptive affect regulation) resulting in treatment resistance (Juarascio et al., 2017; Ricca et al., 2010). For example, in individuals receiving treatment for binge eating disorders, those with lower levels of negative affect and overvaluation of weight and shape had greater improvements in symptoms and severity (Grilo et al., 2012a; Grilo et al., 2012b; Grilo et al., 2012c). Other studies have reported that patients with more severe symptoms, such as more binge eating, more emotional problems, and higher baseline symptoms, had higher risk of treatment failures (Butryn et al., 2006; Castellini et al., 2012; Juarascio et al., 2013a; Vrabel et al., 2008). Therefore, successful treatments must also address underlying causes for symptom severity, including difficulties with affect regulation, in addition to overvaluation of weight, shape, and eating behaviors.

A newer cognitive behavioral approach, Acceptance and Commitment Therapy (ACT), arose in response to limitations within widely adopted cognitive behavioral approaches (Hayes,

2004). Instead of focusing on changing the content of problematic thoughts and emotions, such as overvaluation of weight, shape, and eating behaviors, as is done in CBT, ACT focuses on the context or function these thoughts have in leading to emotional and behavioral effects (Hayes, 2004; Hayes et al., 2006). For example, ACT proposes that attempts to change the content of thoughts and emotions increase their functional importance, but do not equip individuals to cope with these thoughts and emotions when they do re-emerge (Barnes-Holmes & Roche, 2001; Hayes et al., 2006). Instead, it may be more useful to change how the thoughts and emotions function by reducing their psychological importance rather than trying to eliminating them (Barnes-Holmes & Roche, 2001; Hayes et al., 2006).

ACT posits that psychopathology arises from the way language and cognition interact to prevent an individual from engaging in behavior that serves their values-based goals (Hayes et al., 2006). The resulting pathological process is termed experiential avoidance and is defined as the inability "to remain in contact with private experiences, bodily sensations, emotions, thoughts, and memories...with a need to take steps to alter the form or frequency of these events and the context that occasion them." (page 4) (Hayes et al., 2006; Hayes et al., 1996). Unlike CBT, ACT instead focuses on the values and goals of individuals, so as to assist individuals in reframing the context of negative private experiences to allow individuals to continue in values-based behaviors while experiencing negative private experiences (Hayes et al., 2006). From this perspective, experiential avoidance is problematic because it results in psychological inflexibility, or an inability to persist in values-based behavior (Hayes et al., 2006).

ACT describes several processes that result in psychological flexibility (Hayes et al., 2006). Briefly, cognitive fusion is defined as "the tendency to become entangled with one's private events such that these are perceived as reflecting reality rather than transitory mental

contents" (Hayes et al., 2006). Cognitive fusion results in behaviors governed by private events rather than by previous learning or the current environmental context, leading to maladaptive experiential avoidance strategies (maladaptive affect regulation strategies) to avoid or escape these events, and resulting in behavior that is inconsistent with values or goals (Hayes et al., 2006). ACT targets these core problems in order to increase contact and experience of the present moment, to increase psychological flexibility, which allows one to engage in values-based behaviors in the face of difficult private experiences (Hayes et al., 2006). In contrast to CBT-based approaches, the target of therapy in ACT is maladaptive affect regulation strategies, suggesting ACT-based approaches may be important in understanding eating disorder symptoms and their association with obesity.

Studies examining psychological inflexibility have identified it as an important mediator in many eating- and weight-related processes, including rigid dieting (Duarte et al., 2017; Duarte et al., 2016), body dissatisfaction (Masuda et al., 2015; Sandoz et al., 2013), binge eating (Lillis et al., 2011), food cravings (Forman et al., 2013a; Forman et al., 2013b; Juarascio et al., 2011), weight-related concerns (Lillis & Hayes, 2007; Lillis et al., 2009), intuitive eating (Sairanen et al., 2017) and barriers to physical activity (Butryn et al., 2015). Previously discussed risk factors for eating disorder symptoms and obesity included dieting and body dissatisfaction, based on prospective research suggesting increased risk for onset of eating disorders and obesity based on the presence of dieting and body dissatisfaction (Neumark-Sztainer et al., 2006a; Neumark-Sztainer et al., 2002; Neumark-Sztainer et al., 2006c; Neumark-Sztainer et al., 2012; Neumark-Sztainer et al., 2018; Stice, 2002; Stice et al., 1999; Stice et al., 2011a; Stice et al., 2005b). Kraemer et al. suggests that if these two risk factors are involved in the mechanism of onset of

obesity and eating disorders, mediation analysis would help to elucidate this relationship (Kraemer et al., 2001).

Psychological inflexibility, as a process of maladaptive affect regulation, has been examined in relation to body dissatisfaction and dieting. For example, Sandoz et al. (2013) conducted one of the first studies that examined psychological inflexibility related to body dissatisfaction. This measure, the Body Image Action and Acceptance Questionnaire (BI-AAQ), was developed in a sample of male and female undergraduate students (Sandoz et al., 2013). The central construct, termed "body image flexibility," focused on the function of body image related thoughts, mainly body dissatisfaction, and their impact on one's ability to engage with these private experiences while still continuing with values-based behavior (Cash et al., 2005; Sandoz et al., 2013). The authors hypothesized a negative association between body image flexibility and body dissatisfaction and eating disorder symptoms (Sandoz et al., 2013). Their study provided support for their hypothesis, such that when body image flexibility was low, and psychological inflexibility related to body dissatisfaction was high, body dissatisfaction and eating disorder symptoms were high (Sandoz et al., 2013). Furthermore, hierarchical regression analysis demonstrated that when controlling for weight status (BMI), and body dissatisfaction, body image flexibility was still a significant predictor of eating disorder symptoms, and even moderated the association between body dissatisfaction and eating disorder symptoms such that only individuals with high body dissatisfaction and low body image flexibility (or high psychological inflexibility related to body dissatisfaction) evidenced higher eating disorder symptoms (Sandoz et al., 2013). These findings suggest that the presence of body dissatisfaction is not enough to predict eating disorder symptoms. Rather, body dissatisfaction, in conjunction

with maladaptive affect regulation, in this case, psychological inflexibility related to body dissatisfaction, were both needed to predict the presence of eating disorder symptoms.

Similarly, a measure of psychological inflexibility related to dieting, named the Inflexible Eating Questionnaire (IEQ), was developed by Duarte et al. in a community sample of males and females (Duarte et al., 2017). The study defined this construct as "eating inflexibility," the "inflexible adherence to eating rules without regard to internal (hunger or satiety cues) or external (social contexts) contexts, including a sense of control when adhering to rules and a sense of distress when failing to adhere to rules" (pg. 147) (Duarte et al., 2017). The authors reported a strong positive association between the IEQ (psychological inflexibility related to dieting) and measures of dietary restraint and eating disorder symptoms, as well as strong positive associations between the IEQ (psychological inflexibility related to dieting) and stress/depressive symptoms (Duarte et al., 2017). Additionally, the authors reported that psychological inflexibility related to dieting moderated the association between dietary restraint and eating disorder symptoms such that individuals with higher inflexible eating (psychological inflexibility related to dieting) and higher dietary restraint had higher eating disorder symptoms (Duarte et al., 2017). Similar to psychological inflexibility related to body dissatisfaction, these findings also suggest that the presence of dietary restraint is not enough to predict eating disorder symptoms. An individual must present with both high dietary restraint and high levels of psychological inflexibility related to dieting in order for these to significantly predict eating disorder symptoms.

The findings reported on psychological inflexibility related to body dissatisfaction and psychological inflexibility related to dieting have been confirmed and extended in additional studies. For example, Masuda et al. examined the association between weight status, eating

disorder cognitions, and body image flexibility on eating disorder symptoms. The authors reported that when controlling for weight status, body image flexibility mediated the association between eating disorder cognitions and eating disorder symptoms such that high eating disorder cognitions predicted lower body image flexibility (higher psychological inflexibility related to body dissatisfaction), which in turn predicted higher eating disorder symptoms (Masuda et al., 2015). Another study examined the mediator role of body image flexibility in mediating the association between body image shame (a negative body image emotion), binge eating, and weight status, and reported that higher body image shame predicted lower body image flexibility (higher psychological inflexibility related to body dissatisfaction), which in turn predicted higher binge eating and higher weight status, meaning body image shame indirectly predicted increased binge eating and increased weight status through lower body image flexibility (higher psychological inflexibility related to body dissatisfaction) (Duarte & Pinto-Gouveia, 2016).

Studies have also examined the role of eating inflexibility (psychological inflexibility related to dieting) with other purported risk factors for eating disorder symptoms and obesity (Duarte et al., 2016; Pinto et al., 2017). Two studies examined the role of eating inflexibility (psychological inflexibility related to dieting) as a mediator of the association of weight status, and eating disorder symptoms in adolescent and community females (Duarte et al., 2016; Pinto et al., 2017). Both studies reported a significant positive association between weight status, eating inflexibility (psychological inflexibility related to dieting), and eating disorder symptoms, as well as a strong positive association between eating inflexibility (psychological inflexibility related to dieting) and eating disorder symptoms (Duarte et al., 2016; Pinto et al., 2017). Duarte et al. also reported that the association between body dissatisfaction and eating disorder symptoms was mediated by eating inflexibility (psychological inflexibility related to dieting)

(Duarte et al., 2016). Furthermore, both studies reported that eating inflexibility (psychological inflexibility related to dieting) mediated the association between weight status and eating disorder symptoms, such that a higher weight status predicted higher levels of eating inflexibility (psychological inflexibility related to dieting), which in turn predicted higher levels of eating disorder symptoms (Duarte et al., 2016; Pinto et al., 2017). Both measures of psychological inflexibility related to body dissatisfaction and dieting mediated associations between risk factors of eating disorder symptoms and eating disorder symptoms. Both measures were also positively associated with weight status, suggesting psychological inflexibility related to body dissatisfaction and dieting are plausible mechanisms linking eating disorder symptoms with weight gain and obesity.

Knowledge about body dissatisfaction, dieting, and psychological inflexibility of body dissatisfaction and dieting are important to consider in military populations because features of military service may exacerbate risk for dieting and body dissatisfaction. For example, all military services enact mandatory physical fitness, body composition, and appearance standards enforced at least semi-annually (US Department of Defense, 2002). Failure to meet these occupational standards may result in punitive disciplinary actions, such as mandatory counseling, mandatory participation in a weight management program, or mandatory participation in additional physical training, as well as possible discharge from military service (Department of the Army, 2013; US Department of Defense, 2002). Previous studies suggest worry and stress about meeting physical fitness standards are predictors for eating disorder symptoms, such as binge behaviors and purging behaviors like vomiting, diet pill/laxative/diuretic use, fasting, and excessive exercise (Carlton et al., 2005; Garber et al., 2008; McNulty, 1997a, 1997b, 2001). Studies of weight loss strategies used by military service members describe use unhealthy

dieting, vomiting, laxative/diet/pill/diuretic use, excessive exercise, and even use of saunas to meet body composition standards (Lauder et al., 1999; Piche et al., 2014; Rose et al., 1993; Sweeney & Bonnabeau, 1990; Wilson & James, 2018). These behaviors may be especially problematic in military service members who are required to remain constant operational readiness, in addition to bi-annual fitness and body composition testing.

Studies in military populations also suggest a role for body dissatisfaction, dieting, and weight status with respect to eating disorder symptoms and risk. One study conducted by the US Army Research Institute of Environmental Medicine surveying weight loss techniques used to meet body composition standards reported that although only 16% of the sample was considered overweight, 85% considered themselves to be overweight, while 57% had attempted weight loss (Rose et al., 1993). When asked qualitatively about reasons for attempting weight loss, appearance (42.8%) and upcoming weigh-ins (20.9%) were frequently reported as the most important reasons for attempting to lose weight (Rose et al., 1993). Moreover, in a pair of studies assessing eating disorder risk, body dissatisfaction, and dieting in female military service members and ROTC cadets using the Eating Disorder Inventory-2, Lauder and colleagues reported that military females identified as meeting eating disorder risk classification cut-off scores had higher levels of exercise, weight dissatisfaction, and levels of pressure regarding their weight (Lauder & Campbell, 2001; Lauder et al., 1999). Women in the group meeting the eating disorder risk classification cut-off score also had higher levels of eating disorder symptoms, bulimic behaviors, and body dissatisfaction (Lauder & Campbell, 2001; Lauder et al., 1999). These findings suggest an important role for body dissatisfaction and dieting in relation to weight status and eating disorder risk in military service members, although these studies were

conducted in primarily female samples almost two decades ago, so the current status of the problem is not known.

One military-related population of young adults that may also potentially be at risk for eating disorder symptoms and obesity are US Army Reserve Officer Training Corps (ROTC) cadets, who are college and university students in training to become officers in the US military (Today's Military, 2017). US Army ROTC cadets are required to adhere to body composition and physical fitness standards, that in turn may lead to an overemphasis on weight and shape, body dissatisfaction, and use of unhealthy weight control behaviors, in order to meet these standards and retain scholarship benefits, as well as be competitive for favorable officer commission opportunities (Bodell et al., 2014; Johnson et al., 2014; US Army Cadet Command, 2018). For example, one study in female US Army ROTC cadets a point prevalence of 20% of cadets in the sample met the eating disorder risk classification cut-off scores based on a self-report measure of eating disorder symptoms (EDI-2) (Lauder & Campbell, 2001). Cadets identified at risk had a higher prevalence of eating disorder symptoms (binge eating, purging, laxative/diet pill/diuretic use), as well as a higher prevalence of body dissatisfaction (Lauder & Campbell, 2001). Another study in male and female West Point cadets found a similar prevalence of cadets who met eating disorder risk classification cut-off scores based on another self-report measure of eating disorder symptoms (EAT-26). However, the study in West Point cadets did not report on body dissatisfaction, while neither study reported on the association between weight status, as measured by body mass index, and eating disorder symptoms.

Only two studies have reported on the rates of overweight and obesity in ROTC cadets, with a recent study reporting rates of overweight and obesity of 30.1% and 6.2%, respectfully (Crombie et al., 2012; Wilson & James, 2018). The authors also reported that 24% of cadets

were dissatisfied to very dissatisfied with their weight, and 14.9% and 11.6% of cadets were using fasting on water or juices and skipping at least one meal to lose weight (Wilson & James, 2018). Although US Army ROTC cadets may not appear to pose a risk for obesity due to their physical fitness and body composition requirements, one study examining longitudinal changes in weight status found a significant increase in body fat throughout the study period, despite a non-significant increase in weight and BMI (Crombie et al., 2012). Lastly, a mixed methods thesis with a qualitative focus groups, reported that struggling to meet body composition standards has an influence on cadets' eating behaviors and dietary intake (Nevarez, 2017). So, while ROTC cadets are military officers in training, and are expected to meet physical fitness and body composition standards, which may increase their risk for dieting and body dissatisfaction, and purportedly lead to increased risk for weight gain and eating disorder symptoms, no studies have examined the association between eating disorder symptoms and obesity, nor their potential shared association through psychological inflexibility related to body dissatisfaction and dieting, in this population.

Since weight status and eating disorder symptoms are of importance in ROTC cadets, another important question that remains to be answered is which indicator of weight status is most relevant in investigating eating disorder symptoms. Previous studies reporting on the prevalence of overweight and obese weight status in military service members report body mass index (BMI) (Reyes-Guzman et al., 2015; Smith et al., 2012). The military application of BMI, as a weight-for-height screening tool, was relevant when screening for underweight as an indicator of disease and malnutrition (Friedl, 1992; Johnson, 1997). However, given that risks from being overweight come from carrying extra weight as body fat, the military adopted body fat standards, so as to not unnecessarily exclude service members who were heavier due to

greater proportions of fat-free mass (Friedl, 1992; Johnson, 1997). The current approach used by the US Army and ROTC Programs is to screen weight-for-height and to determine percent body fat for service members exceeding their weight-for-height screen (Friedl, 1992; US Department of Defense, 2002). Service members meeting age- and sex-specific weight-for-height screens are assumed to be compliant with age- and sex-specific body fat standards (Friedl, 1992; US Department of Defense, 2002). For service members exceeding weight-for-height screens, body circumference measurements are taken at the neck, abdomen, and hips (for females) and the resulting measures are entered into a regression equation to estimate percent body fat (Friedl, 1992; US Department of Defense, 2002). The Department of Defense body circumference equation has been demonstrated to be within acceptable limits of precision and accuracy compared to underwater weighing and dual-energy X-ray absorptiometry (Friedl, 1997; Hodgdon & Beckett, 1984a, 1984b; Hodgdon & Friedl, 1999). In a recent study comparing BMI, waist circumference, and waist-stature ratio to percent body fat from dual-energy X-ray absorptiometry, Flegal et al. found that waist-stature ratio most strongly correlated with percent body fat in men, while BMI most strongly correlated with percent body fat in women (Flegal et al., 2008). Therefore, it may be necessary to test which indicator of weight status is most strongly associated with eating disorder symptoms as a secondary question.

There is preliminary evidence that suggests weight status and eating disorder symptoms are likely important and related in ROTC cadets. However, there is a paucity of research on the association between weight status and eating disorder symptoms, even though both are likely to be important in this population given the military emphasis on physical fitness and body composition.

The present study sought to contribute to the literature on weight status and eating disorder symptoms by examining the role of eating disorder symptoms as a predictor for unfavorable weight status in ROTC cadets. Evidence from a recent study suggests sex, perceiving oneself as overweight, and attempting weight loss in order to meet body composition standards were all positively associated with a greater eating disorder symptoms score, providing support for the present study (Aim 1). First, we sought to determine which indicator of weight status was most strongly associated to the total eating disorder symptoms score. Next, we hypothesized that the total eating disorder symptoms score would be positively associated with weight status. Furthermore, we hypothesized that there would be an indirect effect of the total eating disorder symptoms score on weight status through psychological inflexibility related to body dissatisfaction, such that a higher eating disorder symptoms score would predict higher levels of psychological inflexibility related to body dissatisfaction. Higher psychological inflexibility related to body dissatisfaction would in turn predict a higher weight status (Figure 1). Additionally, we hypothesized that there would also be an indirect effect of the total eating disorder symptoms score on weight status through psychological inflexibility related to dieting, such that a higher total eating disorder symptoms score would predict higher psychological inflexibility related to dieting. Higher psychological inflexibility related to dieting would in turn predict a higher weight status (Figure 1). In mediational analyses, sex and race/ethnicity were covaried based on previous evidence indicating significant differences on the main study variables (Duarte et al., 2017; Hudson et al., 2007b; Kelly et al., 2012; Sandoz et al., 2013; Striegel-Moore & Bulik, 2007).

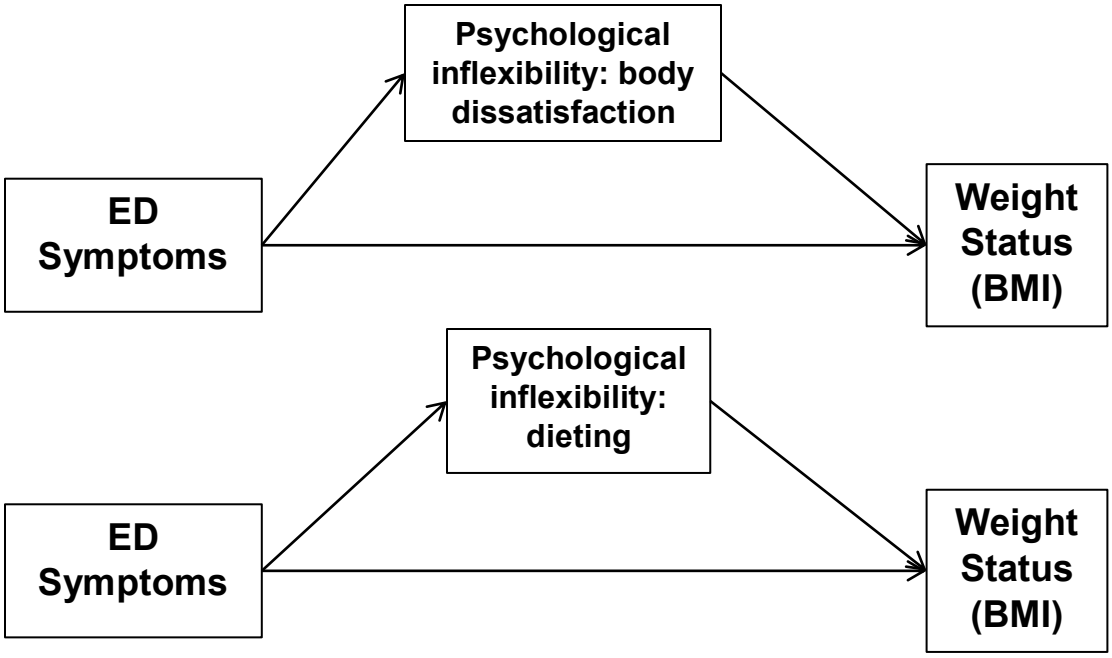


Figure 5.1. Proposed relationship between weight status, eating disorder symptoms, and body dissatisfaction- and dieting-related psychological inflexibility, with sex and race/ethnicity as covariates. ED Symptoms=total eating disorder symptoms score.

C. Methods

1. Participants and Procedure

Data for the present study were drawn from a cross-sectional study designed to examine the eating behaviors and mediators of eating behaviors in a sample of US Army ROTC cadets. Because Michigan has a high rate of adult obesity amongst college students, a convenience sample of US Army ROTC cadets was recruited from the US Army ROTC programs at two Michigan universities (Yahia et al., 2017). Participants who were active members in the US Army ROTC programs, 18-35 years of age, were included. The study was approved by the appropriate institutional review boards, and participant consent was collected. Demographic characteristics, eating behaviors, and mediators of eating behaviors, including eating disorder symptoms and measures of psychological inflexibility, were collected through participant self-reports. Indicators of weight status, including body mass index, waist circumference, and percent

body fat, were determined using anthropometric measures. Eligible participants were provided a $10 grocery gift card for completing the approximately 90-minute long survey and anthropometric measurements.

Two hundred and five ROTC cadets participated. Only participants missing data on all variables of interest were excluded. The final analytic sample consisted of 205 participants. When comparing participant demographic characteristics from the two sites, participants differed only on age and ethnicity, so data from both sites were pooled for further analyses. Participant ages ranged from 18-32 years (M = 20.1, SD = 2.0). Most of the sample was male (68.3%), White/Caucasian (84.4%), non-Hispanic (91.7%), a first year ROTC cadet (43.9%), and was classified as having a normal weight BMI, 18.5-24.9 kg/m^2 (55.5%).

2. Measures

Demographics. Demographic characteristics were asked using the newly developed Military-Specific Demographics and Lifestyle Information Questionnaire, currently being piloted and validated by the US Army Research Institute of Environmental Medicine as part of their Development of a Military Specific Eating Behavior Survey Study (Cole, 2016). Demographic characteristics included: age, sex, race, ethnicity, and ROTC year.

Eating Disorder Diagnostic Scale, DSM-IV (EDDS) (Stice et al., 2000). The EDDS is a self-report measure of eating disorder symptoms based on the diagnostic criteria for eating disorders in the *Diagnostic and Statistical Manual for Mental Disorders*, 4th edition (American Psychiatric Association, 1994). There were a total of 22 questions, including one question about current height, one question about current weight, and one question about birth control usage. The other 19 questions relate to eating disorder symptoms, such as body dissatisfaction (Has your weight influenced how you think about/judge yourself as a person), binge eating behaviors

(During these episodes of overeating and loss of control did you eat alone because you were embarrassed by how much you were eating), binge eating frequency (How many times per week on average over the past 3 months have you eaten an unusually large amount of food and experienced a loss of control), and frequency of purging behaviors (How many times per week on average over the past 3 months have you engaged in excessive exercise specifically to counteract the effects of overeating episodes), such as vomiting, laxative/diuretic use, fasting, and excessive exercise to counteract effects of overeating (Lee et al., 2007). Items are scored and summed to yield a total eating disorder symptoms score, with higher scores indicating greater levels of eating disorder symptoms (Stice et al., 2004b; Stice et al., 2000). Items can also be standardized and summed if using a risk classification cut-off score, with a cut-off score ≥ 16.5 indicating a positive screen for eating disorder risk (Krabbenborg et al., 2012). The items can also be used to determine a probable eating disorder diagnoses based on DSM-IV criteria (Stice et al., 2000). The authors reported a Cronbach's alpha of 0.89, and test-retest reliability of 0.87 for the total eating disorder symptoms score (Stice et al., 2000), as well as excellent criterion, convergent, and predictive validity (Stice et al., 2004b). The total eating disorder symptoms score was used to measure eating disorder symptoms and demonstrated good internal consistency in the current study ($\alpha = 0.82$).

Body Image-Action and Acceptance Questionnaire (BI-AAQ) (Sandoz et al., 2013). The BI-AAQ is a 12-item measure of psychological inflexibility related to body dissatisfaction. The BI-AAQ is a self-report measure of the degree to which one avoids experiences related to body dissatisfaction (If I start to feel fat, I try to think about something else), as well as to the degree one engages in values-based activities despite body dissatisfaction (Worrying about my weight makes it difficult for me to live a life that I value) (Masuda et al., 2015; Sandoz et al.,

2013). All items are rated on a seven-point Likert scale ranging from 1 (never true) to 7 (always true). Items can be scored and summed or reverse scored and summed, ranging from 12-84. When items are reverse scored and summed, this provides a measure of body image *flexibility*. When items are scored and summed, higher scores indicate higher levels of *psychological inflexibility related to body dissatisfaction*. Previous studies indicate the BI-AAQ had good internal consistency ($\alpha = 0.92$), as well as concurrent, criterion-related, and incremental validity (Sandoz et al., 2013). Although most studies report on the total of the reverse scored items, for this study, the total BI-AAQ score without reverse scoring was used to measure psychological inflexibility related to body dissatisfaction. The BI-AAQ demonstrated good internal consistency in the current study ($\alpha = 0.95$).

Inflexible Eating Questionnaire (IEQ) (Duarte et al., 2017). The IEQ is an 11-item self-report measure of psychological inflexibility related to dieting (When I cannot follow my eating plan, I feel very anxious or nervous). Items are rated on a five-point Likert scale ranging from 1 (totally disagree) to 5 (totally agree). Items are scored and summed, with total possible scores ranging from 11-55, and higher scores indicating higher levels of psychological inflexibility related to dieting (Duarte et al., 2017). Previous studies indicate the IEQ had good internal consistency ($\alpha = 0.95$), test-retest reliability, and construct validity in samples of males and females (Duarte et al., 2017). The total IEQ score was used to measure psychological flexibility related to dieting. The IEQ demonstrated good internal consistency in the current study ($\alpha = 0.92$).

Weight Status. Anthropometric measures included height, weight, and body circumferences using Army Regulation 600-9 (AR 600-9): The Army Body Composition Program procedures (Department of the Army, 2013). Height and weight were measured with

participants wearing a physical fitness uniform without shoes, a combat uniform with empty pockets, and coat and boots removed, or civilian clothing without shoes. Height was measured using a Seca 213 portable stadiometer and was rounded to the nearest 0.1cm (seca GmbH, Hamburg, Germany). Weight was measured using a Seca 872 Digital medical scale (seca GmbH, Hamburg, Germany) and was rounded to the nearest 0.1 kg. Height and weight were used to compute BMI (kg/m^2) (Janssen et al., 2002). Body circumferences were measured using the procedures in AR 600-9 using a Gulick measuring tape (5193, Richardson Products), and measurements were recorded to the nearest 0.1 cm at the following sites: neck (below the larynx, perpendicular to the neck), the waist for females (the point of minimal abdominal circumference) or the navel for males, and the hips for females (around the greatest gluteal protrusion) (Department of the Army, 2013). Each measurement was taken in series (neck, abdomen for males; neck, waist, hips for females) at least three times by one research assistant and recorded by a second research assistant. If two measurements at one location were greater than 0.5 cm different, a fourth set of measurements was taken. The measurements were converted to inches and rounded according to AR 600-9, and entered into a sex-specific body fat equation for males, % body fat = [86.010 x Log10 (waist – neck)] – [70.041 x Log10 (height)] + 36.76, and females, % body fat = [163.205 x Log10 (waist + hip – neck)] – [97.684 x Log10 (height)] – 78.387. Percent body fat was recorded to the nearest whole % (Department of the Army, 2013) (Appendix L).

3. Data analysis

Data was examined for univariate and multivariate normality using SPSS statistical software (v.25; SPSS Inc., Chicago, IL). Normality was assessed according to values of skewness (Sk) and kurtosis (Ku), where values Sk > |3| ad Ku > |10| indicate severe violations of

normality (Kline, 2015). Demographic characteristics by site were examined using Chi-Square Tests of Independence (McHugh, 2013) (Table 5.1). In order to determine which indicator of weight status most strongly determined eating disorder symptoms, we conducted a Pearson correlation between indicators of weight status (BMI, waist circumference, and percent body fat), with the total eating disorder symptoms score, using sex, race, and ethnicity as covariates. Data are reported as mean (standard deviation), unless indicated, and a p-value <0.05 was considered statistically significant.

We tested our hypotheses regarding the indirect effects of eating disorder symptoms on weight status via psychological inflexibility related to body dissatisfaction and psychological inflexibility related to dieting in two mediation path models while using sex and race/ethnicity as covariates. Tests of model fit were examined to determine the goodness-of-fit of the proposed models using the following fit indicators: Chi-square ($\chi 2$), Tucker Lewis Index (TLI) ≥ 0.95, Comparative Fit Index (CFI) ≥ 0.95, Root-Mean Square Error of Approximation (RMSEA) with 90% confidence interval ≤ 0.08, and the Standardized Root Mean Square Residual (SRMR) ≤ 0.08 (Bentler & Bonett, 1980; Hu & Bentler, 1999; MacCallum et al., 1996). The fit and comparison of reverse (nonnested) models was also considered using the Bayesian information criterion (BIC) (Merkle et al., 2016; Raftery, 1995; Schwarz, 1978). Analyses were conducted in Mplus (Mplus Version 8; Muthen & Muthen, 1998-2018) using full information maximum likelihood estimation to handle missing data in cases. To examine the specific hypotheses, we implemented the nonparametric, percentile bootstrap method (Falk, 2018; MacKinnon et al., 2002), with 5,000 resamples to construct percentile bootstrap 95% confidence intervals around the product coefficient of the indirect effect of eating disorder symptoms via the hypothesized

mediators of psychological inflexibility related to body dissatisfaction and psychological flexibility related to dieting on weight status (BMI) (Preacher & Hayes, 2008).

D. Results

Preliminary analyses indicated site differences with respect to ethnicity and ROTC Year group (Table 5.1). However, these demographic characteristics were not significantly associated with any of the study variables, and so data from both sites were pooled for further analyses. Means, standard deviations, and correlations between study variables are presented in Table 5.2. BMI was positively associated with the total eating disorder symptoms score (r=0.35, p<0.05), psychological inflexibility related to body dissatisfaction (r=0.22, p<0.05), and psychological inflexibility related to dieting (r= 0.34, p<0.05). The total eating disorder symptoms score was positively associated with psychological inflexibility related to body dissatisfaction (r= 0.74, p<0.05), and psychological inflexibility related to dieting (r=0.48, p<0.05). Psychological inflexibility related to body dissatisfaction was positively associated with psychological inflexibility related to dieting (r=0.52, p<0.05) (Table 5.2). Partial correlational analysis of indicators of body composition, including BMI, waist circumference, and percent body fat to the total eating disorder symptoms score, with sex and race/ethnicity as covariates, indicated that BMI was most strongly correlated with eating disorder symptoms, r=0.392, p<0.001 (Table 5.3). Therefore, BMI was used as the indicator of weight status in path analyses models.

A comparison of study means by demographic characteristics suggested significant differences between males and females on most study variables, with females having significantly higher total eating disorder symptoms scores (17.7 vs. 12.1, p=0.006) and males having a significantly higher BMI (24.9 vs. 24.0 kg/m^2, p=0.038). Females had a significantly higher psychological inflexibility related to body dissatisfaction score (30.8 vs. 24.5, p=0.006).

Table 5.1. Demographic characteristics by site.

Characteristics	Total Sample (n=205) n (%)	Site 1 (n=114) n (%)	Site 2 (n=91) n (%)	p-value
Sex				0.120
Male	140 (68.3)	83 (72.8)	57 (62.6)	
Female	65 (31.7)	31 (27.2)	34 (37.4)	
Race				0.103
White/Caucasian	173 (84.4)	93 (81.6)	80 (87.9)	
Black/African American	16 (7.8)	12 (10.5)	4 (4.4)	
Native American Alaskan Native	2 (1.0)	2 (1.8)	0 (0)	
Asian	9 (4.4)	6 (5.3)	3 (3.3)	
Other	5 (2.5)	1 (0.9)	4 (4.4)	
Ethnicity				**0.023***
Hispanic	17 (8.3)	5 (4.4)	12 (13.2)	
Non-Hispanic	188 (91.7)	109 (95.6)	79 (86.8)	
Race/Ethnicity				0.050
White/Caucasian, non-Hispanic	159 (77.6)	90 (78.9)	69 (75.8)	
Black/African American, non-Hispanic	16 (7.8)	12 (10.5)	4 (4.4)	
Asian, non-Hispanic	9 (4.4)	6 (5.3)	3 (3.3)	
Biracial, non-Hispanic	4 (2.0)	1 (0.9)	3 (3.3)	
Hispanic	17 (8.3)	5 (4.4)	12 (13.2)	
ROTC Year Group				**<0.001***
MS1	90 (43.9)	53 (46.5)	37 (40.7)	
MS2	43 (21.0)	33 (28.9)	10 (11.0)	
MS3	41 (20.0)	13 (11.4)	28 (30.8)	
MS4	31 (15.1)	15 (13.2)	16 (17.6)	
BMI				0.790
Underweight, <18.5 kg/m^2	2 (1.0)	1 (1.0)	1 (1.1)	
Normal Weight, 18.5-24.9 kg/m^2	107 (55.2)	59 (56.7)	48 (53.3)	
Overweight, 25-29.9 kg/m^2	76 (39.2)	38 (36.5)	38 (42.2)	
Obesity, ≥ 30 kg/m^2	9 (4.6)	6 (5.8)	3 (3.3)	

Note: MS=Military Science (i.e. MS1=Military Science Student Year 1); Chi-Square Test of Independence Test; *$p<0.05$.

Table 5.2. Means, standard deviations, and correlations among study variables.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. Sex	-									
2. Ethnicity	0.14*	-								
3. Race	0.04	0.06	-							
4. Age	0.07	0.11	0.15*	-						
5. Body mass index	-0.15*	0.18*	0.03	0.17*	-					
6. Waist circumference	-0.61*	0.03	-0.05	0.12	0.75**	-				
7. Percent body fat	0.78*	0.28*	0.00	0.17*	0.40**	-0.03	-			
8. Total eating disorder symptoms score	0.19*	0.09	0.17*	0.04	0.35**	0.15*	0.36*	-		
9. Psychological inflexibility related to body dissatisfaction	0.19*	0.02	0.21*	0.01	0.22*	0.06	0.28*	0.74*	-	
10. Psychological inflexibility related to dieting	0.03	0.05	0.17*	0.06	0.34*	0.22*	0.22*	0.48*	0.52*	-
Range	-	-	-	18-32	17.6-32.7	61.0-101.7	4.1-42.9	0-67	12-84	11-53
Mean or n	-	-	-	20.1	24.6	80.3	19.4	13.6	26.2	30.4
SD or %	-	-	-	2.0	3.0	8.8	8.0	12.0	14.9	10.2
Skewness	-	-	-	2.8	0.3	-0.08	0.6	1.3	-1.2	-0.2
Kurtosis	-	-	-	11.9	-0.3	-0.5	-0.08	1.9	1.2	-0.4

Note: Pearson point-biserial correlational analyses, *p<0.05.

Table 5.3. Partial correlations of weight status with the total eating disorder symptoms score, controlling for sex, race, ethnicity.

Variable	r	p-value
Body mass index	0.392	<0.001
Waist circumference	0.358	<0.001
Percent body fat	0.345	<0.001

Note: A partial correlation was run to determine the relationship between an individual's total eating disorder symptoms score and weight status variables while controlling for sex, race, and ethnicity.

There were also significant differences on all study variables by race (Table 5.4). There were significant differences in BMI by ethnicity, with individuals identifying as Hispanic having a significantly higher measured BMI compared to individuals identifying as non-Hispanic (26.4 vs. 24.5 kg/m^2, p=0.014). There were significant differences in total eating disorder symptoms scores only between MS3 and MS4 cadets, with MS3 cadets having a significantly higher total eating disorder symptoms score compared to MS4 cadets (16.9 vs. 8.6, p=0.016). There were also significant differences between study variables by BMI classification. Individuals classified as having an obese BMI ($\geq$ 30.0 kg/m^2) had significantly higher eating disorder symptoms (39.6 vs. 15.9, 10.3, and 9.0, p<0.001), significantly higher BMI (31.1 vs. 26.9, 22.6, and 18.0 kg/m^2, p<0.001), significantly higher psychological inflexibility related to body dissatisfaction score (40.6 vs. 23.2, p=0.001), and significantly higher psychological inflexibility related to dieting score (41.6 vs. 32.8 and 27.6, p<0.001). Similarly, individuals classified as meeting the eating disorder risk cut-off score $\geq$ 16.5 had significantly higher total eating disorder symptoms scores (39.5 vs. 11.2, p<0.001), significantly higher BMI (27.0 vs. 24.4 kg/m^2, p=0.001), significantly higher psychological inflexibility related to body dissatisfaction score (50.9 vs. 23.7, p<0.001), and significantly higher psychological inflexibility related to dieting scores (39.8 vs. 29.5, p<0.001) (Table 5.4).

Table 5.4. Study means by demographic covariates.

Characteristic	EDDS Mean (SD)	p-value	BMI Mean (SD)	p-value	BI-AAQ Mean (SD)	p-value	IEQ Mean (SD)	p-value
Sex		**0.006***		**0.038***		**0.006***		0.697
Male	12.1 (11.8)		24.9 (2.9)		24.5 (13.8)		30.2 (10.1)	
Female	17.71 (11.8)		24.0 (3.2)		30.8 (16.6)		30.8 (10.5)	
Race		**0.001****		**0.002****		**0.001****		**0.004****
White/Caucasian	12.9 (11.7)[b]		24.5 (2.9)[b]		25.0 (14.0)[b]		30.1 (9.7)	
Black/African American	11.7 (11.5)		25.8 (3.4)		28.6 (14.9)		25.5 (10.9)[b]	
Native American/Alaskan Native	34.5 (2.1)[a]		32.0 (0.9)[a]		55.0 (17.0)[a]		47.0 (2.8)[a]	
Asian	25.1 (13.0)		24.1 (3.2)[b]		39.8 (15.6)[a]		35.9 (12.5)	
Biracial-White/Asian	6.5 (2.1)		20.9 (1.3)[b]		18.0 (1.4)		29.0 (14.1)	
Biracial-White/Black	21.3 (10.2)		26.0 (2.4)		40.0 (29.0)		44.0 (5.6)[a]	
Ethnicity		0.220		**0.014***		0.754		0.456
Non-Hispanic	13.3 (12.1)		24.5 (2.9)		26.3 (14.8)		30.3 (10.2)	
Hispanic	17.2 (11.3)		26.4 (3.6)		27.5 (16.3)		32.2 (10.6)	
ROTC Year		**0.016****		0.219		0.338		0.855
MS1	14.8 (13.3)		24.6 (3.3)		27.6 (16.1)		29.8 (10.8)	
MS2	11.9 (8.9)		24.2 (2.6)		25.7 (12.2)		30.8 (9.5)	
MS3	16.9 (13.2)[a]		24.4 (2.9)		28.0 (17.0)		31.4 (10.8)	
MS4	8.6 (8.3)[b]		25.6 (2.7)		22.2 (11.7)		30.2 (8.7)	
BMI		**0.001****		**0.001****		**0.001****		**0.001****
Underweight, <18.5 kg/m^2	9.0 (1.4)		18.0 (0.6)[d]		40.5 (9.2)		36.0 (16.7)	
Normal wt, 18.5-24.9 kg/m^2	10.3 (9.4)[c]		22.6 (1.5)[c]		23.2 (12.3)[a]		27.6 (9.7)[b]	
Overweight, 25.0 -29.9 kg/m^2	15.9 (13.2)[b]		26.9 (1.4)[b]		28.2 (16.5)		32.8 (9.8)[a]	
Obesity, ≥ 30.0 kg/m^2	39.6 (6.7)[a]		31.1 (0.9)[a]		40.6 (15.0)[b]		41.6 (8.1)[a]	
Meet EDDS Risk Cut-Off		**<0.001***		**0.001***		**<0.001***		**<0.001***
Not at risk (EDDS <16.5)	11.2 (8.7)		24.4 (2.8)		23.7 (11.9)		29.5 (9.8)	
At risk (EDDS ≥ 16.5)	39.5 (9.5)		27.0 (3.8)		50.9 (16.7)		39.8 (8.5)	

Note: EDDS=total eating disorder symptoms score; BMI=body mass index; BI-AAQ=psychological inflexibility related to body dissatisfaction; IEQ=psychological inflexibility related to dieting; MS=Military Science; *p<0.05, t-test; **p<0.05, 1-way ANOVA.

Results for mediational analysis for Model 1 are presented in Table 5.6. First, we hypothesized that there was a direct effect of the total eating disorder symptoms score on weight status and an indirect effect mediated through psychological inflexibility related to body dissatisfaction. The indices of overall model fit indicated very good fit ($\chi 2(4) = 6.27$, p=0.18; CFI=0.99; TLI=0.99; RMSEA=0.05; SRMR=0.04 (Table 5.5, Model 1)). Higher total eating disorder symptom scores significantly predicted a higher weight status (*B*=0.13, *p*<0.001).

Table 5.5. Fit indices for two path analysis models and their reverse models.

Model	**χ2**	**df**	***p***	**CFI**	**TLI**	**RMSEA**	**SRMR**	**BIC**
1. Path analysis: EDDS → BIAAQ → BMI	6.27	4	0.18	0.99	0.98	0.05	0.04	5546
1a. Path analysis (Reverse): BMI→BIAAQ→EDDS	19.93	4	<0.01	0.84	0.88	0.14	0.08	5560
2. Path analysis: EDDS → IEQ → BMI	2.13	1	0.14	0.99	0.92	0.07	0.02	4406
2a. Path analysis (Reverse): BMI→BIAAQ→EDDS	1.25	1	0.26	0.99	0.98	0.03	0.02	4405

Note: df=degrees of freedom; CFI=Comparative Fit Index; TLI=Tucker Lewis Index; RMSEA=Root Mean Square Error of Approximation; SRMR= Standardized Root Mean Square Residual; BIC=Bayesian Information Criteria; EDDS=Eating Disorder Diagnosis Scale, total eating disorder symptoms score; BI-AAQ=Body Image-Action and Acceptance Questionnaire, psychological inflexibility related to body dissatisfaction; IEQ=Inflexible Eating Questionnaire, psychological inflexibility related to dieting; BMI=body mass index, weight status.

Higher total eating disorder symptoms scores also significantly predicted higher psychological inflexibility related to body dissatisfaction (*B*=0.96, *p*<0.001). In turn, higher psychological inflexibility related to body dissatisfaction predicted a lower weight status (*B*=-0.06, *p*<0.019). Additionally, this association was moderated by sex, such that sex was negatively associated with weight status (*B*=-1.76, *p*<0.0.001), and therefore the interaction between psychological

Table 5.6. Parameter estimates for EDDS (Total eating disorder symptoms score) → BIAAQ (Psychological inflexibility related to body dissatisfaction → BMI (weight status).

Parameter	Variables	Unstandardized Estimate (SE)	Standardized Estimate (SE)	95% Confidence Interval	p-value
Coeff.	BI-AAQ → Race/Ethn	1.87 (1.67)	0.05 (0.05)	[-1.491, 5.128]	0.263
	BI-AAQ → EDDS	0.96 (0.06)	0.76 (0.04)	[0.828, 1.072]	<0.001
	BMI → Race/Ethn	1.04 (0.51)	0.14 (0.07)	[-0.007, 2.007]	0.04
	BMI → Sex	-1.76 (0.42)	-0.27 (0.06)	[-2.571, -0.950]	<0.001
	BMI → BI-AAQ	-0.06 (0.03)	-0.30 (0.13)	[-0.12, -0.008]	0.019
	BMI → BIAAQ X Sex	0.09 (0.03)	0.27 (0.09)	[0.031, 0.143]	0.002
	BMI → EDDS	0.13 (0.03)	0.51 (0.11)	[0.068, 0.193]	<0.001
	BI-AAQ ↔ BI-AAQ X Sex	41.09 (9.03)	0.46 (0.06)	-	<0.001
	Sex ↔ BI-AAQ X Sex	0.89 (0.39)	-0.20 (0.08)	-	0.010
	EDDS ↔ Sex	1.26 (0.39)	0.23 (0.07)	-	0.001
	EDDS ↔ BI-AAQ X Sex	48.98 (13.4)	0.45 (0.07)	-	<0.001
	EDDS → BI-AAQ (Male) → BMI	-0.06 (0.03)	-	[-0.109, -0.007]	0.022
	EDDS → BI-AAQ (Female) → BMI	0.03 (0.02)	-	[-0.022, 0.074]	0.298
	Total Direct Effect (Male)	0.07 (0.02)	-	[0.031, 0.122]	0.002
	Total Direct Effect (Female)	0.15 (0.03)	-	[0.104, 0.210]	<0.001
Intercepts	BMI	23.07 (0.84)	7.71 (0.43)	-	<0.001
	BI-AAQ	-13.32 (0.47)	-0.90 (0.06)	-	<0.001
Residual Variance	BMI	6.85 (0.64)	0.76 (0.06)	-	<0.001
	BI-AAQ	92.32 (10.23)	0.42 (0.06)	-	<0.001
R-Square	BMI	0.58 (0.06)	-	-	<0.001
	BI-AAQ	0.23 (0.06)	-	-	<0.001

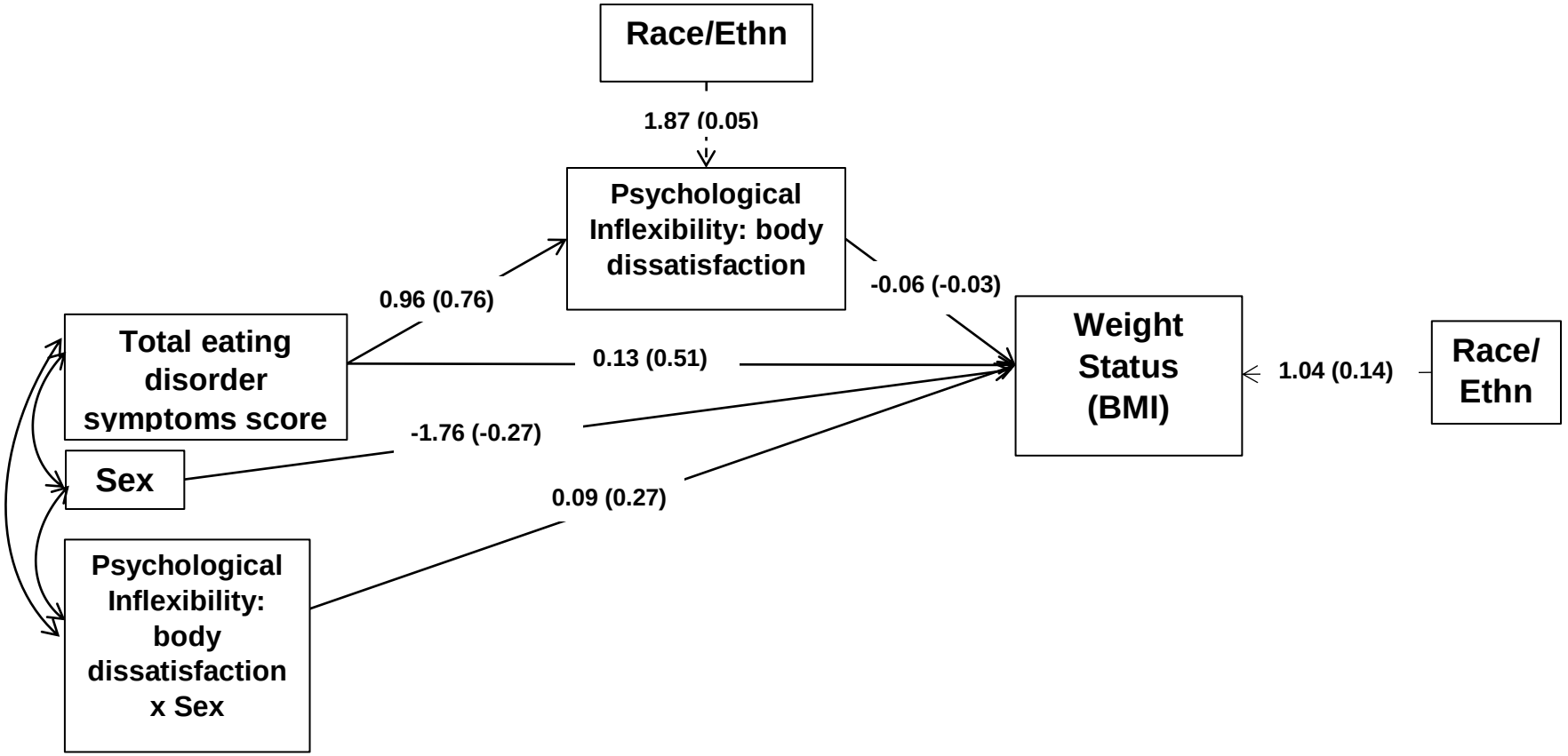


Figure 5.2. Fully specified model displaying the effects of eating disorder symptoms on weight status through psychological inflexibility: body dissatisfaction with race/ethnicity as covariates. Unstandardized and standardized regression coefficients are presented. The standardized regression coefficients can be interpreted as the change in standard deviation units of *Y* for every standard deviation change in *X*. Significant paths are shown with solid arrows. Non-significant paths are shown with dashed arrows. Race/Ethn=Race/Ethnicity combined into a dichotomous variable (White/Caucasian=0, Other=1); BMI=body mass index.

inflexibility related to body dissatisfaction and sex, BI-AAQ x Sex, was positively associated with weight status (*B*=0.09, *p*=0.002). As a result, the overall indirect effects of the total eating disorder symptoms score on weight status through psychological inflexibility related to body dissatisfaction differed by sex. For males, there was a significant negative indirect effect of the total eating disorder symptoms score on weight status through psychological inflexibility related to body dissatisfaction, such that a higher total eating disorder symptoms score predicted a higher psychological inflexibility related to body dissatisfaction score, which in turn predicted lower weight status (*B*=-0.06, 95% CI [-0.109, -0.007], *p*=0.022). However, the indirect effect of the eating disorder symptoms score on weight status through psychological inflexibility related to body dissatisfaction was not significant for females (*B*=0.03, 95% CI [-0.022, 0.074], *p*=0.298). The total direct effects of the total eating disorder symptoms score on weight status were significant for males (*B*=0.07, 95% CI [0.031, 0.122], *p*=0.002) and females (*B*=0.15, 95% CI [0.104, 0.210], *p*=<0.001), such that a higher total eating disorder symptoms score predicted a higher weight status (Table 5.6). Other significant paths are shown in Figure 5.2.

Next, we hypothesized that there was an indirect effect of the total eating disorder symptoms score on weight status mediated through psychological inflexibility related to dieting (Table 5.7). The indices of overall model fit indicated moderate to good fit ($\chi 2(1) = 2.13$, p=0.14; CFI=0.99; TLI=0.92; RMSEA=0.07; SRMR=0.02 (Table 5.5, Model 2)). Higher total eating disorder symptoms score significantly predicted a higher weight status (*B*=0.09, *p*=0.001). Higher total eating disorder symptoms scores also significantly predicted higher psychological inflexibility related to dieting scores (*B*=0.44, *p*<0.001). In turn, higher psychological inflexibility related to dieting scores predicted a higher weight status (*B*=0.05, *p*=0.034). There was a significant positive indirect effect of the total eating disorder symptoms score on weight

status partially mediated through psychological inflexibility related to dieting (*B*=0.02, 95% CI [0.002, 0.042]), such that a total eating disorder symptoms score predicted a higher psychological inflexibility related to dieting score, which in turn predicted a higher weight status. The total direct effects of the total eating disorder symptoms score on weight status were significant (*B*=0.09, 95% CI [0.039, 0.143], *p*<0.001) (Table 5.7). Other significant paths are shown in Figure 5.3.

Table 5.7. Parameter estimates for EDDS (Total eating disorder symptoms score) → IEQ (Psychological inflexibility related to dieting) → BMI (weight status).

Parameter	Variables	Unstandardized Estimate (SE)	Standardized Estimate (SE)	95% Confidence Interval	p-value
Coeff.	IEQ→ Race/Ethn	-0.86 (1.60)	-0.03 (0.06)	[-4.09, 2.205]	0.558
	IEQ → EDDS	0.44 (0.05)	0.51 (0.05)	[0.345, 0.549]	<0.001
	BMI → Sex	-1.54 (0.44)	-0.24 (0.07)	[-2.420, -0.691]	0.001
	BMI → Race/Ethn	0.87 (0.53)	0.12 (0.07)	[-0.193, 1.890]	0.101
	BMI → IEQ	0.05 (0.02)	0.16 (0.08)	[0.005, 0.093]	0.034
	BMI → EDDS	0.09 (0.03)	0.34 (0.09)	[0.039, 0.143]	0.001
	EDDS ↔ Sex	1.23 (0.40)	0.22 (0.07)	-	0.002
	EDDS ↔ Race/Ethn	0.65 (0.36)	0.13 (0.07)	-	0.071
	Sex ↔ Race/Ethn	0.03 (0.01)	0.14 (0.07)	-	0.068
	EDDS → IEQ → BMI	0.02 (0.01)	0.08 (0.04)	[0.002, 0.042]	0.042
	Total Direct Effect	0.09 (0.03)	0.34 (0.09)	[0.039, 0.143]	<0.001
Intercepts	BMI	22.32 (0.59)	7.47 (0.44)	-	<0.001
	IEQ	24.72 (0.99)	2.43 (0.18)	-	0.003
Residual	BMI	6.86 (0.62)	0.77 (0.06)	-	<0.001
Variance	IEQ	76.41 (6.55)	0.74 (0.05)	-	<0.001
R-Square	BMI	0.23 (0.06)	-	-	<0.001
	IEQ	0.26 (0.05)	-	-	<0.001

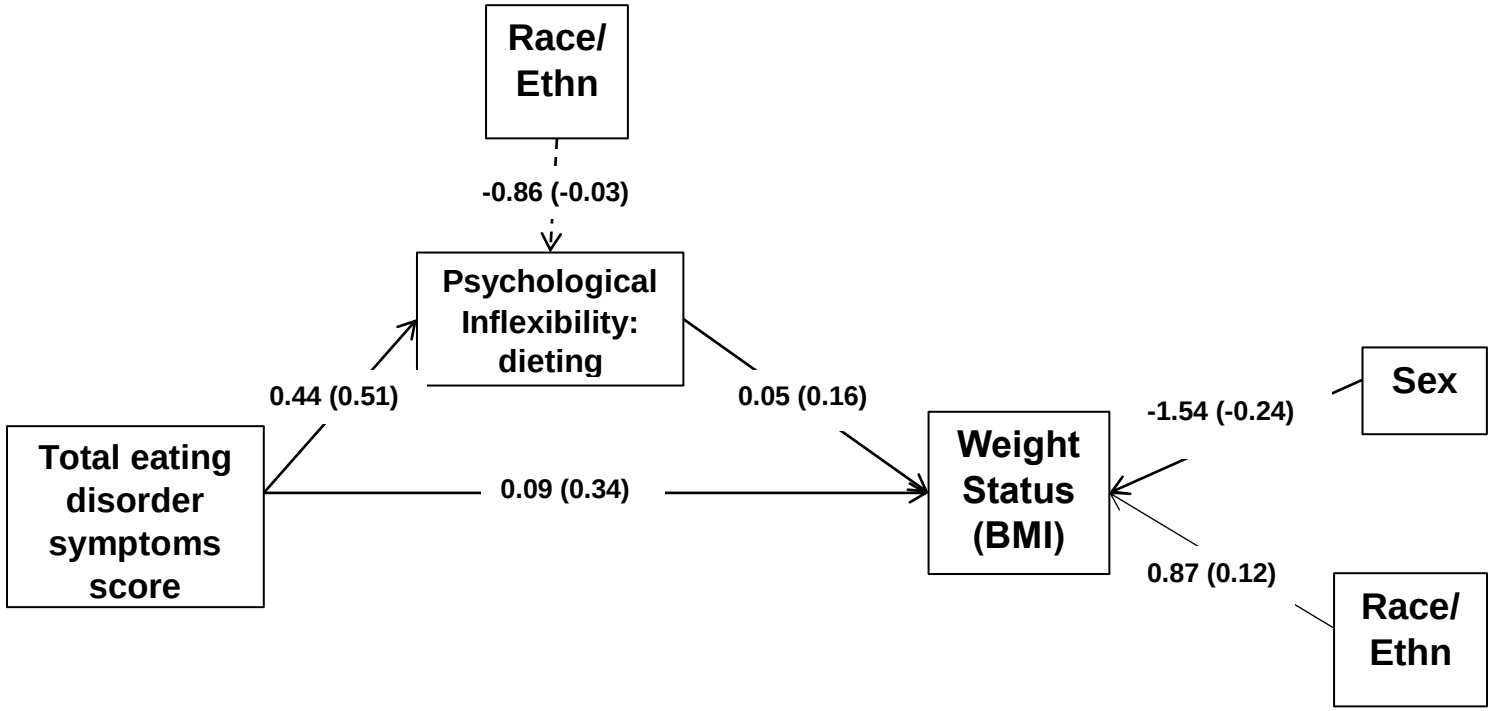


Figure 5.3. Fully specified model displaying the effects of eating disorder symptoms on weight status through psychological inflexibility: dieting with sex and race/ethnicity as covariates. Unstandardized and standardized regression coefficients are presented. The standardized regression coefficients can be interpreted as the change in standard deviation units of *Y* for every standard deviation change in *X*. Significant paths are shown with solid arrows. Non-significant paths are shown with dashed arrows. Race/Ethn=Race/Ethnicity combined into a dichotomous variable (White/Caucasian=0, Other=1); BMI=body mass index (weight status).

In order to provide additional support for the hypothesized models, we also tested models (1a and 2a) in which the predictor, total eating disorder symptoms score, and the outcome, weight status (BMI), were reversed (Kenny, 2014). The indices of overall model fit are shown in Table 5.5 (Model 1a and 2a). In the reversed model, Model 1a, a higher BMI significantly predicted a higher eating disorder symptoms score (B=0.94, p<0.001). A higher BMI also predicted higher psychological inflexibility related to body dissatisfaction (B=1.01, p<0.001). In turn, higher psychological inflexibility related to body dissatisfaction predicted higher eating disorder symptoms scores (B=0.61, p<0.001). Additionally, this association was moderated by sex, such that sex was positively associated with eating disorder symptoms (B=3.55, p=0.003), and therefore the interaction between psychological inflexibility related to body dissatisfaction and sex, BI-AAQ x Sex, was negatively associated with weight status but was not significant (B=-0.17, p=0.06). As a result, the overall indirect effects of BMI on the total eating disorder symptoms score on weight status through psychological inflexibility related to body dissatisfaction differed by sex. Both males and females had a significant, positive indirect effect of BMI on total eating disorders symptoms scores, such that a higher BMI predicted a higher psychological inflexibility related to body dissatisfaction score, which in turn predicted a higher eating disorder symptoms score (males: B=0.62, 95% CI [0.158, 1.136], p=0.014; females: B=0.44, 95% CI [0.108, 0.847], p=0.018). The total direct effects of BMI on eating disorder symptoms score were significant for males (B=1.56, 95% CI [0.987, 2.154], p<0.001) and females (B=1.39, 95% CI [0.922, 1.842], p=<0.001). Despite evidence suggesting significant indirect effects for both males and females, this model evidenced poorer fit than the hypothesized model (Model 1a, Table 5.5) (Merkle et al., 2016). Furthermore, considering grades of evidence proposed by Raftery (1995) for comparison of nonnested models using a

model's Bayesian information criterion (BIC), a difference of >10 between the BIC of Model 1 and Model 1a suggests there is strong evidence for Model 1, the hypothesized model, over Model 1a (Merkle et al., 2016).

In the reverse model, Model 2a, higher BMI significantly predicted a higher total eating disorder symptoms score (B=1.10, p<0.001). A higher BMI also significantly predicted higher psychological inflexibility related to dieting scores (B=1.14, p<0.001). In turn, higher psychological inflexibility related to dieting scores predicted a higher total eating disorder symptoms score (B=0.48, p<0.001). There was a significant positive indirect effect of BMI on the total eating disorder symptoms score on partially mediated through psychological inflexibility related to dieting (B=0.55, 95% CI [0.275, 0.925]), such that a higher BMI predicted a higher psychological inflexibility related to dieting score, which in turn predicted a higher total eating disorder symptoms score. The total direct effects of BMI on the total eating disorder symptoms score were significant (B=1.10, 95% CI [1.170, 2.114], p<0.001). Evidence from this model suggests stronger indirect and total effects, as well as better model fit compared to the hypothesized model (Model 2a, Table 5.5) (Merkle et al., 2016). However, when considering the grades of evidence proposed by Raftery (1995) for comparison of nonnested models using a model's Bayesian information criterion (BIC), a difference of 1 between the BIC of Model 2 and Model 2a suggests there is weak evidence for Model 2a over the hypothesized model, Model 2 (Merkle et al., 2016). Taken together, evidence from reverse models provides support for the hypothesized models, Model 1 and Model 2, as most representative of the data and theory, in ROTC cadets.

E. Discussion

Previous studies of eating disorder symptoms and weight status suggested that increased presence of eating disorder symptoms increased risk of weight gain and obesity onset (Goldschmidt et al., 2016; Goldschmidt et al., 2012; Neumark-Sztainer et al., 2006c; Neumark-Sztainer et al., 2012; Stice et al., 1999; Stice et al., 2005b). Additionally, previous studies suggested that military service members have increased presence of eating disorder symptoms and that eating disorder risk is increased among individuals who engage in unhealthy weight control behaviors, feel they are overweight, and are body dissatisfied (Bodell et al., 2014; Carlton et al., 2005; Garber et al., 2008; Lauder & Campbell, 2001; Lauder et al., 1999; McNulty, 1997a, 1997b, 2001). Evidence from civilian studies also suggested a shared onset pathway for eating disorders and obesity, including important factors like body dissatisfaction, dieting, negative affect, and affect regulation (Neumark-Sztainer et al., 2006c; Neumark-Sztainer et al., 2012; Stice, 1994, 2001; Stice et al., 2011a; Stice et al., 2005b; Stice et al., 1998). Studies on obesity and eating disorder symptoms suggest difficulties with affect regulation, such as psychological inflexibility, may represent a mechanism by which eating disorder symptoms and obesity are linked (Dakanalis et al., 2014; Forman, Butryn, Hoffman, & Herbert, 2009; Forman et al., 2016; Harrison et al., 2016; Lavender & Anderson, 2010; Lillis et al., 2009; Lillis et al., 2011; Lillis et al., 2016; Palmeira, Pinto-Gouveia, & Cunha, 2017; Rohde et al., 2018; Stice, Shaw, Burton, & Wade, 2006). Psychological inflexibility related to body dissatisfaction and dieting represent two constructs of affect regulation related to body dissatisfaction and dieting that may explain the association between eating disorder symptoms and weight status. Therefore, the present study sought to examine if there was a direct effect of eating disorder symptoms on

weight status and if this effect was mediated by psychological inflexibility related to body dissatisfaction and dieting.

Descriptive analysis suggested that BMI was positively associated with the total eating disorder symptoms score, psychological inflexibility related to body dissatisfaction, and psychological inflexibility related to dieting. These findings are consistent with previous studies and conceptual models describing weight status, eating disorder symptoms, and measures of psychological inflexibility (Duarte et al., 2017; Lavender & Anderson, 2010; Masuda et al., 2015; Pinto et al., 2017; Sandoz et al., 2013; Timko et al., 2014). Additionally, psychological inflexibility related to body dissatisfaction was appropriately associated with psychological inflexibility related to dieting. This finding also corroborates previous findings examining psychological inflexibility related to body dissatisfaction and dieting in models of weight status and eating disorder symptoms (Duarte et al., 2017; Ferreira, Trindade, & Martinho, 2016; Pinto et al., 2017). These findings suggest that the study variables are associated in ways consistent with previous studies and conceptual models on weight status, psychological inflexibility related to body dissatisfaction, psychological inflexibility related to dieting, and eating disorder symptoms.

Descriptive analysis also suggested there were differences in the total eating disorder symptoms score based on sex, race, ROTC year group, and weight status. Previous studies have described a higher rate of eating disorder diagnoses amongst females (Hudson et al., 2007a; Striegel-Moore & Bulik, 2007). However, most studies were conducted primarily with females or with larger female samples, while ROTC and military populations are predominantly male. One previous study found that although total eating disorder symptoms scores differed by sex, there was no significant association between sex and meeting eating disorder risk classification

cut-off scores (Aim 1). It may be that although females may endorse higher eating disorder symptoms scores, eating disorder risk classification cut-off scores may be different for males, suggesting the need for continued surveillance, especially in military male populations.

There were also significant differences in study variables by race and ethnicity. However, this may have been due, in part, to the uneven group sizes in racial distribution, which is expected in this ROTC population, where the majority of ROTC cadets identify as white/Caucasian (Tatro, personal communication, December 4, 2018). Indeed, after combining race/ethnicity designations to create more even distribution of group sizes, there were no significant differences in eating disorder symptoms scores ($p=0.110$), BMI ($p=0.050$), psychological inflexibility related to body dissatisfaction ($p=0.066$), and psychological inflexibility related to dieting ($p=0.091$) (Data not shown). Therefore, a dichotomized race/ethnicity variable was used in mediational model analysis to account for these differences in distribution (0= White/Caucasian, non-Hispanic; 1= Other).

As for ROTC year group, there was a significant difference in the total eating disorder symptoms scores between MS3 cadets and MS4 cadets, with MS3 cadets having significantly higher eating disorder symptom scores. This corroborates a previous finding by Beekley et al. in a sample of West Point cadets (Beekley et al., 2009). The authors reported significantly higher rates of meeting eating disorder risk classification cut-off scores during year 3 compared to year 1 and year 4 cadets (Beekley et al., 2009). Although it is not known why cadets present with higher eating disorder symptom scores during year 3, ROTC cadets are required to attend summer training during the summer of year 3 and performance during year 3, including summer training camp, are taken into consideration in determining which cadets will be awarded active

duty commissions (US Army Cadet Command, 2018). However, additional studies, including longitudinal and qualitative studies, are needed to uncover the nature of this phenomenon.

There were also significant differences in weight status based on eating disorder risk classification, with individuals meeting eating disorder risk classification cut-off scores having significantly higher BMI than those not meeting eating disorder risk classification cut-off scores ($p<0.001$). These findings are in agreement with previous studies in military service members, which found that increased weight status was associated with increased eating disorder symptoms (McNulty, 1997a, 1997b, 2001). These findings are also in agreement with previous etiologic models of eating disorder which suggest that a high BMI is associated with increased eating disorder symptoms (Stice, 2002; Stice et al., 1998).

There were also significant differences in psychological inflexibility related to body dissatisfaction based on sex, weight status, and eating disorder risk classification. Females had significantly higher psychological inflexibility related to body dissatisfaction scores, and a higher score signifies that one tends to avoid body image related experiences (Sandoz et al., 2013). This finding is corroborated by previous studies in males and females, which reported significantly higher psychological inflexibility related to body dissatisfaction in females compared to males (Sandoz et al., 2013). Individuals with an obese weight status also had significantly higher psychological inflexibility related to body dissatisfaction compared to individuals with a normal weight and overweight weight status ($p=0.001$). This is in agreement with previous studies that report a positive association between weight status and psychological inflexibility related to body dissatisfaction (Masuda et al., 2015; Moore et al., 2014). Psychological inflexibility related to body dissatisfaction scores were also significantly higher in individuals meeting eating disorder risk classification cut-off scores ($p<0.001$). This is in agreement with previous studies that report

higher psychological inflexibility related to body dissatisfaction in individuals with higher levels of eating disorder symptoms (Masuda et al., 2015; Moore et al., 2014; Timko et al., 2014). It appears that factors associated with eating disorder risk, including sex and weight status, result in significant differences in psychological inflexibility related to body dissatisfaction, suggesting psychological inflexibility related to body dissatisfaction is also likely an indicator of eating disorder risk and weight status in ROTC cadets.

Participants also differed on psychological inflexibility related to dieting scores based on weight status and eating disorder risk classification. Individuals with an obese weight status had significantly higher psychological inflexibility related to dieting scores, signifying that they tend to adhere more rigidly to dieting rules, compared to individuals with an overweight and normal weight status ($p<0.001$). This finding is corroborated by previous studies suggesting a positive association between weight status and psychological inflexibility related to dieting (Duarte et al., 2016; Pinto et al., 2017). Additionally, individuals classified as meeting eating disorder risk classification cut-off scores also had significantly higher psychological inflexibility related to dieting scores compared to individuals not meeting eating disorder risk classification cut-off scores ($p<0.001$). These findings are also corroborated by previous studies identifying a positive association between eating disorder symptoms, eating disorder risk classification, and psychological inflexibility related to dieting (Duarte et al., 2016; Pinto et al., 2017). Similar to psychological inflexibility related to body dissatisfaction, psychological inflexibility related to dieting also appears to be an important indicator of eating disorder risk and weight status in ROTC Cadets.

No previous study has examined the association between different indicators of body composition and weight status, such as BMI, waist circumference, and percentage body fat, with

total eating disorder symptoms scores. In the present study, BMI was most strongly correlated with total eating disorder symptoms scores ($p<0.05$). Although previous studies in military service members have suggested that BMI has limited utility in assessing physical readiness and body composition due to the greater likelihood that military service members carry more of their weight as lean body mass (Friedl, 1997, 2012), the findings in the current study suggest that BMI, as an indicator of weight status, may potentially be used to screen for eating disorder symptoms and risk. Currently, BMI is used as a first-level screen to assess compliance with body composition standards (Department of the Army, 2013; US Department of Defense, 2002). Individuals not meeting age- and sex-specific weight-for-height BMI cut-offs, must then have body fat assessed using body circumference methods (Department of the Army, 2013; US Department of Defense, 2002). Therefore, some individuals who exceed weight-for-height BMI cut-offs may be determined to be compliant with percent body fat standards, and not receive any further monitoring or guidance until the next semi-annual physical fitness and body composition assessment. However, the findings of this study suggest that individuals exceeding the BMI-screen, which averages 24-25 kg/m^2 for females and 26-27 kg/m^2 for males, may be at increased risk for developing eating disorder symptoms. Therefore, BMI represents a useful metric for tracking and monitoring development of eating disorder symptoms and risk in ROTC cadets.

This study also adds to the literature by examining two mechanisms by which eating disorder symptoms may be associated to weight status, psychological inflexibility related to body dissatisfaction and psychological inflexibility related to dieting. In the first mediation model, the direct and indirect effects of total eating disorder symptoms scores on weight status through psychological inflexibility related to body dissatisfaction were examined. Results suggest that this model explains 58% of the variance in weight status (BMI), with psychological inflexibility

related to body dissatisfaction acting as a mediator between eating disorder symptoms and weight status. Moreover, the path between psychological inflexibility related to body dissatisfaction and weight status was moderated by sex, suggesting that psychological inflexibility related to body dissatisfaction mediated the association between eating disorder symptoms and weight status, but only for males, which found that higher psychological inflexibility related to body dissatisfaction scores predicted a lower weight status. These findings are in contrast to previous studies in which higher psychological inflexibility related to body dissatisfaction predicted a higher weight status (Duarte et al., 2016). While, this effect was observed in the female sample, it failed to reach significance likely due to the smaller female sample.

One reason for the contrasting findings in males may be that males in the current study had psychological inflexibility scores that were lower than those reported in previous samples (M=71.5, SD=13.8 vs. M=67.5, SD=15.9, data not shown), suggesting that males in the current study had lower psychological inflexibility related to body dissatisfaction, or generally, a more positive body image. Males in the current study also had a higher weight status than in previous studies (M=24.9 kg/m^2, SD=2.7 vs. M=23.8 kg/m^2, SD=5.2) (Masuda et al., 2015). Another reason for the discrepant findings that higher eating disorder symptoms predicted higher psychological inflexibility related to body dissatisfaction, or more rigid thoughts and beliefs about the body, which in turn predicted a lower weight status, may be that males with higher eating disorder symptoms and higher psychological inflexibility related to body dissatisfaction were more successful in maintaining a lower weight status due to their eating disorder symptoms. Or, in turn, males with lower psychological inflexibility related to body dissatisfaction, or a more positive body image, may desire to achieve a higher weight status by

increasing muscle. One previous study examined muscle dysmorphia in a sample of military service members and reported a rate of 12.6% positive screens for muscle dysmorphia for military males (Campagna & Bowsher, 2016), suggesting muscularity may be an issue of concern to military service members, especially males. However, the current study did not include specific measures of male body dissatisfaction, such as drive for thinness or drive for muscularity. These findings suggest that psychological inflexibility related to body dissatisfaction remains an important, yet underexplored factor in understanding the association between eating disorder symptoms and weight status in ROTC cadets.

This study also examined the direct and indirect effects of eating disorder symptoms on weight status through psychological inflexibility related to dieting. Results from this model suggested that 23% of the variance in weight status (BMI) was explained, with psychological inflexibility related to dieting mediating the association between eating disorder symptoms and weight status. The results suggested that higher eating disorder symptoms scores predicted higher psychological inflexibility related to dieting scores, which in turn predicted a higher weight status. While no study has examined the path between psychological inflexibility related to dieting and increased weight status, two studies reported a significant positive association between weight status, psychological inflexibility related to dieting, and eating disorder symptoms (Duarte et al., 2016; Pinto et al., 2017). The findings in the current study compared to the extant literature may be explained by the fact that most studies examining psychological inflexibility related to dieting in association with eating disorder symptoms use weight status as a control variable, rather than a an outcome or consequence of eating disorder symptoms or psychological inflexibility related to dieting (Stice, 2001, 2002; Stice et al., 1998). These results also add to the literature on psychological inflexibility related to dieting, which has been

conducted primarily in females (Duarte et al., 2017; Duarte et al., 2016; Ferreira et al., 2016; Pinto et al., 2017; Trindade & Ferreira, 2015). In comparison to findings from previous studies, participants in the current study reported higher psychological inflexibility related to dieting scores (M=30.4, SD=10.2 vs. M=27.3, SD=9.7), despite comprising a majority male sample (Ferreira et al., 2016; Trindade & Ferreira, 2015). These findings suggest that psychological inflexibility related to dieting remains an important factor in understanding eating disorder symptoms and weight status in both male and female ROTC cadets.

Overall, the present findings support the concept of potential shared pathways between eating disorder symptoms and obesity (Haines & Neumark-Sztainer, 2006), as well as findings from prospective studies suggesting eating disorder symptoms, including dieting and body dissatisfaction, increase risk for weight gain and obesity onset (Neumark-Sztainer et al., 2012; Stice et al., 2005b). Furthermore, this study supports acceptance and commitment therapy-based frameworks of obesity onset and eating disorders that suggest a role for affect regulation difficulties, mainly psychological inflexibility, as underlying mechanisms by which eating disorder symptoms result in problems with weight status (Dakanalis et al., 2014; Harrison et al., 2016; Hayes et al., 2006; Hayes et al., 1996; Lavender & Anderson, 2010; Whiteside et al., 2007). The current study also adds to the literature on specific measures of psychological inflexibility, psychological inflexibility related to body dissatisfaction and dieting, by providing evidence that psychological inflexibility related to body dissatisfaction and dieting provide a useful framework for understanding the association between eating disorder symptoms and weight status in male and female ROTC cadets (Duarte et al., 2017; Duarte et al., 2016; Duarte & Pinto-Gouveia, 2016; Masuda et al., 2015; Moore et al., 2014; Pinto et al., 2017; Rodgers, Berry, & Franko, 2018; Sandoz et al., 2013; Timko et al., 2014; Trindade & Ferreira, 2015). To

our knowledge, this is the first study to examine psychological inflexibility related to body dissatisfaction and dieting in military-related samples.

While this study had many important findings, it was not without limitations. First, the cross-sectional nature of the study limits drawing causal conclusions. Next, the use of a convenience sample from Army ROTC programs at two Michigan universities limits the generalizability of the findings to other ROTC cadets and military-related populations. Also, the use of self-report measures, in particular, measures of eating disorder symptom behaviors and psychological inflexibility related to body dissatisfaction and dieting, may introduce bias from nonresponse or other response bias due to the sensitive nature of the study. Another limitation is the limited number of variables included in the model. Although there are many shared risk factors between eating disorder symptoms and weight status, this study only focused on psychological inflexibility related to body dissatisfaction and dieting. Finally, there are very few studies that have examined weight status outcomes as a result of reduction in eating disorder symptoms through interventions that target psychological inflexibility, dieting, or body dissatisfaction (Lillis et al., 2009; Lillis et al., 2011; Lillis et al., 2016; Palmeira et al., 2017; Pearson, Follette, & Hayes, 2012; Rohde et al., 2018), although evidence is promising that psychological inflexibility related to body dissatisfaction and dieting represent important targets for future interventions.

Future studies should include larger, randomized samples of Army ROTC programs, with longitudinal data collection to allow the determination of how eating disorder symptoms and obesity develop amongst ROTC cadets. Additionally, studies should include clinical interviews and observational methods to corroborate the findings of self-report measures. Future studies should also include qualitative methods to determine, from the perspective of ROTC cadets,

important factors that contribute to eating behaviors, eating disorder symptoms, weight gain, and obesity onset. Finally, future studies should examine the role of psychological inflexibility related to body dissatisfaction and dieting using an experimental design, such as interventions that examine eating disorder symptoms and weight status, while targeting psychological inflexibility related to body dissatisfaction and dieting.

F. Conclusion

The current study offers important insights for research on eating disorder symptoms, weight status, and psychological inflexibility related to body dissatisfaction and dieting. The findings in this study support the direct effect of eating disorder symptoms on weight status, and also explore the roles psychological inflexibility related to body dissatisfaction and dieting in mediating this association. These findings have important implications for military-related populations, including ROTC cadets. They emphasize the important role of affect regulation, primarily psychological inflexibility related to body dissatisfaction and dieting, may play in the relation between eating disorder symptoms and weight status. The findings also support the importance of continuing to examine factors related body dissatisfaction, dieting, and affect regulation in order to understand the nature of eating disorder symptoms, weight gain, and shared risk factors between eating disorders and obesity within military-related populations. Given that military-related populations will continue to be exposed to factors that may increase dieting and body dissatisfaction, such as enforcement of semi-annual physical fitness standards and enrollment in mandatory weight management programs, it may be beneficial to develop monitoring, prevention, and treatment programs that also include facets of affect regulation, such as psychological inflexibility related to body dissatisfaction and dieting, in order to mitigate risks related to development of eating disorder symptoms and weight gain and obesity onset. Thus,

future studies should continue to examine the nature and role of these outcomes, in order to simultaneously prevent and treat eating disorder symptoms and obesity, as well as to enhance health, physical fitness, and operational readiness amongst military-related populations.

CHAPTER 6 – Dieting and body image concerns in US Army ROTC cadets in a Midwestern university: a qualitative investigation

A. Abstract

Objective: Military standards of readiness, including physical fitness and body composition, are enacted to ensure physical fitness, health, and operational readiness in military populations. Yet, some evidence suggests military-related populations experience high rates of eating- and weight-related problems, such as eating disorders and obesity. Studies in military service members even suggest that enforcement of military physical fitness and body composition standards may be associated with dieting, body dissatisfaction, and adoption of unhealthy weight control behaviors, all which are risk factors for eating disorders and obesity. However, it is not known how or why these factors may be associated with increases in dieting and body dissatisfaction in military populations. US Army ROTC cadets represent a military-related population that is exposed to these risk factors, and that will also eventually serve as leaders and enforcers of these policies. Qualitative methods may help elucidate the eating behaviors of ROTC cadets, how these are shaped, and potentially reveal factors related to dieting and body dissatisfaction, including factors of the military context such as the ROTC environment and the enforcement of physical fitness and body composition standards. In order to address gaps regarding experiences related to eating behaviors and body image within the ROTC context, the purpose of this qualitative study was to use in-depth responsive telephone interviews to describe the eating behaviors and mediators of eating behaviors from the perspective of ROTC cadets; specifically, to discover their perceptions of their own eating behaviors; to learn about how and why they go about their eating behaviors from their own perspective; to understand the role of the ROTC context in shaping and influencing their eating behaviors; to understand how

ROTC cadets describe their preparation to meet physical fitness and body composition standards in terms of their eating behaviors; and to describe and understand their perceptions and experiences related to body image within the context of ROTC.

Methods: Participants were drawn from a larger sample of US Army ROTC cadets recruited to complete a quantitative study on eating behaviors and mediators of eating behaviors in US Army ROTC cadets. Purposive sampling considering sex, ROTC year group, and performance on physical fitness and body composition assessments was used to select information-rich, extreme, and negative cases. Eighteen US Army ROTC cadets consented to participate in the study. Data collection consisted of in-depth, semi-structured phone interviews. Interviews were recorded for accuracy. Interview recordings were transcribed verbatim using oTrancribe. Interviews were coded and analyzed using thematic coding with codes selected based on the main research questions. Interviews were coded and extracted using NVivo 12.

Results: Of the 18 ROTC cadets recruited for the study, there were: three MS1 (Military Science Year 1) males, two MS1 females; two MS2 females, three MS3 males; three MS3 females, one MS3 male; and two MS4 females, two MS4 males. Overall, participants did not differ from the larger sample on weight status and eating disorder symptoms. Cadets described their usual eating behaviors, including their usual meals, their perceptions of healthy and unhealthy foods. Cadets described selecting healthy or unhealthy food choices based on many factors, including the cost and access of the food, as well as how they perceived the foods made them feel or perform. Cadets discussed various perceived determinants for eating behaviors, such as food access and availability, feelings related to eating behaviors, knowledge about eating behaviors, time and money. One of the most salient influences on cadets' eating behaviors was the ROTC context, which included general aspects of ROTC, physical fitness training, the

program cadre, and other ROTC cadets. Preparing for physical fitness and body composition assessments emerged as an important influence on eating behaviors for some cadets, leading some cadets to adopt more regulated, and at times unhealthy, weight control behaviors in order to meet physical fitness and body composition standards. Cadets also described their experience and perception of body image within the ROTC context. While most cadets generally communicated neutral or positive experiences related to body image, some cadets, in particular cadets that struggled with meeting body composition standards, reflected negative aspects of body image, such as weight concern and body dissatisfaction.

Conclusions: Overall, the findings suggest that in addition to traditional determinants of eating behaviors, such as food accessibility, time, and money, the ROTC context emerged as an important and unique determinant of eating behaviors in ROTC cadets. Two particular aspects of the ROTC context, including preparation for physical fitness and body composition assessments, as well as body image perception within the ROTC context, emerged as factors that could potentially contribute to detrimental eating behaviors, including dieting, unhealthy weight control behaviors, and body dissatisfaction. Understanding the eating behaviors and determinants of those eating behaviors in ROTC cadets is complex and challenging in particular because of their intersection as both college students and military members in training. A better understanding of the unique perspectives and challenges experienced by ROTC cadets will assist nutrition educators, program staff, and policy makers in developing and implementing more effective and comprehensive nutrition programs that address the unique needs of ROTC cadets without further increasing risk for the development of eating disorder symptoms and obesity.

B. Introduction

The Department of Defense (DoD) is an executive branch department of the United States (US) federal government. The DoD is charged with coordinating and supervising the functions of the government concerned directly with national security and the US Armed Forces, which includes the Department of the Army, the Department of the Navy, and the Department of the Air Force (US Department of Defense, 2017). The DoD ensures physical readiness and national security by enacting policies adopted by the Armed Forces. One specific policy, the DoD Physical Fitness and Body Fat Programs Procedures, instructs the Armed Forces on policies related to physical fitness and readiness (US Department of Defense, 2002). Specifically, the policy states that:

> "Service members shall maintain physical readiness through appropriate nutrition, health, and fitness habits. Aerobic capacity, muscular strength, muscular endurance, and desirable body fat composition, form the basis for the DoD Physical Fitness and Body Fat Programs." (US Department of Defense, 2002)

The Army uses the guidance described above to select and retain service members. Specifically, the Army uses body composition and physical fitness standards, assuming these are indicative of physical performance, military appearance, and chronic health disease risk (Friedl, 2012).

Initially, these standards consisted of weight-for-height tables intended to identify potential recruits that were underweight, malnourished, and at greater risk for infectious diseases prevalent at the time (Johnson, 1997). As the Army became professionalized, and service members started serving in the military for their entire career, health concerns transitioned towards obesity and development of chronic disease. In the 1980s, the first Army Weight Control Regulation was published, which required assessment of body composition to determine fitness

for service (Johnson, 1997). Along with the weight control regulation, there is also a regulation that mandates regular physical activity and semi-annual assessment of muscular strength (2 minutes of push-ups), muscular endurance (2 minutes of sit-ups), and cardiorespiratory endurance (2-mile run) (Department of the Army, 2012).

Today, the current regulation, Army Regulation 600-9, The Army Body Composition Program, published in 2013, states that:

> "Soldiers must maintain a high level of physical readiness in order to meet mission requirements. Body composition is one indicator of physical readiness that is associated with an individual's fitness, endurance, and overall health." (Department of the Army, 2013)

In addition, the stated objectives of the program are to ensure that "soldiers achieve and maintain optimal well-being and performance under all conditions" and to "assist in establishing and maintaining: operational readiness, physical fitness, health, and a professional military appearance" (Department of the Army, 2013).

The previous edition of the regulation, published in 2006, stated that the objectives of the program were to ensure "all personnel are able to meet physical demands of their duties and present a trim military appearance" and also stated that, "excessive body fat connotes a lack of personal discipline, distracts from military appearance, and may indicate a poor state of health, physical fitness, or stamina" (Department of the Army, 2006). The previous and the current regulations mandate semi-annual assessment of body composition through a two-step process (Department of the Army, 2013). The first step in the process is comparing a soldier's weight-for-height by sex and age against a weight-for-height screening table (Department of the Army, 2013). Soldiers who meet screening table weights are assumed to be compliant with the body

composition standards (Department of the Army, 2013). Soldiers exceeding screening table weights must have percent body fat (BF%) determined using body circumference measurements of the neck and abdomen (and hips for females) (Department of the Army, 2013). Soldiers exceeding sex- and age-specific percent body fat standards are subject to additional medical testing, enrollment into the Army Body Composition Program, which requires nutrition education and monthly body composition assessment. Soldiers are also subject to a suspension of favorable actions, that bars individuals from promotion, reenlistment, and attendance to military professional education programs (Department of the Army, 2013).

Even with mandatory physical fitness training and assessment programs, the rates of overweight and obesity experienced by the military services continues to grow. In 2015, using data from population-wide health-related behavior surveys conducted from 1995-2008, Reyes-Guzman et al. reported an increase in the prevalence of overweight and obesity from 50.6% in 1995 to 60.8% in 2008 (Reyes-Guzman et al., 2015). The authors attributed the increase in overall prevalence due to a rise in obesity rates, which more than doubled from 5% in 1995 to 12.7% in 2008 (Reyes-Guzman et al., 2015). Equally concerning are the medical and non-medical the costs associated with the growing burden of obesity in the military. In 2006, one study determined that the Military Health System spent over $1.1 billion in costs related to excess weight and obesity (Dall et al., 2007). Furthermore, the cost of training a soldier is estimated to be ~$70,000, and the Army discharged 24,000 Soldiers between 1999 and 2006 for failure to meet body composition standards (Naghii, 2006). Overweight and obesity burdens the military and nation in a manner that may affect operational readiness and potentially national security.

Similar concerns are raised for trends observed in eating disorder diagnoses and self-report eating disorder risk classification rates amongst military service members. Recently, a systematic review by Bodell et al. reported on studies of eating disorder diagnoses and self-report eating disorder risk classification rates amongst studies conducted with active duty military populations, reserve officer training corps (ROTC) and US Military Academy cadets, college students, and college athletes (Bodell et al., 2014). The authors reported that when eating disorder diagnoses were used to determine rates of eating disorders, these were similar across the varying populations, ranging 0.1-5% in active duty and ROTC/military academy cadets, compared to 0-5% in college students and college athletes (Antczak & Brininger, 2008; Beekley et al., 2009; Bodell et al., 2014; Forney & Ward, 2013; Hudson et al., 2007a; Johnson et al., 1999; Lauder & Campbell, 2001). This finding may have resulted from the fact that diagnoses with an eating disorder may be grounds for medical discharge, potentially resulting in underreporting of eating disorders (Department of the Army, 2016). Self-reported eating disorder risk classification rates are attained from self-report questionnaires conducted in an anonymous or confidential manner. Study results indicate different trends of eating disorder risk classification rates within these populations, ranging 2-7% in active duty and ROTC/military academy males and 20-33% in active duty and ROTC/military academy females compared to 8.5-9.5% and 16-25% in college males and females, respectively, providing support to the notion that eating disorders tend to be underreported amongst military populations. (Beekley et al., 2009; Bodell et al., 2014; Forney & Ward, 2013; Hudson et al., 2007b; Johnson et al., 1999; Lauder & Campbell, 2001; Lauder et al., 1999; Warner et al., 2007). The evidence suggests that there is a similarly high prevalence of eating disorders and eating disorder symptoms amongst military-related populations, as there is high prevalence of obesity. However, studies in military

populations have not examined if there is an association between eating disorders/eating disorder symptoms and obesity.

Although eating disorders/eating disorder symptoms and obesity are often thought as separate, and potentially contradictory conditions, some reasons to consider the shared association between obesity and eating disorders/eating disorder symptoms are that they tend to co-occur (Flament et al., 2015; Neumark-Sztainer et al., 2002), there is crossover between these conditions (Fairburn et al., 1998; Lebow et al., 2015; Neumark-Sztainer et al., 2006c), they have shared risk factors (Haines et al., 2010; Loth et al., 2015; Neumark-Sztainer et al., 2007; Stice et al., 2005b) and both are difficult to treat (Agras, 2001; Balantekin et al., 2017; Pi-Sunyer, 2002). Cross-sectional and longitudinal studies in adolescents indicate that overweight and obese youth are more likely to engage in binge eating and unhealthy weight control behaviors such as vomiting, or taking diet pills, diuretics, or laxatives, compared to non-overweight adolescents (Neumark-Sztainer et al., 2002), and also have higher rates of meeting binge and purge eating disorder criteria (Flament et al., 2015). Additionally, studies have shown that 30-40% of individuals with eating disorders were overweight as children (Fairburn et al., 1998; Lebow et al., 2015), and that dieting and unhealthy weight control behaviors resulted in greater weight gain over time (Neumark-Sztainer et al., 2006b). Longitudinal studies have identified dieting, unhealthy weight control behaviors, and body dissatisfaction as risk factors for both obesity and eating disorders/eating disorder symptoms (Loth et al., 2014; Quick et al., 2013; Stice et al., 2008; Stice et al., 2005b). Finally, the presence of eating disorders/eating disorder symptoms can make obesity more difficult to treat (Balantekin et al., 2017). Given that obesity and eating disorders/eating disorder symptoms share many features and similar pathways to onset, there is a need to concurrently examine these conditions to identify shared risk factors and mechanisms, in

order to develop interventions that simultaneously address both conditions (Goldschmidt et al., 2016; Haines & Neumark-Sztainer, 2006).

While prospective studies suggest similar paths to eating disorders and obesity, including dieting, unhealthy weight control behaviors, and body dissatisfaction, most studies have not examined their shared association and whether eating disorder symptoms might contribute to the development of obesity (Loth et al., 2014; Quick et al., 2013; Stice et al., 2008; Stice et al., 2005b). Additionally, most studies reporting on the role of these risk factors have only examined these risk factors in univariate models and not how these various risk factors might interact to produce eating disorder symptoms and obesity (Culbert et al., 2015; Jacobi et al., 2004; Stice, 2002). The Dual Pathway Model of bulimic behaviors (binge eating and purging) is one multivariate etiologic model first proposed by Stice as a way to describe how sociocultural pressures resulted in the development of eating disorder symptoms (bulimic behaviors) (Stice, 1994). Stice proposed that sociocultural pressures result in the transmission and adoption of body image ideals (internalization of the body image ideal) (Cash, 2011; Stice, 1994). Internalization of the body image ideal then interacts with a person's actual body image. In the current society, most emphasis on body image is placed on weight and shape. The resulting interaction between the person's body image ideal and actual body image result in the development of body dissatisfaction when these are discrepant, such as when one has a high BMI or a higher weight status than desired (Cash, 2011; Stice, 1994).

Body dissatisfaction, in turn, predicts eating disorder symptoms through two mediating pathways, a dieting pathway and a negative affect pathway (Stice, 1994). Purportedly, dieting is adopted because of the belief that it is an effective way to change weight and shape to conform to a body image ideal (Stice, 1994). Meta-analytic evidence suggests that increased body

dissatisfaction is associated with increased onset of eating disorder symptoms, which is mediated by increases in dieting and negative affect (Stice, 2002; Stice & Shaw, 2002), with body dissatisfaction also associated with dieting, including unhealthy weight control behaviors, and eating disorder symptoms in young adults (Shagar et al., 2017). Evidence suggests individuals with obesity have higher levels of body dissatisfaction, with one study reporting that individuals with obesity with higher negative affect, also had higher body dissatisfaction, which in turn predicted more frequent binge eating (Jansen et al., 2008; Weinberger et al., 2017). These findings suggest that body dissatisfaction predicts higher levels of dieting, unhealthy weight control behaviors, and eating disorder symptoms.

Dieting, in turn, is proposed to result in eating disorder symptoms and weight gain. Restraint Theory posits that dieting results in binge eating due to physiological and cognitive mechanisms (Polivy & Herman, 1985). Dieting may result in physiological changes, such as increasing the salience of food cues and the reward value of food, leading to increased cravings, as well as adoption of a cognitive regulated eating style susceptible to disruption, leading to disinhibition and binge eating (Polivy & Herman, 1985). Data from prospective studies supports the role of dieting in predicting increases in negative affect and onset of eating disorder symptoms (Goldschmidt et al., 2012; Neumark-Sztainer et al., 2006c; Neumark-Sztainer et al., 2011; Stice, 2001; Stice et al., 2002), as well as weight gain and obesity onset (Drapeau et al., 2003; Goldschmidt et al., 2016; Goldschmidt et al., 2012; Neumark-Sztainer et al., 2006c; Neumark-Sztainer et al., 2012; Stice et al., 1999; Stice et al., 2005b), with negative affect also mediating this association (Goldschmidt et al., 2016). One meta analyses of 25 prospective studies on dieting and dietary restraint reported that while neither of these measures predicted weight loss, 75% of the studies reporting on dieting predicted weight gain in those endorsing

dieting, suggesting that dieting is not an effective strategy to prevent weight gain in an obesogenic environment (Lowe et al., 2013). Meta analytic and prospective evidence also supports a path leading from dieting to eating disorder symptoms and weight gain/obesity onset.

One population of young adults that may potentially be at risk for eating disorder symptoms and obesity is US Army Reserve Officer Training Corps (ROTC) cadets. US Army ROTC cadets are college and university students in training to become officers in the U. S. military and are required to adhere to body composition and physical fitness standards (Today's Military, 2017). The requirement to meet military standards may lead to an overemphasis on weight and shape, body dissatisfaction, and use of unhealthy weight control behaviors, in order to meet these standards and retain scholarship benefits, as well as to compete for favorable officer commission opportunities (Bodell et al., 2014; Johnson et al., 2014; US Army Cadet Command, 2018). One study in female US Army ROTC cadets reported on rates of meeting eating disorder risk classification cut-off scores and found that 20% of cadets in the sample (n=310) met the risk score cut-off for eating disorder risk based on a self-report measure of eating disorder symptoms (Eating Disorder Inventory-2) (Lauder & Campbell, 2001). Cadets identified at risk had higher rates of eating disorder symptoms (bingeing, purging, laxative/diet pill/diuretic use), as well as higher rates of body dissatisfaction and dieting (Lauder & Campbell, 2001). However, the association between weight status, as measured by self-reported BMI, and eating disorder symptoms was not reported (Lauder & Campbell, 2001).

Another study in male and female West Point cadets found a similar prevalence of eating disorder risk, with 19% of female cadets in the sample meeting the risk classification cut-off score for eating disorder risk based on a different self-report measure of eating disorder symptoms (Eating Attitudes Test-26). However, this study did not report on body dissatisfaction

or the association between eating disorder symptoms and weight status (Beekley et al., 2009). A more recent study in a large sample of male and female ROTC cadets reported rates of overweight and obesity of 30.1% and 6.2%, respectively. Additionally, 24% of cadets in the sample were dissatisfied to very dissatisfied with their weight, and 14.9% and 11.6% of cadets reported using unhealthy weight control methods consisting of fasting on water or juices or skipping at least one meal to lose weight (Wilson & James, 2018). Studies of eating disorder symptoms in ROTC cadets suggest that high rates of cadets meet at risk classification cut off scores for eating disorder risk.

Although US Army ROTC cadets may not appear to pose a risk for obesity due to their physical fitness and body composition requirements, one study examining longitudinal changes in weight status in ROTC cadets reported a significant increase in body fat throughout the study period, despite a non-significant increase in weight and BMI (Crombie et al., 2012). A mixed methods thesis with qualitative focus groups, reported that struggling to meet body composition standards influenced cadets' eating behaviors and dietary intake (Nevarez, 2017). While ROTC cadets are military officers in training and are expected to meet physical fitness and body composition standards, the pressure to meet these standards may increase their risk for dieting and body dissatisfaction, both of which may then increase risk for weight gain and eating disorder symptoms. Few studies have examined the role of dieting and body dissatisfaction in this population.

ROTC cadets have an important role in the health and readiness of military forces. Given this role, the growing burden of obesity and eating disorders on the military forces, and the complex interplay between the military context and programs to address physical fitness and body composition, studies examining these relationships are warranted. Qualitative research

methods provide a necessary approach to begin to develop an understanding of the scope and meaning of the problem directly from the individuals most affected by the problems and least likely to have a voice to speak out about it. Additionally, qualitative approaches may assist in uncovering previously unidentified risk factors, as well as suggesting questions for future research (Curry et al., 2009).

Only one qualitative thesis has examined eating behaviors in ROTC cadets, while there have also been a limited number of qualitative studies primarily with military veterans (Breland et al., 2018; Breland et al., 2017; Hatzfeld et al., 2016; Jay et al., 2016; Jayne et al., 2019; Nevarez, 2017; Smith et al., 2009). Nevarez reported on the eating behaviors of ROTC cadets, with specific questions about the ROTC context, and found that preparing for body composition assessments and struggles with food cost were important contributors to the dietary habits of Army ROTC cadets at Eastern Illinois University (Nevarez, 2017). Similarly, Smith et al. reported that food insecurity and military service impacted veterans' health and weight status during and after military service, with many veterans reporting a preference for sweets and junk foods, as well as using these foods as an escape to military stress (Smith et al., 2009). Additionally, Breland et al. reported that military environments and stressors, such as trauma and the need to meet military weight requirements, promoted disordered eating habits, with many female veterans reporting a lack of basic skills related to eating behaviors, such as how to shop, cook, and eat as a civilian after leaving the military services (Breland et al., 2018; Breland et al., 2017). Similarly, many female veterans also reported overeating in response to stress and negative affect and delayed adoption of healthful eating because they felt they didn't deserve to eat healthy (Breland et al., 2018). Therefore, an understanding of Army ROTC cadets' eating

behaviors and their motivations for these eating behaviors is necessary to understand the role and impact of the ROTC context as well as weight-related disorders in this population.

In order to address gaps regarding experiences related to eating behaviors and body image within the ROTC context, the purpose of this qualitative study was to use in-depth responsive telephone interviews to describe the eating behaviors and mediators of eating behaviors from the perspective of ROTC cadets; specifically, to discover their perceptions of their own eating behaviors; to learn about how and why they go about their eating behaviors from their own perspective; to understand the role of the ROTC context in shaping and influencing their eating behaviors; to understand how ROTC cadets describe their preparation to meet physical fitness and body composition standards in terms of their eating behaviors; and to describe and understand their perceptions and experiences related to body image within the context of ROTC. This knowledge will help inform future studies to understand, monitor, and examine the eating behaviors of ROTC cadets, specifically problematic eating behaviors such as dieting, body dissatisfaction, and unhealthy weight control behaviors in order to understand and identify how the ROTC context potentially relates to eating disorder symptom and obesity development.

C. Methods

1. Basic Conceptual Framework

The conceptual framework for this study is depicted in Figure 3.1. The conceptual framework was adapted from ecological models of health behavior (Sallis, Owen, & Fisher, 2015). Ecological models of health behavior conceptualize the multiple influences on health behaviors (Sallis et al., 2015). Ecological models are developed in order to understand the contribution of specific influences of health behavior across multiple levels, including: the

individual domain, the environmental domain, and the policy domain (Sallis et al., 2015). The purpose of developing ecological models is to understand how specific health behaviors arise as a result of the interaction between different levels in the model in order to develop comprehensive interventions that address the multiple levels contributing to health behaviors (Sallis et al., 2015).

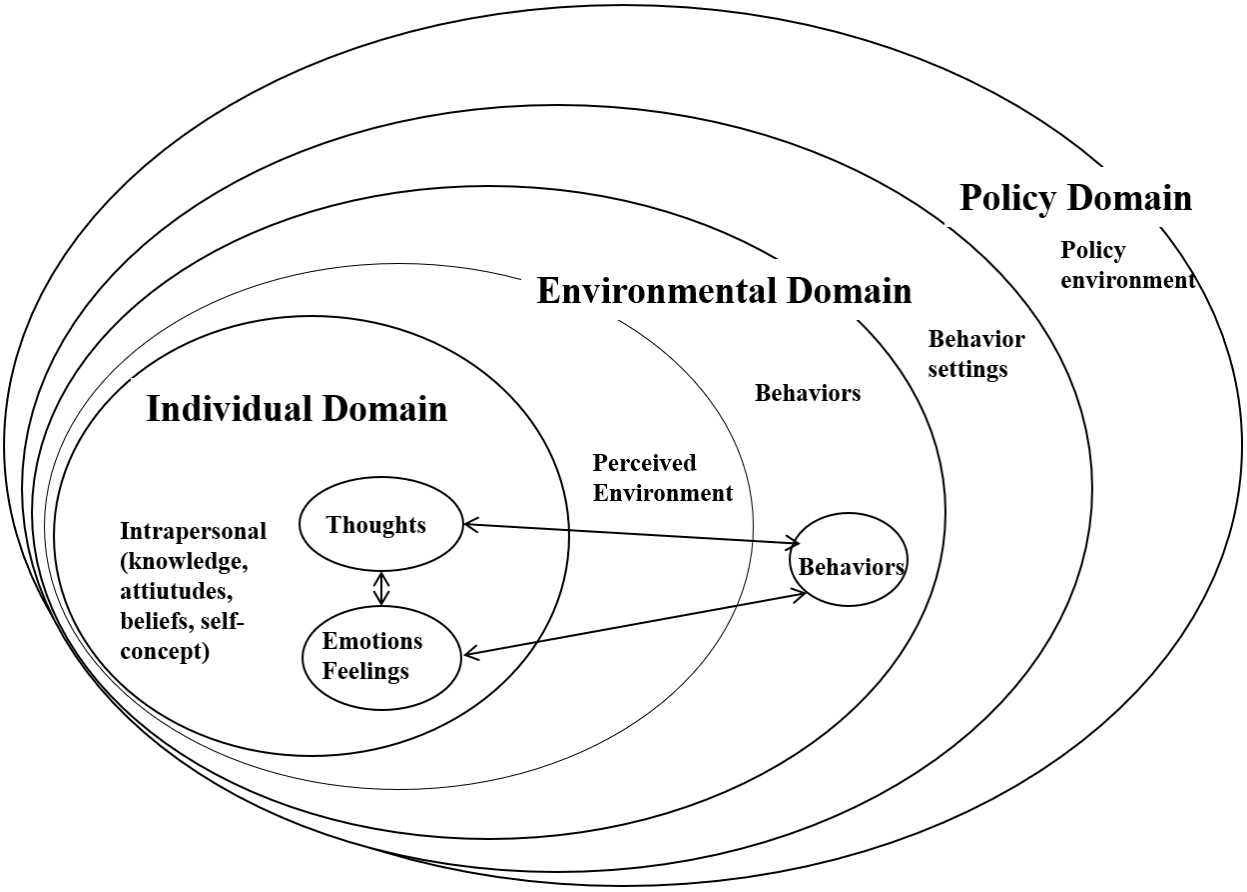


Figure 6.1. Proposed conceptual framework. The proposed conceptual framework is adapted using aspects of socioecological models of health behaviors and cognitive behavioral theories about eating, obesity, and body image. The socioecological individual domain includes intrapersonal aspects, including knowledge, attitudes, and beliefs, which also includes the cognitive behavioral aspects of thoughts and feelings. The environmental domain includes the perceived environment, the actual behaviors, both positive and problematic according to cognitive behavioral theories, and the setting in which behaviors take place. The policy domain includes the policy environment.

For this study, we considered the following domains:

1) The individual domain included:
    - Intrapersonal aspects, defined as individual characteristics and include individual concepts such as knowledge, attitudes, behavior, self-concept and skills
2) The environmental domain included:
    - Perceived environment: the way an individual perceives the environment
    - Behaviors: living domains, which includes settings where most behaviors take place
    - Behavior settings: which describe the physical locations that individuals interact within
3) The policy domain included:
    - Policy environment: which includes the laws and regulations that govern the environment

Also considered were cognitive behavioral perspectives, that posit that moods and emotions influence an individual's thoughts. Thoughts, in turn influence an individual's behaviors, while those behaviors in turn influence an individual's mood and feelings (Cash, 2011; Cooper & Fairburn, 2001; Fairburn et al., 2003). Cognitive behavioral perspectives were considered within the socioecological model since they serve to explain how problematic eating behaviors, such as dieting or unhealthy weight control behaviors arise from problematic thoughts and feelings, such as stress and body dissatisfaction (Cash, 2011; Cooper & Fairburn, 2001; Fairburn et al., 2003).

2. Research Questions

The overarching research question was: What are the eating behaviors and mediators of eating behaviors of ROTC cadets? This research question was broken down into individual research questions.

1. How do ROTC cadets describe their eating behaviors?
2. What is the perspective of ROTC cadets on how and why they choose their eating behaviors?
3. How do ROTC cadets describe the role of the ROTC context in shaping and influencing their eating behaviors?
    a. What role do the cadre play in terms of eating behaviors?
    b. What role do other cadets play in terms of eating behaviors?
4. How do ROTC cadets describe their preparation for physical fitness and body composition assessments relative to their eating behaviors?
5. What are the perceptions and experiences of ROTC cadets related to body image within the context of ROTC?

The conceptual framework and research questions were used to develop the semi-structured interview guide (Appendix M).

3. Study Design

A qualitative descriptive design (Sandelowski, 2010) using in-depth responsive interviews (Patton, 2002) was used to describe the eating behaviors and mediators of eating behaviors of ROTC cadets. This method was used in order to explore cadets' eating behaviors and reasons for engaging in these eating behaviors, particularly in relation to the ROTC context.

All research procedures were approved by the Institutional Review Board at Michigan State University.

3a. Site Selection

US Army ROTC cadets were recruited from the Michigan State University (MSU) ROTC Program, which was selected because it is one of the largest programs within the seventh brigade region of the ROTC. Additionally, recent data from the 2016 National College Health Assessment on students from MSU reported that there were rates of overweight and obesity of 23% and 10.6%, respectively. Although 66.3% of students were classified as having a normal weight status, 33% of those students were still trying to lose weight (Hembroff, 2016). The study also reported that over half of respondents consumed less than 2 servings of fruits and vegetables per day (66.5%), while 3.7% of students surveyed reported a problem with eating disorders over the last 12 months (Hembroff, 2016). Similarly, the CDC currently ranks Michigan 17th in terms of adult obesity, with 18.1 % of young adults between 18-25 years of age classified as obese, and a high rate of metabolic abnormalities identified among Michigan university students (Centers for Disease Control and Prevention/National Center for Chronic Disease Prevention and Health Promotion/Division of Population Health, 2017; Yahia et al., 2017). Therefore, the ROTC program at Michigan State provided an opportunity to describe a broad range of eating behaviors.

3b. Sampling

The US Army ROTC is comprised of eight brigades responsible for managing US Army ROTC programs within their regions and includes over 30,000 enrolled college and university students (Tatro, personal communication, December 4, 2018). The seventh brigade comprises US Army ROTC programs in the states of Michigan, Indiana, Ohio, Kentucky, and Tennessee

and includes over 3,400 enrolled ROTC cadets (Tatro, personal communication, December 4, 2018). There are five US Army ROTC programs within the state of Michigan, with the largest program at Michigan State University (MSU) (Tatro, personal communication, December 4, 2018). In the 2017-2018 school year, there were 145 students enrolled at the US Army ROTC Program at MSU (Tatro, personal communication, December 4, 2018). ROTC year groups are determined by year of enrollment in the program and are an abbreviation of the class name Military Science (MS) (Today's Military, 2017). Thus, students are identified as MS1 for first year students, MS2, for second year students, MS3 for third year students, and MS4 for fourth- and fifth-year students. Students within the program are organized using military hierarchical organization, including squads and companies. The entire MSU US Army ROTC organization is considered a battalion, which in the military, signifies a group of companies (Today's Military, 2017). The MSU US Army ROTC program is the "Spartan Battalion." The program is headed by a battalion commander, a US Army commissioned officer in the rank of Major or Lieutenant Commander, who is named the chairperson of the Department of Military Science. The rest of the staff consists of non-commissioned officers and commissioned officers. Commissioned officers, in the rank of Captain, are assigned as the primary instructors for each year group (MS1, MS2, MS3, MS4). Non-commissioned officers, who are enlisted personnel in the rank of staff sergeant, sergeant first class, and master sergeant, are assigned as assistant instructors for each year groups (MS1, MS2, MS3, MS4). Within the context of a military educational setting, all instructors are termed "cadre" or the cadre.

Following IRB approval, this qualitative study was conducted as a follow on to a larger, quantitative study on the eating behaviors and mediators of eating behaviors in US Army ROTC cadets (Chapter 4, Chapter 5). During the informed consent process, in addition to providing

consent to participate in the quantitative, face-to-face portion of the study, cadets were asked to provide consent to participate in qualitative, in-depth telephone interviews. Of the 205 ROTC cadets that provided informed consent and participated in the larger quantitative study, 114 ROTC cadets were from MSU. Of the 114 ROTC cadets that were from MSU, 34 consented to participating in the qualitative telephone interviews.

Sample size was determined to achieve maximum information power (Fusch & Ness, 2015; Malterud et al., 2016; Mason, 2010). Purposive sampling was used in order to select a range of participants with various experiences related to ROTC for one-on-one telephone interviews, including "information-rich" participants as well as extreme and negative cases (Patton, 2002; Pope & Mays, 1995). Consenting cadets were selected considering the following break characteristics: sex and year group (Military Science (MS) 1, MS2, MS3, MS4), as well as by their responses to questions in the Military-Specific Mediators of Eating Behaviors Survey:

7) Have you ever failed the body fat tape test/assessment?

9) Have you ever failed your Weigh-in/BMI measurement?

17) How do you typically feel the week prior to the record height and weight (including tape test if needed)? Responses ranged from "Not at all stressed" to "Extremely stressed";

48) Did you PURPOSELY try to lose weight within the PAST 6 MONTHS?

Considering the break criteria above, a minimum of 16 cases were sought, with at least 2 male and 2 female participants per year group to achieve saturation (Malterud et al., 2016). Of the 34 cadets consenting to participate in the qualitative telephone interview, 27 cadets were contacted to schedule a telephone interview, and 18 cadets scheduled and conducted telephone interviews, including:

- Three MS1 males, Freshman (Fr) Male (M) 1, FrM2, FrM3

- Two MS1 females, Freshman (Fr) Female (F) 1, FrF2
- Three MS2 males, Sophomore (So) Male (M) 1, SoM2, SoM3
- Two MS2 females, Sophomore (So) Female (F) 1, SoF2
- One MS3 male, Junior (Jr) Male (M) 1
- Three MS3 females, Junior (Jr) Female (F) 1, JrF2, JrF3
- Two MS4 males, Senior (Sr) Male (M) 1, SrM2
- Two MS3 females, Senior (Sr) Female (F) 1, SrF2

Each participant was offered a $20 Amazon.com gift card for their participation in the study, which was emailed to each participant following the completion of telephone interviews.

3c. Data collection procedures

As part of the larger study, participants completed various questionnaires containing demographic information, as well as surveys on eating behaviors and mediators of eating behaviors. Quantitative data were collected using face-to-face data collection. Qualitative in-depth interviews were conducted via telephone.

Due to the nature of the study content, eating behaviors, the ROTC context, and discussion on body image perceptions, as well as the busy schedules of ROTC cadets, telephone, in-depth responsive interviews were conducted. Use of telephone interviews allowed for greater flexibility for scheduling (Cachia & Millward, 2011; Carr & Worth, 2001; Sturges & Hanrahan, 2004) and increased privacy for respondents (Cachia & Millward, 2011; Lechuga, 2012). Selected ROTC cadets were contacted by telephone and were asked to select a telephone interview time that was convenient for their schedule.

After an interview time was selected, the participants were contacted by the lead researcher, a PhD student with previous experience and training in designing and conducting

qualitative research studies. The interviews were conducted in the research lab by the lead researcher using semi-structured, in-depth interview questions from the interview guide, as well as follow-on and probing questions. All interviews lasted between 45 and 75 minutes. All interviews were recorded using two digital recording devices. Recorded interviews were transcribed using oTranscribe by four trained undergraduate research assistants. The lead researcher proofed each transcript to verify the accuracy of the transcription (Poland, 1995).

4. Measures

Interview Guide A semi-structured interview guide was created to allow for clarification and probing as necessary. All participants were asked the following questions:

1. Tell me about your eating. Can you please describe a typical day in terms of your eating?
2. How do you decide what to eat?
3. What is your eating like now that you are in ROTC?
4. If you have an Army Physical Fitness Test and body composition assessment, how do you prepare for those in terms of your eating behaviors?
5. What are your experiences related to body image in ROTC?
6. What is in place in ROTC that helps to support your eating behaviors?
7. What would you like to see in place within ROTC to help support your eating behaviors?

The full version of the interview guide, including probe questions, is available in Appendix M.

Demographics. Demographic characteristics were asked using the newly developed Military-Specific Demographics and Lifestyle Information Questionnaire, currently being piloted and validated by the US Army Research Institute of Environmental Medicine as part of their Development of a Military Specific Eating Behavior Survey Study (Cole, 2016). Demographic characteristics included: age, sex, race, ethnicity, and ROTC year.

Eating Behaviors and **Mediators of Eating Behaviors** (Cole, 2016). Additional questions regarding military-specific eating behaviors and mediators of eating behaviors were asked using the newly developed Military-Specific Eating Habits and Military-Specific Mediators of Eating Behaviors Questionnaires, currently being piloted and validated by the US Army Research Institute of Environmental Medicine as part of their Development of a Military Specific Eating Behavior Survey Study (Cole, 2016). Specific eating behaviors assessed included: primary eating style over the past 30 days (low calorie, high calorie, high protein, low fat, etc.) and primary reason for the eating style (no special reason, weight loss, weight gain, performance, health, lifestyle, budget, etc.). Specific mediators of eating behaviors assessed included: ever failing a body fat assessment, ever failing a BMI screen, stress regarding the body composition assessment, weight perception, desire to weigh less/more, attempting to lose weight, purposely trying to lose weight, trying to lose weight for appearance or performance reasons, and exercising for appearance or weight loss reasons.

Eating Disorder Diagnostic Scale, DSM-IV (EDDS) (Stice et al., 2000). The EDDS is a self-report measure of eating disorder symptoms based on the diagnostic criteria for eating disorders in the *Diagnostic and Statistical Manual for Mental Disorders*, 4th edition (American Psychiatric Association, 1994). There were a total of 22 questions, including one question about current height, one question about current weight, and one question about birth control usage. The other 19 questions relate to eating disorder symptoms, such as body dissatisfaction (Has your weight influenced how you think about/judge yourself as a person), binge eating behaviors (During these episodes of overeating and loss of control did you eat alone because you were embarrassed by how much you were eating), binge eating frequency (How many times per week on average over the past 3 months have you eaten an unusually large amount of food and

experienced a loss of control), and frequency of purging behaviors (How many times per week on average over the past 3 months have you engaged in excessive exercise specifically to counteract the effects of overeating episodes), such as vomiting, laxative/diuretic use, fasting, and excessive exercise to counteract effects of overeating (Lee et al., 2007). Items are scored and summed to yield a total eating disorder symptoms score, with higher scores indicating greater levels of eating disorder symptoms (Stice et al., 2004b; Stice et al., 2000). Items can also be standardized and summed if using a risk classification cut-off score, with a cut-off score ≥ 16.5 indicating a positive screen for eating disorder risk (Krabbenborg et al., 2012). The items can also be used to determine a probable eating disorder diagnoses based on DSM-IV criteria (Stice et al., 2000). The authors reported a Cronbach's alpha of 0.89, and test-retest reliability of 0.87 for the total eating disorder symptoms score (Stice et al., 2000), as well as excellent criterion, convergent, and predictive validity (Stice et al., 2004b). The total eating disorder symptoms score was used to measure eating disorder symptoms and demonstrated good internal consistency in the current study ($\alpha = 0.82$).

Weight Status. Anthropometric measures included height, weight, and body circumferences using Army Regulation 600-9 (AR 600-9): The Army Body Composition Program procedures (Department of the Army, 2013). Height and weight were measured with participants wearing a physical fitness uniform without shoes, a combat uniform with empty pockets, and coat and boots removed, or civilian clothing without shoes. Height was measured using a Seca 213 portable stadiometer and was rounded to the nearest 0.1cm (seca GmbH, Hamburg, Germany). Weight was measured using a Seca 872 Digital medical scale (seca GmbH, Hamburg, Germany) and was rounded to the nearest 0.1 kg. Height and weight were used to compute body mass index (kg/m^2) (Janssen et al., 2002). Body circumferences were measured

using the procedures in AR 600-9 using a Gulick measuring tape (5193, Richardson Products), and measurements were recorded to the nearest 0.1 cm at the following sites: neck (below the larynx, perpendicular to the neck), the waist for females (the point of minimal abdominal circumference) or the navel for males, and the hips for females (around the greatest gluteal protrusion) (Appendix) (Department of the Army, 2013). Each measurement was taken in series at least three times by one research assistant and recorded by a second research assistant. If two measurements at one location were greater than 0.5 cm different, a fourth set of measurements was taken. The measurements were converted to inches and rounded according to AR 600-9, and entered into a sex-specific body fat equation for males, % body fat = [86.010 x Log10 (waist – neck)] – [70.041 x Log10 (height)] + 36.76, and females, % body fat = [163.205 x Log10 (waist + hip – neck)] – [97.684 x Log10 (height)] – 78.387. Percent body fat was recorded to the nearest whole % (Department of the Army, 2013).

5. Data analysis

Quantitative data was analyzed using SPSS V. 25 (IBM Corp.; 2017. IBM SPSS Statistics for Windows: Armonk, NY). Independent samples t-tests were conducted to test results between qualitative participants and the rest of the sample. Data are reported as mean (standard deviation), unless indicated, and a p-value <0.05 was considered statistically significant.

Qualitative data analysis was conducted using NVivo V12 (NVivo qualitative data analysis software; QSR International Pty Ltd: London). Qualitative data was analyzed using thematic analysis. Data analysis was conducted by the lead researcher and one undergraduate researcher. The lead researcher and undergraduate researcher read through all the transcripts and developed a preliminary code book. The preliminary codes were then applied to all transcripts by both researchers, and all coded transcripts were reviewed by both researchers until consensus

was achieved. Codes were grouped by themes which reflected the research questions. Coded data was extracted using NVivo. Extracted data was used to create matrices for all participants for each code. Matrices were then created to condense extracted data and to identify relevant factors associated with each theme. Emergent themes and related factors were further synthesized, with representative quotes chosen to illustrate themes and factors.

D. Results

1. Participant characteristics

Of the 34 participants that consented to complete a qualitative interview, 27 were contacted, and eighteen completed a qualitative interview, including nine male and nine female US Army ROTC cadets, with an average age of 20.1 years (Table 6.1). This sample size was determined adequate because the saturation point was met (i.e., no new information was heard) (Miles, Huberman, & Saldana, 2013). Most participants were White/Caucasian (72.2%), not Hispanic (83.3%), first (MS1) and second (MS2) year ROTC cadets (27.8% and 27.8%,

Table 6.1. Demographic characteristics of the qualitative sample (n=18) and the entire sample (n=205) of participating ROTC cadets.

Characteristic	Qualitative Sample (n=18)	Total Sample (n=205)	p-value
Age (y)	20.1 (1.5)	20.1 (2.0)	0.985
Height (cm)	171.0 (6.9)	174.7 (9.8)	0.089
Weight (kg)	75.7 (13.1)	75.4 (12.6)	0.933
BMI	25.8 (3.7)	24.6 (3.0)	0.077
Male BF (%)	17.1 (6.6)	15.2 (4.6)	0.204
Female BF (%)	30.1 (4.4)	28.6 (6.0)	0.433
Total Eating Disorder Symptoms Score	16.7 (11.8)	13.7 (11.9)	0.273

Note: BMI=body mass index; t-test, *p<0.05.

respectively), and were contracted (66.7%), meaning they were receiving a scholarship through the US Army ROTC program (Table 6.2). Most participants endorsed an eating style that consisted of "I just ate whatever" and "Balanced Meals" (41.2% and 41.2%, respectively). Most participants answered, "no reason" (41.2%) as their reason for following their specific meal style, followed by "performance" (23.5%) as a reason for following eating style (Table 6.2). Most participants reported never failing a weight for height screening (72.2%), currently meeting the weight for height screen (55.6%), never failing a percent body fat assessment (77.7%), currently meeting the body composition standards (77.8%), and never failing a physical fitness assessment (83.3%) (Table 6.3). Most participants were not stressed about the body composition assessment (55.6%) and reported feeling satisfied with their current weight (55.6%) (Table 6.3). Of the eighteen participants, nine (50%) desired weight loss, while three (16.7%) desired weight gain, and 11 (61.1%) had attempted weight loss (Table 6.3). The primary reasons for attempting weight loss were appearance (22.2%) and performance (11.1%). When asked about reasons for exercise, participants reported exercise primarily for appearance (77.8%) and weight loss reasons (38.9%) (Table 6.3).

Table 6.2. Categorical demographic characteristics of qualitative participants (n=18).

Characteristics	n (%)
BMI	
18.5-24.99 kg/m^2	9 (50.0)
25-29.99 kg/m^2	6 (33.3)
≥ 30 kg/m^2	3 (16.7)
Gender	
Male	9 (50.0)
Female	9 (50.0)

Table 6.2. (cont'd).

Characteristics	n (%)
Race	
White/Caucasian	13 (72.2)
Black/African American	4 (22.2)
Native American	1 (5.6)
Ethnicity	
Non-Hispanic	15 (83.3)
Hispanic	3 (16.7)
ROTC Year Group	
MS1	5 (27.8)
MS2	5 (27.8)
MS3	4 (22.2)
MS4	4 (22.2)
Contracting Status	
Contracted	12 (66.7)
Not Contracted	6 (33.3)
Primary Eating Style (n=17)	
I just ate whatever	7 (41.2)
Balanced Meals	7 (41.2)
High Carbohydrate	2 (11.8)
High Protein	1 (5.8)
Reason for Eating Style	
No Reason	7 (41.2)
Performance	4 (23.5)
Lifestyle	2 (11.8)
Weight Loss	2 (11.8)
Weight Gain	1 (5.8)
Budget	1 (5.8)

Note: BMI= body mass index; MS=Military Science.

Table 6.3. Qualitative participant responses to mediators of eating behaviors questions (n=18).

Proposed Mediators of Eating Behaviors	n (%)
Ever Failed Weight for Height Screening	
No	13 (72.2)
Yes	5 (27.8)
Current Screening Weight	
Meets the screening weight	10 (55.6)
Over the screening weight	8 (44.4)
Ever Failed Percent Body Fat Assessment	
No	14 (77.8)
Yes	4 (22.2)
Current Body Fat Standard Compliance	
Meets the % body fat standard	14 (77.8)
Over the % body fat standard	4 (22.2)
Ever Failed the Physical Fitness Assessment	
No	15 (83.3)
Yes	3 (16.7)
Stressed About Body Composition Assessment?	
No	10 (55.6)
Yes	8 (44.4)
Weight Perception	
Satisfied with weight	10 (55.6)
Not satisfied with weight	8 (44.4)
Desire Weight Loss	
No	9 (50.0)
Yes	9 (50.0)
Desire Weight Gain	
No	15 (83.3)
Yes	3 (16.7)
Attempted Weight Loss	
No	7 (38.9)
Yes	11 (61.1)
Appearance reason for weight loss	
No	14 (77.8)
Yes	4 (22.2)
Performance reason for weight loss	
No	16 (88.9)
Yes	2 (11.1)
Exercise for weight loss	
No	11 (61.1)
Yes	7 (38.9)
Exercise for appearance	
No	4 (22.2)
Yes	14 (77.8)

The mean BMI for the sample was 25.8 kg/m^2 (3.7), with most participants classified as having a normal weight BMI of 18.5-24.9 kg/m^2 (50.0%). The mean body fat percentage was 23.6% (6.8), which ranged from 4.1-25.5% for males and 23.7-39.1% for females. The mean total eating disorder symptoms score was 16.7 (11.8). One participant (5.6%) met the criteria for a probable eating disorder diagnosis, while two participants (11.1%) met the eating disorder risk classification cut-off scores ≥16.5 (Table 6.1).

The data for the qualitative participants was drawn from a larger sample of US Army ROTC cadets. There were no significant differences between the qualitative participants and the total sample on all characteristics except combined body fat percentage. There were also no significant differences between qualitative participants and the study sample on female body fat percentage nor male body fat percentage.

2. Themes

Through thematic analysis, we identified three major themes in relation to eating behaviors in ROTC cadets: usual eating behaviors, determinants of eating behaviors, and the role of the ROTC context in shaping eating behaviors. Under usual eating behaviors, we organized related factors into three major categories associated with the Cognitive Behavioral Theory: healthy foods (feelings/thoughts/beliefs), unhealthy foods (feelings/thoughts/beliefs), and usual meals (behaviors) (Table 6.4). Under determinants of eating behavior, we organized five related factors associated with the socioecological framework and cognitive behavioral theory: Individual/interpersonal factors included feelings related to eating behaviors, knowledge (thoughts about eating behaviors) and environmental factors included availability of food

Table 6.4. Factors underlying the "Usual eating behaviors" theme.

Code	Factors	Examples
Usual meals	On campus	have unlimited access to foods
	Off campus	a) have to purchase and prepare foods b) have to carry all their foods with them for the day
	Schedule	a) physical training resulted in eating more breakfast b) physical training resulted in inadequate time to eat usual breakfast
	Meal patterns	meals skipped because of schedule
Healthy foods	Definition	a) nutrient content of foods b) healthy foods feel lighter
	Healthy food examples	foods based on food guide pyramid
	Reasons for eating or not eating healthy foods	a) eat healthy foods to feel better b) eat healthy foods to improve physical performance c) eat healthy foods to feel full on fewer calories and lose weight d) don't eat healthy foods because of cost, access, and convenience
Unhealthy foods	Definition	a) Greasy, sugary, processed foods b) No nutritional value
	Examples of unhealthy foods	a) greasy foods, fast foods, desserts b) convenience foods
	Reasons for eating or not eating unhealthy foods	a) avoid unhealthy foods due to perceived consequences of not feeling good, not feeling satiated, and feeling more tired b) avoid unhealthy foods due to negative impact on physical performance c) avoid unhealthy foods due to negative impact on weight and body shape d) eat unhealthy foods because of food cost, convenience, cravings, not worried about consequences

choices, money, and time (Table 6.5). The role of the ROTC context in shaping eating behaviors included six related factors associated within the socioecological framework and cognitive behavioral theory, including: the role of the cadre (individual/interpersonal factor), the ROTC context in general (environmental factor), the role of other cadets (individual/interpersonal factor), preparation for the physical fitness and body composition assessments (policy

/environmental factor), and perceptions of body image within the ROTC context (individual factor) (Table 6.6).

Table 6.5. Factors underlying the "Determinants of eating behaviors" theme.

Codes	Factors	Examples
Food access and availability	On campus	a) positive aspect: access to greater variety of foods b) positive aspect: easier to eat healthier c) negative aspect: perceive less variety, less access to preferred foods, limited access to foods due to cafeteria schedule
	Off campus	a) negative aspect: time and money required to purchase and prepare foods b) negative aspect: how to store and access foods during the day c) positive aspect: living with parents improved access due to not having to purchase or prepare foods
Feelings related to eating behaviors	Hunger/satiety	a) eat when hungry, stop eating when full b) physical training results in changes in appetite c) select foods for the satiating properties
	Food preferences	a) taste is number one priority b) cravings for certain foods c) using foods as rewards or to soothe feelings
Knowledge related to eating behaviors	Content	a) nutrient needs for increased physical activity level b) knowledge about unhealthy food choices c) use knowledge about recipes at home to decide what foods to prepare d) use knowledge learned about healthy eating to plan food intake e) limited previous knowledge
	Sources of knowledge	a) family: eating habits, knowledge about healthy foods, recipes b) school classes or sports: more specific knowledge about nutrients or eating for performance c) college health-related courses: more advanced concepts about nutrition and physiology and performance d) internet: recipes and tips on foods and supplements from fitness related pages e) other cadets: knowledge on dietary supplements and how to improve performance

Table 6.5. (cont'd).

Money	Off campus cadets	a) healthy foods too expensive and perishable, must rely on cheaper convenience foods b) despite cost of healthy foods, cadets found ways to balance healthy food choices with cost c) prioritized preparing own foods over going out to save money
	On campus cadets	Prioritize eating at the cafeteria over going out to save money
Time	Schedules	a) Limited time results in altering usual food choices b) Limited time also resulted in skipping meals
	Time for food preparation	a) Limited time resulted in less food preparation and dining out more frequently b) Limited time resulted in relying on unhealthier convenience foods

Table 6.6. Factors underlying the "Role of the ROTC context in shaping eating behaviors" theme.

Code	Factor	Examples
Role of the cadre	Involvement	a) teach nutrition class during first year of ROTC program b) role models and mentors for physical training c) focus on people who are struggling
	Expectations	a) cadets expected to already know what to do in terms of nutrition to be successful b) cadets expect cadre to be more involved, earlier, with more specific guidance
ROTC in general	Change in eating behaviors	a) replaced unhealthy food choices with healthy food choices to lose weight and be in better shape b) having ROTC physical training resulted in cadets eating breakfast more frequently or eating larger breakfasts c) more conscious to make healthier food choices and food choices that help with performance
Role of the cadre	Involvement	a) teach nutrition class during first year of ROTC program b) role models and mentors for physical training c) focus on people who are struggling

Table 6.6. (cont'd).

Code	Factor	Examples
Role of the cadre (cont.)	Expectations	a) cadets expected to already know what to do in terms of nutrition to be successful b) cadets expect cadre to be more involved, earlier, with more specific guidance
ROTC in general	Change in eating behaviors	a) replaced unhealthy food choices with healthy food choices to lose weight and be in better shape b) having ROTC physical training resulted in cadets eating breakfast more frequently or eating larger breakfasts c) more conscious to make healthier food choices and food choices that help with performance
Other Cadets	Positive involvement	a) Other cadets provide encouragement, motivation and advice b) Other cadets encourage eating of healthy foods c) other cadets work out with cadets struggling d) Other cadets provide specific sport-fueling advice
	Negative	a) seek out cadets based on how they look not what they know b) cadets might not have the education and training to give appropriate advice
	Perception of other cadets	a) other cadets are more self-aware in body image and physical performance b) other cadets rely on each other for information on nutrition and training c) other cadets might judge you because of your eating habits or physical performance
Physical training	Change in eating behaviors	a) awareness of energy and nutrient needs for physical activity b) smaller appetite or less of an appetite for unhealthy foods because they negatively impact performance c) conscientious in replacing unhealthier food choices with healthier food choices d) freer in diet because of physical training
Preparation for physical fitness and body composition assessments	Change in eating behaviors	a) eat healthier foods to intentionally lose weight b) skip meals, beverages, and take diuretics to lose weight c) Limit unhealthy foods to prevent fatigue and cramping d) replace unhealthy foods with healthy foods to enhance performance e) include more carbohydrate-based foods to improve performance f) drink more water to improve hydration g) minimal changes in diet, instead focus on physical preparation

Table 6.6. (cont'd).

Code	Factor	Examples
Preparation for physical fitness and body composition assessments (cont.)	Stress about composition assessment process	a) cadets that were not stressed met the screening weight table b) cadets that were not stressed and did not meet the screening weight table but passed the tape were usually males c) cadets that are stressed are on the border of meeting body composition standards
	Perceptions about body composition assessments in general	a) stress about assessments because they are tied to scholarships and developmental opportunities b) way it is implemented can be improved so people don't have to lose a lot of weight in a short period of time c) body composition standards should take into account physical fitness performance d) feel body composition standards are not realistic if they cannot be met by people who are above average physical performers e) if you fail the weight for height screening, you are a failure f) the way the current standards are implemented may result in adoption of unhealthy eating behaviors
Perceptions of body image	Body image concerns	a) no concerns, eat whatever they want b) cadets that were smaller were more self-aware in size c) smaller cadets perceived size difference as being weaker compared to larger, muscular, taller male cadets d) larger cadets perceived size differences as thinner, more toned cadets tended to be runners or faster e) smalls and large cadets reported pushing themselves to make sure they are able to compete at the same level as cadets who were taller and muscular or thinner and more toned
	Body composition standards and body image	a) more self-conscious of weight, engage in more behaviors to try to change weight b) how cadets perform on the body composition assessment impacts their body image perception
	Change in eating behaviors	a) some cadets eat more meals and more protein to try to build muscle b) some cadets relax eating style if they can meet the body fat standard c) for other cadets not meeting the weight for height screening makes them become stricter in their eating behavior

2a. Theme 1: Usual eating behaviors

This theme was defined as how the cadets defined and described their usual eating behaviors. 1) "Usual meals" was defined as cadets' usual meal patterns, including food choices. 2) "Healthy foods" was defined as the specific types of foods cadets described as healthy, reasons they considered these foods healthy, and reasons they did or did not include these foods as part of their usual meal patterns. 3) "Unhealthy foods" was defined as the specific types of foods cadets described as unhealthy, reasons they considered these foods unhealthy, and reasons they did or did not include these foods as part of their usual meal patterns (Table 6.4).

1) Meals

The cadets describe their usual meals in terms of food availability, schedule, and meal patterns. About half of cadets lived on campus, and half of cadets lived off campus. Cadets living on campus described meals in terms of foods available in the cafeteria. JrM1, who lived on campus, discussed how this relates to his eating behaviors.

> "Um, well I live on campus, so I eat in the cafeterias a lot. So, all the food is prepared for me. Um, there's usually a pretty wide variety, ranging from like pizza to a salad bar. And, um, obviously in the cafeterias there's no limit on, like, the quantity you can get. So, um or like the frequency that you can go in and eat."

The cadet suggested a wider availability to food in terms of the foods available, food choices, quantities available, and even frequency of access to foods are available to cadets who live on campus and dine in campus cafeterias.

Cadets living off campus described needing to purchase and prepare their own foods. The cadets living off campus focused more on the cost of foods, the foods available for them to prepare, and the time to prepare the foods. For example, SoM2, who lived off campus, discussed how he accessed food.

> "I live in an apartment; I don't have the MSU meal plan or anything like that. So…what I do pay attention to is when I go to the store is to try to buy like more healthier things but it's a tough balance between like the price you're going to pay at the store. Um, how long it takes to actually to prepare that meal, um how difficult it is because a lot of people, a lot of college students don't really know how to cook that well."

In contrast to cadets who live on campus and have meal plans, cadets who live off campus, consider aspects of accessing, purchasing, and preparing foods that students on campus may not need to worry about.

Cadets living off campus that also commuted to campus described limitations in accessibility to food. For some cadets that commuted >30 minutes, they often had to bring all the foods they needed for the day, since cadet physical training usually starts at 5:45 am in the morning. SoF2 stated,

> "…in the morning, I get up at, uh, between four a.m. and quarter after four, and I make sure I have everything set for the day and I, um, grab my lunch, and then I drive to campus which is about an hour drive for me, and I get here for PT [physical training] in the morning and then we do PT [physical training]for an hour to two hours depending on the day.

In addition to commuting and participating in physical training and classes, cadets that commute from off campus must also have access to the foods they will need for the day, whether they have access to maintain and heat these foods or not.

All cadets, regardless of whether they lived on campus or off campus, described their schedule as important related to their meal patterns and food choices. For most cadets, their physical fitness training schedule, which goes from 5:45-7:00 am, was mentioned in terms of their eating behaviors. Some cadets described eating breakfast because they had physical fitness training early in the morning. For example, JrM1 stated,

> "the days that we have PT [physical training] in the morning I would say, um, I'd go and eat breakfast after PT [physical training]. Whereas, days that I don't have PT [physical training] I usually don't go to breakfast."

Similarly, FrM1 stated, “I try to, every morning after PT [physical training], I eat eggs and sometimes I eat sausage to go with it.” For some cadets, they appear to eat breakfast more often because they have physical training in the morning.

For other cadets, having physical training in the morning meant that they did not have enough time to eat between physical training, showering, and attending their first class. They described making different food choices, such as selecting portable foods to eat on the go. For example, SrM1 stated that his breakfast depended on whether he had time after physical training. “I have class at eight thirty so I'm kind of rushing out the door. Uh, so I might grab two granola bars…to eat on the way to class.” This contrasts with what happens on days that aren’t rushed, where SrM1 is, “able to eat a good breakfast like…waffles…or cereal.” The evidence suggests that time limitations due to the limited time between physical training and class results in cadets making different food choices, such as eating more portable convenience foods.

Most cadets described eating at least two to three meals a day. Cadets who tended to skip meals, did so due to class schedule. SoF1 stated, “Some days…I feel I'm really busy my class schedule. So…I eat granola bars a lot…for lunch and sometimes for breakfast.”
In addition to physical training schedule, class schedules also affect whether cadets eat a meal or not, and what kind of meal they are able to eat.

Overall, when cadets described their eating behaviors, they considered how their living arrangements, including living on or off campus, influenced food access, purchase, and preparation. Additionally, they based their usual meal patterns and food choices upon food accessibility, availability, and ROTC/class schedules. This evidence suggests that these socioecological facets, food access and availability, schedules, and time, are important to understanding the eating behaviors of ROTC cadets.

2) Healthy foods

The cadets also described their usual eating behaviors in terms of specific food choices. The cadets described their food intake in terms of healthy, or good foods, and unhealthy, or bad foods. Most cadets defined healthy foods as foods that provide the recommended level of nutrients, such as carbohydrates, proteins, vitamins, and minerals, to maintain their activity level and health. JrF1 stated,

> "I know that somebody with my activity level should be eating um lots of protein. And the nutrients in fruits and vegetables would be really good for me since I go to college and I'm exposed to a lot of sick people and I need to keep my immune system up."

Most cadets defined healthy foods in terms of nutrient content and predominantly discussed protein, followed by vitamins and minerals. Few cadets talked about calorie needs, calorie intake, or carbohydrate intake.

Some cadets described healthy foods as foods that were lighter, with less fat, or less processing. FrF2 described healthy foods as "…something more organic, not highly processed food," as well as, "…something light…not something really pretty heavy." Cadets described healthy foods as feeling lighter which may suggest either feelings of fullness or perceptions of weight associated with healthier foods.

For the most part, all cadets provided as examples of healthy foods the foods based on the food guide pyramid, including fruits, vegetables, whole grains, dairy, and proteins. For example, SoM3 stated, "I try to maintain…the classic food pyramid…how much you're supposed to eat per day of… dairy, meat for protein, fruits and veggies, grains…a good balance of all of that." FrF1 also talked about fish, discussing examples of healthy foods as,

> "…vegetables…and fruits definitely…So, usually, like, having more vegetables and water or milk…Fish is good because it has, like, a good kind of fat in it, um, and, you know, raw vegetables are good…you can have, like, bread and everything, but you should have a lot of vegetables and fruit along with it…for…a more balanced diet."

Almost all cadets that provided examples of healthy foods mentioned fruits, vegetables, and proteins. Fewer cadets talked about dairy foods and carbohydrate-based foods such as starches and grains. A few cadets also made reference to food groups on the food guide pyramid and a balance between the food groups.

Cadets discussed different reasons for eating or not eating healthy foods as part of their usual intake. For example, several cadets described feeling better throughout the day. SoF1 stated, "Once I was able to [make healthier choices]…I noticed…I'm generally feeling better throughout the day, feeling my brain…feeling clearer and able to think a little better." SrF1 also stated, "It's easy to choose the stuff [healthy foods] I know will make me feel better." It appears that cadets who describe feeling better eating healthy foods also prioritize eating healthy foods.

Some cadets also discussed feeling as if their physical performance improved after eating healthier foods. SoF1 reported that once she was able to make healthier choices, she "noticed…a significant difference…in [her] PT [physical training] performance." Similarly, FrM1 stated,

> "…I noticed when I stayed away from that type of stuff [unhealthy foods], and eat healthy like apples, and…bananas throughout the day, more fruits…I wouldn't feel as bad...and I felt good when I work out, and…I like that feeling."

Many cadets discussed prioritizing healthy foods because of the beneficial effects they perceived towards their physical performance when eating healthy foods.

Cadets also discussed healthy foods as a tool for weight loss due to how it made them feel satiated and more satisfied on fewer calories. For example, JrM1 discussed how he eats healthier food to lose weight. He stated, "I guess…I will eat more like grilled chicken and vegetables than, uh, like what I usually do. …it's lower in calories but it's more filling or it's still

filling." Some cadets discussed using healthy foods intentionally to help them lose weight because they were able to feel satiated and more satisfied on fewer calories.

A few cadets discussed reasons for not including healthy foods in their diets, such as cost, accessibility, and convenience. For example, JrF1 stated,

> "I just can't imagine people, especially in college, that can afford to buy all of that food and have time to eat that in a separate meal and still get enough calories to get through the day."

Cadets that discussed having reasons for not including healthy foods in their diet tended to report less healthy foods instead.

In summary, cadets tended to define healthy foods in terms of their nutrient content and dietary quality, suggesting they are important properties of foods to cadets. Nutrient content predominantly focused on proteins, vitamins, and minerals, suggesting a potential need to educate cadets on important nutrients (carbohydrate and fat) contained in a balanced diet. In addition to nutrient content, cadets predominantly discussed importance of protein, fruits, and vegetable food groups, while dairy and grains were overlooked. This raises concern because carbohydrates, vitamin D, and calcium-rich foods are vital for healthy, active populations. Furthermore, cadets referenced the food guide pyramid despite its replacement by the "Choose My Plate" recommendations in 2011, suggesting a need for more updated nutrition guidance.

Cadets that valued healthy foods identified benefits of feeling better throughout the day, improved physical performance, and assisting with satiety while pursuing weight loss. These findings suggest that focusing on the benefits of having nutritious and balanced food choices may support adoption of healthier eating behaviors. Cadets who reported not eating healthy foods cited the cost and effort required to purchase, plan, and prepare healthy foods. This finding

suggests a need for identifying resources for making healthy food choices more accessible to ROTC cadets.

3) Unhealthy foods

Almost all cadets defined unhealthy foods as foods that were greasy/fatty and sugary. For example, SrF2 described unhealthy foods as, "…typically, fast food...fried foods…dessert, not all desserts, but, things like ice cream or cake and things like that…" FrF1 also described unhealthy foods as foods that were , "very sauce or…fatty…", as did JrF2, who called unhealthy foods "fattening." For the most parts, cadets agreed that foods that they identified as unhealthy foods tended to be greasy, fried, or saucy.

Some cadets also defined unhealthy foods as very processed. For example, FrF1 talked about , "…staying away from that more…the super processed foods that I think of…the cereal, which has…a lot of sugar, usually staying away from that…" Similarly, FrM3 stated, "I mean as far as like other processed foods, just like, like any dessert…I always try and stay away from desserts like ice cream or cookies." The cadets appeared to think of unhealthy foods as highly processed foods.

Cadets also defined unhealthy foods as foods that did not provide nutritional value. For example, JrF2 stated that unhealthy foods are foods that, "…[don't] have nutritional value." Some cadets defined unhealthy foods as not providing nutrients that are needed or as not having any nutritional value.

Almost all cadets provided examples of unhealthy foods as greasy foods, fast foods, and desserts. For example, SoF1 provided examples of unhealthy foods as, "…things like…pizza or eating too…much pasta, or bread…things like desserts, cookies, cake…stuff like that." Similarly, SoM3 stated, "Yeah, so like no dessert, no candy…no eating at McDonalds…kind of

the foods that are just high in sugar and fat." In general, cadets agreed that their definition of unhealthy foods included greasy foods, fast foods, and foods high in sugar.

Some cadets also reported convenience foods as examples. JrF1 talked about, "…Ramen noodles, rice…SpaghettiOs…'cause I obviously see what they say on the nutrition label and it's pretty much 100% carbs…chips or popcorn or pretzels, and those are obviously the same crap that I eat every day…" Similarly, SoM3 talked about,

> "…things like…instant rice packets or…instant oatmeal, when the days are tight… hamburger helper…those things are usually a little bit quicker, higher in fat and sodium…frozen meals, too, that you can just heat up and eat right there…chicken pot pies…ramen…those are usually the things that are just quick."

Cadets acknowledged the unhealthy qualities of convenience foods, such as the high sugar, fat, and sodium content.

Most cadets reported avoiding unhealthy foods. Some cadets stated that eating these foods made them feel unwell. For example, SrF1 stated, "…like it does not really feel good for you to eat fast food, or greasy, fried food, and all of that…[it] makes you feel gross." SrF2 also discusses that these foods weigh her down. She stated,

> "So…if I go to the store and…I buy something like that [unhealthy foods] it'll make me sick and I tend not to eat those...just because of that reason. It doesn't necessarily taste bad but…it makes me sick…a lot of times, after eating foods that aren't necessarily healthy for me, fast foods or processed foods or a lot of desserts, I find that I just feel a lot more…weighted down, sluggish, throughout the day."

Many cadets discussed avoiding unhealthy foods because of some of the consequences they perceived from eating these foods such as not feeling good, not feeling satiated, and even feeling more tired after eating those foods.

Other cadets described unhealthy foods as negatively impacting their physical performance. SoF1 stated, "my body doesn't…feel as well…I don't perform as well in PT [physical training]." FrF1 stated, "[when] I ate… ramen…the night before and working out just

became so much harder and I felt, like, very bad running and everything." SoM3 stated, "I don't, like, thoroughly enjoy eating junk 'cause like I said it does affect you in ways, like, it makes you more tired and it kind of slows down your performance." Cadets that focused on physical performance reported observing that eating unhealthy foods resulted in slowing down their performance, even impacting their physical training. They've reported the impact of unhealthy foods on performance as one of the reasons they try to avoid unhealthy foods.

Some cadets even related unhealthy foods to the size and shape of their bodies. SrM2 stated,

> "I think it's better if I don't [have a dessert], just 'cause, like…I know for…my height and…with Army standards, I'm overweight in my height, and so…I-I try to…avoid…eating out…avoid eating…desserts."

Similarly, FrM1 stated,

> "I can't eat stuff like that [pizza and fried chicken] if I really want to stay in shape…like burgers and hotdogs and fries. I try to not to eat that, that type of stuff…I 've noticed…that...if I eat, you know, kind of bad things…I get bigger you know and like out of shape."

In relating unhealthy foods to the size and shape of bodies, cadets suggested that eating these foods results in someone becoming overweight and heavy set.

Interestingly, some cadets talked about reasons they included unhealthy foods in their diets. For example, SrF1 stated,

> "my weaknesses are, like, ice cream and cookies and chocolate. But I don't really worry about it because I tell myself I've eaten healthy enough and I work out enough that I can enjoy those things too and not really feel bad about it."

JrF3 also stated, "…I pretty much just eat whatever I want. I'm not like super worried about, um, like my weight or anything..." in reference to her eating out. SoM3, on the other hand discussed other reasons for eating unhealthy foods, stating ,

> "I also mix in with cheaper things like…Ramen, the classic, uh, college student meal…times when I'm, like, more busy…I'll make myself something really quick, like a bowl of Ramen…instant rice packets or things like that…instant oatmeal, when the days are tight…hamburger helper…those things are usually a little bit quicker, higher in fat and sodium…the unhealthy stuff is, the only reason I do that is for time and money-sake."

Some cadets intentionally included unhealthy foods in their diet. Most cadets that did this did so because of the cost and convenience of those foods, while some selected these foods due to food cravings, or lack of worry about the impacts of unhealthy food choices.

In summary, when discussing unhealthy foods, cadets defined unhealthy foods in terms of their nutritional and sensory qualities, suggesting that nutritional and sensory qualities are important properties of unhealthy foods for cadets. However, cadets appeared to demonize fats, not acknowledging some potentially healthful fats and oils. Cadets also defined fried foods, fast foods, desserts, and convenience foods as unhealthy foods. The evidence suggests that cadets are aware of unhealthy food sources, including ultra-processed foods, which is in agreement with current research seeking to define and describe the health impacts of ultra-processed foods (Juul et al., 2018).

Most cadets described avoiding unhealthy foods due to some of their perceived consequences, suggesting that focusing on balancing the intake of unhealthy foods as well as the impacts of these foods on performance may be a beneficial way to provide education to cadets in relation to their eating behaviors. Some cadets discussed reasons for including unhealthy foods in their diet, suggesting the need for education on healthier alternatives that are cost and time effective to replace some unhealthy food choices. Few cadets discussed not being overly concerned with intake of unhealthy food choices, also suggesting a need for education on the functions of foods, which include eating for pleasure, so as to not dichotomize food choices.

2b. Theme 2: Determinants of eating behaviors

This theme was defined as how cadets decided what foods to eat. 1) Food access and availability was defined as how and where cadets access foods. 2) Feelings related to eating behaviors was defined by cadets using feelings, such as hunger/satiety and food preferences/cravings, to decide eating behaviors. 3) Knowledge related to eating behaviors was defined by cadets using knowledge about nutrition and food choices to decide eating behaviors. 4) Money was defined by how money and the cost of food related to the eating behaviors of cadets. 5) Time was defined by how time, either as a daily schedule or a cafeteria schedule, as well as the time and convenience of preparing meals, affected eating behaviors (Table 6.5).

1) Food access/availability

Availability was defined as how and where ROTC cadets access foods. For most cadets, availability was defined by whether they lived on campus and had a meal plan or lived off campus and had to grocery shop and prepare their own foods. Most cadets living on campus, discussed this as helpful to their eating behaviors because it provided them access to foods. FrF1 discussed how the cafeteria has been helpful to her. She stated,

> "So, I like that…there's, like…a variety of food so, you can kind of pick and choose…sometimes…the caf [cafeteria] has, like, really good options and then other times it feels like there's not a lot…I mean you can always eat a salad…I…go…back to the caf [cafeteria] for…a second breakfast…then sometimes I would go back to the caf [cafeteria], like, after dinner and have a little, like, snack after while I studied, so."

Similarly, JrM1 stated, "the quantity of food available and like the variety available in the cafeteria is greater." Cadets living on campus and eating at cafeterias described as one of the advantages being that they had access to a greater variety of foods.

Some students living on campus also felt that living on campus and having access to the cafeteria helped them make healthier food choices. SoF1 stated,

> "Once I was able to figure out where things were and when food was served and figure out how that works with my schedule, I was able to make some more of those…healthier choices…with my meals and able to…plan everything out a little bit more."

However, some students found that eating in the cafeteria actually made it more difficult to make healthy choices. For example, JrM1 stated,

> "…it would be easier if I didn't like eat in the caf [cafeteria] all the time…'cause I wouldn't have all the other foods already prepared in the cafeteria…'cause…sometimes they'll have something that I really like…temptation is greater in the cafeteria than it would be at home…the food is already prepared for you and in like in more variety, so it's easier to eat more food in the cafeteria than it would be at home…it can sometimes be frustrating…because, like…I know that I'll eat more in the cafeteria when I don't like need to but since it's food that like, it's easier to eat just 'cause it's right there. It's easy access."

While most cadets found that they were able to eat healthier because they ate at the cafeteria, and had daily access to fresh fruits and vegetables, another cadet found that having too many choices made it harder to eat healthier because in addition to having access to healthier foods, cafeteria also provided easy and unlimited access to unhealthy food choices.

Some students found living on campus and eating at the cafeteria was not as helpful to their eating behaviors. Cadets stated that because they lived on campus and had to eat at the cafeteria, they had trouble accessing foods because of the schedule when the cafeteria was open, they perceived having limited food choices, or they did not enjoy the food choices available. SrF1 stated,

> "I guess, if anything, my diet has become…less diverse…when I'm at home, I have a lot of different foods that my mom will make, like…chicken cordon bleu…or meatloaf or whatever. But here, I really just eat chicken as my meat."

Similarly, FrM2 stated, "there's not a whole lot of options, but if I want options, I will get a salad." However, some students adapted to this by keeping foods in their room. For example, SoF1 stated,

> "I…make sure I keep some stuff in my room as well if I don't have time to go to the caf [cafeteria]…I have some Jimmy Dean Breakfast sandwiches…so I'll eat one of those if I don't have time to go to the caf [cafeteria] for breakfast."

Some cadets described negative aspects of living on campus and relying on the cafeteria for their foods, including lack of diversity of choices or not enjoying the foods that are served. Yet, other cadets overcame these challenges by keeping their own foods in their dorm rooms or preparing their own foods on campus. However, this also entails spending additional money beyond the money that was already spent to have an on-campus meal plan, which may not be possible for all cadets living on campus.

For most students living off campus, they had to access their foods by purchasing them at the grocery store and preparing them. Most cadets living off campus reported more difficulties with access to foods due to cost, time, and money to prepare foods. For example, SrF2 discussed how sometimes she won't get a chance to eat because she prepares her own foods. She stated,

> "sometimes, I don't always get a chance to eat, because I always cook my meals for the most part. And, so, I don't really buy ready-made anything and, I know, it's not as healthy, but at the same time, it does give…people more time and a chance to eat."

SoM2 found himself eating a mix of the healthy and non-healthy. He stated,

> "I try to, as much as I can…save money. So…my diet consists of…a blend of…frozen vegetables and meat and that sort of thing, usually cooked into a, a meal. And then…I also mix in with cheaper things like…Ramen, the classic, uh, college student meal."

SrM2 also stated that sometimes he doesn't have what he wants so he tends to eat out more. He stated, "I look at…what food I have…if I can make it, I'll make it. If not, I'll just eat whatever else I have, or…[if] I don't have any food or…I haven't done grocery shopping…I get some food." Cadets living off campus have different challenges when accessing food. They have to go to the grocery store, purchase the food, and prepare their own foods. For some cadets, this results in not being able to eat certain meals. For other cadets this results in incorporating a variety of

healthy and not healthy foods due to the cost of foods. And yet other cadets, will eat out more often.

Some students living off campus also felt that living off campus limited their access to healthy foods. For example, JrF1 stated,

> "I'm living… about half an hour away from campus...and then I work a lot of hours...in the morning when I get ready for PT I have to pack everything in my bag for the entire day…for lunch I'll have, you know, ramen noodles…So, I'm obviously not eating well. Um, but that's mostly just because I'm really busy... you can't be carrying around, you know, fresh meat or fruit with you for twelve hours a day when you're on campus."

Similarly, SoM2 stated,

> "I live in an apartment; I don't have the MSU meal plan or anything like that. So…what I do pay attention to is when I go to the store is to try to buy like more healthier things but it's a tough balance between like the price you're going to pay at the store…how long it takes to actually to prepare that meal…how difficult it is because a lot of people, a lot of college students don't really know how to cook that well."

For most cadets, living off campus limited their access to what they described as healthy foods. Some reasons for limited access were not being able to transport and prepare foods while on campus, as well as the perceived cost of healthy foods and the time it takes to prepare healthy foods.

Availability of food is an important consideration in understanding the eating behaviors and food choices of ROTC cadets. For example, one might expect that students living on campus with access to cafeterias would have greater ease and access to healthier food choices since they do not have to purchase or prepare foods. While this is true for some cadets, other cadets also perceived barriers such as variety, taste preference, and even the schedule when cafeterias are open that cadets must overcome. On the other hand, students that live off campus, although they may have access to a greater variety of foods through grocery shopping and access to meal prepping, have perceived barriers of time, cost, and preparation of those foods. Therefore, the

evidence suggests that understanding the eating behaviors of cadets must consider their living situation and perceived barriers to accessing healthful foods and provide suggestions and solutions through nutrition education to perceived barriers tailored to their specific living situations.

2) Feelings

The cadets discussed two feelings in relation to their eating behaviors, hunger/satiety and food preferences/cravings. Cadets described hunger and satiety in different ways in relation to their eating behaviors. Some cadets reported using hunger and satiety as a means to decide when to start eating and when to stop eating. For example, FrM2 stated, "I kind of eat when I feel hungry and…I drink when I feel thirsty." Similarly, SrM2 stated,

> "…typically…lunch I would eat…just to…where I don't need to eat more, but…I could still eat more…dinner…I would either just eat until, like, I get full…I would say, like, dinner is, like, the heavier meal of the three."

Many cadets talked about how their eating related to hunger and satiety, with many, but not all, cadets reporting that they tend to eat when hungry and tend to stop eating when full. Hunger and satiety may be an important eating behavior to consider when working with cadets.

Other cadets discussed selecting specific foods or eating behaviors because of their perception that they would result in satiety or feelings of fullness. SoF1 talked about how missing breakfast affected her day. She stated,

> "…if I don't eat something…filling in the mornings, I tend to get pretty hungry throughout the day…and when...I get very hungry…I'm not able to pay attention as well in class…I get pretty sleepy…and I am not able to keep my eyes open in class."

FrM2 stated, "If I am feeling, like, really hungry I'll have…roasted chicken and…mashed potatoes." He also stated, "I usually like to eat…light ingredients…but like heavier meal because…I like to have a lot of calories…so I cannot be hungry, or I can run longer." Many

cadets reported feeling hungrier during breakfast meals because of their physical activity training. Other cadets discussed making specific food choices in order to satisfy hunger. This evidence suggests that talking about the satiety properties of foods may be important when working with ROTC cadets, including activity-oriented meal timing the night before and the morning of physical training to assist with managing hunger and satiety.

Cadets also discussed their food preferences in relation to their eating behaviors. Cadets tended to focus on the taste of foods as well as cravings for foods. For example, SrM1 stated,

> "…I'd probably say taste is number one…if it doesn't taste good, uh, probably won't eat it…if I'm given a choice…to eat something that tastes good or not tastes good, I'm always going to choose the thing that tastes better…for example…I'll eat carrots and snap peas…for a snack…because…they taste fine to me…but I will not eat broccoli because it tastes so gross to me."

SoM2 talked about how he struggled with the foods he enjoys, stating, "I struggle to limit my intake of those three things [meat, cheese, and bread], a lot, 'cause that's kind of like the core of what I really enjoy to eat and it's not too difficult to make." For many cadets, the taste of food was a primary reason for the foods they chose to eat. This means it is important to consider food preferences and offering alternatives, for example for vegetables, to assist cadets in making balanced food choices without forcing them to eat foods that don't taste good to them. Talking about managing cravings may also be important with cadets.

A few cadets even talked about food as a way to soothe and reward themselves. For example, JrF1 talked about, "get[ting] either like a donut or a candy bar if it's a really rough day." Similarly, in talking about dessert, SrM2 stated,

> "I would probably eat, like, dessert…all the time, but…I usually, like, maybe once a week if not once every other week…like, ice cream or…cookies or stuff like that. I normally, uh, try to avoid those…but...once a week, I'll…spoil myself."

A few cadets used foods to reward themselves, which is not in itself problematic, but perhaps alternative strategies for managing stress, as well as an "all foods fit" approach can help prevent this behavior from becoming problematic.

Cadets' feelings about food, including hunger/fullness and food preferences and cravings, appear to be important aspects related to their eating behaviors. The evidence suggests that many cadets already use hunger/fullness cues to decide when to eat and what to eat. However, there also appears to be room for instructing cadets on strategies for managing hunger/fullness, including recognizing and respecting hunger/fullness cues and managing mealtimes and food choices to assist with hunger/fullness. Another major aspect related to eating behaviors were preferences, such as taste. Respecting cadets' taste preferences, as well as providing alternative ideas for including food groups, especially vegetables, may be beneficial in encouraging cadets to improve eating behaviors. It may also be beneficial to further explore food cravings and the idea of using foods as rewards and as a way to soothe in order to identify and manage potentially problematic eating behaviors.

3) Knowledge

Cadets also discussed how knowledge about foods related to their eating behaviors. Some cadets discussed the type of nutrition knowledge they had. Many cadets discussed knowledge related to nutrition for activity level. For example, JrF1 discussed,

> "…somebody with my activity level should be eating…lots of protein…and I know that we also need carbs...as a primary energy source just to get through the day…preferably complex carbs instead of simple sugars."

Many cadets acknowledge that their nutritional needs may be different due to their activity levels. Only a few cadets recognize the importance of total energy intake, as well as intake of carbohydrates and protein.

Many cadets also discussed knowledge related to unhealthy food choices. For example, SrM1 stated, “I think it’s pretty well known that vegetables are a healthy thing and potato chips are not a healthy thing.” Similarly, SoM2 stated, “I'll stay away from that stuff [junk food, Doritos] and I think that's just a pretty…well known thing that that’s not the healthiest option.” Most cadets report having knowledge about “unhealthy food” choices. Many cadets report feeling that information about unhealthy foods is “common knowledge”.

Other cadets discussed how they used their knowledge to inform their eating behaviors. For example, SrM1 stated, “…a lot of times I’ll use recipes that my mom makes at home that I know I like…that are convenient for me to make that are easy to make that I know I can make.” Another example was given by SoM2, who stated,

> “I would say…for a person my age, as active as I am in ROTC…I try to maintain…the classic food pyramid…how much you’re supposed to eat per day of…dairy, meat for protein, fruits and veggies, grains…[I try]…to make sure that I have, each day, the recommended amount of…each of those items.”

Some cadets report using knowledge learned from home, including knowledge on food preparation, to inform their eating behaviors. Other cadets report using knowledge learned from school, including knowledge about the food guide pyramid, to decide which foods to eat.

Other cadets stated that they had limited knowledge. For example, SoM2 stated, “I'm not very educated…on exactly all that I need and how much of that thing I need.” A few cadets reported that they didn’t feel like they had a lot of formal education on nutrition and based their eating behaviors on what they had been told or past experiences.

Cadets generally described an awareness of nutrition needs for physical activity. However, only a few cadets expressed specific knowledge regarding nutrition for athletic performance. Therefore, this gap may represent an opportunity to support cadets’ eating behaviors. On the other hand, few cadets reported that their eating behaviors were based on their

nutrition knowledge. This finding suggests that not enough is known on how cadets act upon their nutrition knowledge to determine their eating behaviors. However, almost all cadets previously reported avoiding foods they considered unhealthy, while most also communicated that knowledge about unhealthy foods was generally known. This evidence suggests that cadets do indeed enact some nutrition knowledge, at least in terms of what foods they tend to limit or avoid. A few cadets also reported that they had limited knowledge on nutrition and used other experiences to inform their eating behaviors. Taken together, the evidence suggests that cadets are willing to enact nutrition knowledge in relation to their eating behaviors, but perhaps there are some potential gaps, such as nutrition for physical performance and how to enact nutrition knowledge into eating behaviors.

Cadets also described gaining nutrition knowledge from a variety of sources, including family members, previous classes or participation in sports, current degree program, the internet, and other cadets. Many cadets described growing up with healthy eating habits. For example, SoF1 stated,

> "I was raised on pretty, pretty healthy foods overall…so, I learned pretty early on…that I felt a lot better if…I ate…more things like protein, and fruits, and vegetables…I grew up…with my mom teaching me [how to shop and cook]…"

Many cadets also reported using recipes that they learned for your family. JrF3 stated, "I usually just text my mom…and ask her what kind of [recipes to make]…she usually gives me some suggestions." Cadets described learning their eating habits from the way their parents fed them. Other cadets stated that their parents would be their primary source on what healthful foods were. Parents were also the source of how to shop, cook, and prepare foods.

Cadets reported learning a lot of basic nutrition information from experiences in school including high school and middle school classes or through sports. SoM1 stated, "We got into a

health class that taught us…the basic components of…foods with carbs, proteins, vitamins and such like that." Similarly, SoM3 stated,

> "I took a foods class in high school…what's good for you, what's bad for you…what good habits are…one of the main projects was coming up with a meal plan for a month…I think that was a pretty good way to look at it…figure out the things that you should do, the habits you should get into."

SrM1 stated, "…my coach talked about carbo-loading in high school…so that's what I do…run for like performance." Some cadets also reported gaining knowledge related to nutrition through school classes and team sports. These cadets described more knowledge about more specific aspects of nutrition, such as the basic nutrient components of foods and how to plan and eat for performance.

Some cadets reported learning about nutrition from their current degree programs. For example, SoF2 stated,

> "I think it's been really helpful, as a nursing student…we're having classes on pathophysiology and nutrition and health promotion, and so it's helpful for me to be able to see…what are the breakdown of the nutrients in the foods that we are consuming and how does that affect our body long-term, and what can be some of the negative adverse effects of not supplementing our body properly with nutrients…[and] understanding some of the physiology behind how our body reacts to those things has definitely impacted my own personal lifestyle as far as my eating habits and physical activity."

A few cadets described learning about nutrition from their degree programs. These cadets communicated more advanced concepts in nutrition relating to the physiology of nutrition and fueling for performance.

Other cadets learned about nutrition from the internet. SrF1 stated she followed people on "…Instagram, like, a lot of healthy food people on Instagram that I see making different recipes…" Another cadet, FrF2, reported using different bodybuilding websites, such as bodybuilding.com. She stated, "…body building PhDs actually do research you know…they

usually have…articles…what combinations of foods or…prior supplements…something that they actually know about…certain workouts…to lose weight or like gain muscle." FrM3 stated,

> "I've just looked up…online…other people um…like fitness athletes…I've looked up articles online…fitness pages…body building pages…and just…some of the advice that they have to like help them maintain a healthy lifestyle."

Some cadets also gained nutrition knowledge from the internet, through internet searches or by following social media pages. Most cadets reporting using social media tended to focus on people described as "fitness athletes" or pages related to "bodybuilding."

On the other hand, some cadets learned about nutrition from other cadets. For example, FrF2 stated,

> "Somebody told me…[to drink] beet juice…[because] beet juice actually helps with the endurance, to keep going…they told me [to take it] a month and a half before the PT [physical fitness] test…I tried it and, you know, the running…the endurance has been lasting awhile."

Similarly, JrM1 stated, "…talking to other people and…asking them like how they eat, or what they eat, how they exercise…talking to other cadets who do well on the PT [physical fitness] test…just asking…what do they do…hearing out what other people's strategies are." Many cadets also reported relying on other cadets for nutrition information, including information on dietary supplements and information on eating to enhance physical performance.

In addition to discussing how nutrition knowledge related to their eating behaviors, cadets also discussed sources of nutrition knowledge. For many cadets, these sources included family members, pervious classes and participation in sports, current degree programs, the internet, and other cadets. The most important source of nutrition knowledge appeared to be family, in particular eating habits developed while growing up. Cadets also discussed still determining their nutrition knowledge from the advice of family, as well as seeking information on shopping and meal prepping from family. The evidence suggests that family represents an

important source of nutrition knowledge, although the knowledge communicated by family members may not always be accurate. So, therefore, it is important to gauge not only what the knowledge of cadets is, but also the sources of knowledge, and the accuracy of this knowledge.

Many cadets also discussed gaining nutrition knowledge from academic settings, including middle school, high school, sports participation, and current degree programs. Cadets acquiring knowledge through school and sports tended to focus on the basic components of foods, such as carbohydrates, proteins, vitamins, and basic food groups. Cadets reporting knowledge from sports also talked about sport-specific eating consideration, such as carb loading. Cadets have also gained knowledge through current degree programs. Cadets reporting knowledge through current degree programs, particularly in health-related fields, tended to discuss more advanced concepts of nutrition, such as nutrition pathophysiology and nutritional needs related to physical activity. The evidence suggests that while some cadets are exposed to nutrition knowledge prior to participation in ROTC, this exposure is not consistent. Similarly, the level of nutrition knowledge is not consistent across cadets, suggesting that exposure to advanced nutrition concepts, in particular nutrition for performance in the higher education setting may be beneficial for this population with specialized nutrient needs as well as a specialized role as future leaders and mentors in military settings.

Cadets also discussed gaining nutrition knowledge through knowledge sources that may be less reliable, such as the internet and other cadets. Cadets using the internet, focused on internet pages related to “fitness athletes” and “body building.” Many of these pages may, unfortunately, not be created and monitored by credentialed professionals, and may therefore serve as a platform to perpetuate unhelpful and unhealthful ideas and knowledge related to nutrition and body image. Similarly, knowledge gained from other cadets, depending on the

other cadets' experience, education, and credentials, may also lack the evidence base of nutrition information provided by reputable sources, such as registered dietitians and evidence-based practice guidelines. Taken together, the evidence suggests that cadets may rely on unreputable sources of nutrition knowledge which in turn may perpetuate harmful ideas about nutrition that may result in unhealthful eating behaviors that could intensify concerns about body image and dieting that, in the long term, result in development of eating disorder symptoms.

4) Money

Several cadets also reported how money and the cost of food related to their eating behaviors. Money was expressed as an important reason for eating behaviors, especially for cadets living off campus who did not have a dining hall meal plan and purchased their own foods. For example, JrF1 stated,

> "well I think most people would hope that healthy foods are more affordable because everybody goes to the grocery store and it seems like the healthy foods are more expensive and I don't know very many college kids who can afford that…when I go shopping I see that…fruits or vegetables or the healthy chicken is way more expensive than other things that don't go bad first of all…and second of all are quicker to prepare…so…money is a big deciding factor for me….I know that somebody with my activity level should be eating…lots of protein…and I know that we also need carbs.....but I also know how much it would cost and how much time and planning it would take…I couldn't make myself spend that much money on food."

The cadet described that she understands what meal pattern she should be following, and what kinds of foods she should focus on, but perceives that those foods are more expensive and perishable, given her time limitations, so she states she can't see herself spending that much on money.

Despite monetary concerns expressed by other cadets, they also expressed a willingness to find a balance between healthy eating. For example, SoM2 stated,

> "…what I do pay attention to is when I go to the store is to try to buy like more healthier things but it's a tough balance between…the price you're going to pay at the store…how long it takes to actually to prepare that meal….how difficult it is because a lot of people…don't really know how to cook that well."

He goes on to state, "Even though it is really easy to buy, it's really cheap, and it's…really convenient…I just try to stay away from that stuff," meaning he usually purchases and prepares his own foods, like vegetables, meats, cheeses, and breads, instead of relying on convenience foods. SoM3 also stated,

> "…I am a college student …so I try to, as much as I can…save money…so…my diet consists…of a blend of…frozen vegetables and meat…usually cooked into…a meal…and...I also mix in with cheaper things like…Ramen…you can say my diet is…a mix of both the healthy and the non-healthy..."

So, despite expressing concerns about money and the cost of foods, some cadets articulated ways to balance healthy food choices with cost.

Some cadets also prioritized preparing their own foods over dining out to save money. For example, SrM2 stated, "…if I spent more money on…grocery shopping…I'd rather… use my money, time with my groceries and…avoid eating out." SoM2, who liked to purchase and prepare his own foods stated, stated, "…going out to eat is kind of a more expensive thing…especially for a college student…so, it doesn't happen too often, I would say the times it does happen is when…you got a reason to do it." Despite money being a concern, cadets prioritized preparing their own foods over eating out to save money.

Only two cadets living on campus and dining in the cafeteria discussed the role of money and cost in their eating behaviors. For example, FrF1 stated, "Rarely…sometimes when my friends come up, we'll go out for…a meal…but…fund-wise, I'd rather eat at the caf [cafeteria]…because I'm already paying for it." Similarly, JrM1 stated, "I don't order food or go out to eat a lot, just because the caf [cafeteria] is a two-minute walk away and I already paid for

it." So, generally, students that live on campus and have paid for an on-campus meal plan reported prioritizing eating at the cafeteria to save money.

Some cadets expressed that despite having knowledge about healthy eating behaviors, they chose not to follow that knowledge due to money concerns. Despite monetary concerns, other cadets also expressed a willingness to balance the health benefits of foods, including using a balance of foods that they perceived healthy and unhealthy, preparing their own foods, and limiting dining out. Although most cadets that had on campus meal plans did not express concerns with money, at least two cadets living on campus stated they were unwilling to spend additional money on food because it was already paid for and available to them. The evidence suggests that there is a need to assist cadets in actionable ways to balance choices about eating behaviors with concerns about cost.

5) Time

Most cadets discussed time as a primary reason for their specific eating behaviors. Time appeared to be described in two different contexts. One context was that of following a schedule, whether it was a class schedule or the schedule when the cafeteria was open. The other context was in terms of convenience and the time it takes to prepare and eat meals. With respect to schedules, several cadets discussed altering their eating behaviors due to their schedules. All ROTC cadets discussed their schedule included the time for physical training, which consisted of reporting to physical training by 5:45am until 7:00am at least three times per week.

From there, the interaction between the ROTC schedule and the cadets' class schedule resulted in different eating behaviors. For example, some cadets reported eating different foods than they normally would eat. For example, SoF1 who discussed that she usually ate eggs at the cafeteria for breakfast and a salad and sandwich for lunch, stated, "I keep some stuff in my room

as well if I don't have time to go to the caf [cafeteria] at all…lunch, on a busy day, is usually…a granola bar or something similar." Similarly, SrF1 reported that she carried fruit and peanut butter in her bag, stating, "I'm on-the-go a lot, I don't really have a whole lot of time to stop in the caf [cafeteria]…so, I'll usually eat that. I don't really have a breakfast outside of that. Several cadets had to alter the usual or preferred food choices at specific meals due to time limitations.

Other cadets discussed skipping meals altogether because of time limitations. For example, FrF2 stated, "sometimes when…you're running late to class, for me, sometimes, you know, I don't have time to eat. I…skip meals, the majority of the time." Similarly, FrM1 stated, "I'd say about three or four times [I skip dinner], ' cause the caf [cafeteria], I can never remember when they open and close." Several cadets also chose to skip meals because of time limitations.

A few cadets also discussed dining out more often because of time limitations. For example, SoF2 stated, "I do, occasionally…go to fast food restaurants, if…on my way back from clinical or…I didn't have time to prepare food beforehand." JrF2 also stated, "some weeks I would do…food prep for the week and…other weeks I'll eat out a lot like it just depends on like my workload or how much time I have to cook." JrF3 similarly discussed how her schedule related to eating out, stating ", I think it just depends on like my schedule…so…when I work…I'll eat like McDonald's [for breakfast]…Mondays and Fridays…I'll make dinner." She also discussed living near a lot of fast food restaurants and eating out on days she didn't prepare foods. Some cadets dealt with time limitations by dining out for meals more often.

Another way time was discussed was in terms of convenience and the time it took to prepare meals. For example, cadets that had limited time for meals reported relying more on convenience foods. JrF1 stated,

> "I'm living…about half an hour away from campus...and…I work a lot of hours...so, in the morning…I have to pack everything in my bag for the entire day…I have to do

> something quick and something that's nonperishable that I can just toss into the microwave and eat in fifteen minutes and then go back to work…for lunch I'll have…ramen noodles and then by the time I get home I'll get some SpaghettiOs or rice or something for dinner…so, I'm obviously not eating well…but that's mostly just because I'm really busy...I'm just kinda fitting it in where I can."

Similarly, SoM3, who stated,

> "…probably like 2-3 times a week...I have…what I would consider a well-blended…and then the other times would be times when I'm…more busy…I'll make myself something really quick, like a bowl of Ramen…it only takes, like, three minutes and then go about my business…other things…like instant rice packets…instant oatmeal, when the days are tight…hamburger helper…those things are usually a little bit quicker, higher in fat and sodium, I guess…the unhealthy stuff…the only reason I do that is for time and money-sake."

Other cadets dealt with time limitations by relying on convenience foods that are "higher in fat and sodium."

Most cadets reported that time had some degree of impact on their eating behaviors. For some cadets, this entailed altering their usual food choices at meals so they could eat on the go. For other cadets, this involved skipping meals altogether or dining out more often. Some cadets responded to time limitations by relying on quicker, more convenience food choices. The evidence suggests that time limitations are an important factor to consider in understanding the eating behaviors of cadets. Nutrition education geared towards cadet should be focused on providing nutritious and feasible alternatives when time is a concern.

2c. Theme 3: The role of the ROTC context in shaping eating behaviors

This theme was defined by the different aspects of the ROTC context that influenced eating behaviors. 1) The role of the cadre was defined by the different ways the cadre influenced cadets' eating behaviors. 2) The ROTC context in general was defined how participating in ROTC influenced cadets' eating behaviors. 3) The role of other cadets was defined by how other cadets influenced cadets' eating behaviors. 4) Physical training was defined by how participating

in ROTC physical training had an impact in cadets' eating behaviors. 5) Preparation for the physical fitness and body composition assessment was defined by what cadets did, in terms of their eating behaviors, to prepare for physical fitness and body composition assessments. 6) Perceptions of body image within the ROTC context was defined by how cadets perceived body image within ROTC, how body image related to ROTC, and how body image related to cadets' eating behaviors (Table 6.6).

1) The role of the cadre

Cadets described the role of the cadre in relation to their eating behavior. Many cadets stated that one resource the cadre provided in terms of eating behavior was a class about nutrition. SrM1 stated, "I think maybe MS1 [military science first] year they talked about some nutrition help program or something like that." FrM1 similarly stated,

> "We had a class on…overall well-being in the military and…one of those things that were talked about in the class was...the food…pyramid…our [cadre]…is basically talking to us about…eating healthy and how eating healthy is one of the most important things in the Army because it…brings overall good fitness…on and off the battlefield…he said… 'a soldier needs to be…trained and disciplined…and food…plays a big part in that'…"

While other cadets felt like they weren't taught much. For example, SrF1 stated, "…it's [nutrition] not really a big emphasis, I'd say." Similarly, FrM3 stated,

> "…there hasn't really been a lot of the cadre…stressing the importance of nutrition…they'll stress…you have to run a lot, you have to lift heavy weights, you have to go and read up on the material, but they don't really stress…how important the nutrition is, at least from my perspective, from what I've heard."

The cadets appear to suggest that the primary way the cadre may relate to their eating behaviors is through a nutrition class taught during the first year of the ROTC program. While some cadets found it helpful, other cadets did not find that nutrition was an important emphasis of the cadre or that they were taught much about nutrition by the cadre.

Cadets also described the cadre as role models and mentors who, by their own level of physical fitness, set an example in terms of eating behaviors. For example, JrF1 stated,

> "…most of our cadre were in combat arms…so, they have been physically fit their entire career…they're still really in shape...so I think a lot of people really look up to them for their expertise…they know the demands of the PT [physical training] and how best to fuel your body…so, they do definitely have a positive impact."

In contrast, JrF3 stated,

> "…they don't even really talk about…I mean…like I know that they…want us to eat healthy and stuff, but that's not like a huge thing that they really hit on…they're just all about like PT [physical training] and stuff…when they talk about fitness…it's just all about like working out…they want us to pass our PT [physical fitness] test so, in order to pass your PT test, you do more PT [physical training]…they…just really focus on doing more PT [physical training]."

Many cadets reported looking up to the cadre due to their physical appearance and abilities and looking to the cadre to advice regarding physical performance. However, the emphasis appeared to be on physical training vs. other eating behaviors.

Some cadets stated that the cadre tended to focus mainly on people who were struggling to meet physical fitness and body composition standards, but if you did not fall into that category, the cadre would not seek out to help you. For example, SrM1 stated,

> "They [the cadre] are concerned about…their main concern is the PT [physical fitness] test and height and weight [body composition assessment]…if you're passing that…good…and then if you're not passing that…then…they'll…get more involved…they'll start…helping you out…give you a more regimented…diet and nutritional help…but…if you're doing fine in those things they're not going to…outline for you how to do it, 'cause clearly whatever you're doing is, doing alright."

SrF2 also stated,

> "So…if the cadre members saw that there was a cadet struggling or if they saw…a cadet was reaching out for help for nutrition…they would step in. However, if they saw that a cadet was healthy or didn't need help, they wouldn't mention anything about nutrition."

A few cadets expressed a less positive view of this involvement. For example, JrF1 stated,

> "…whenever they [the cadre] see us eating crap when we're in class…they make comments about it…if you don't absolutely have a 300 PT [physical fitness] score [maximum score on physical fitness assessment] they talk to you about…what could you be doing better... 'maybe you should be working out more on your own time'… 'maybe you shouldn't be eating pizza… you would do better on the PT [physical training] test'…"

While almost all cadets agreed that the cadre would provide help is asked, they also all stated that help was focused on individuals who were struggling to meet physical fitness and body composition standards vs. other cadets in general.

A few cadets felt that they were already expected to have a certain level of nutrition knowledge for success in ROTC. For example, JrF3 stated, "…it just doesn't really seem there's anything in place…I think they [the cadre] just…kind of expect us to know, that you just need…to PT [physical training] and eat healthy and then you'll pass height and weight [body composition assessment]…and your PT [physical fitness] test." FrF1 also stated,

> "Specifically, I mean, I don't feel like it's [nutrition] discussed a lot in ROT-C…you're expected to know…already…especially because it [nutrition] is something sort of taught in high school…I feel like I've learned a lot more from my class then I have maybe through ROT-C."

Some cadets felt they did not get much help related to nutrition from the cadre because they were already expected to know what they need to do in terms of nutrition to be successful in ROTC.

At the same time, cadets expressed that they wished the cadre would do more in terms of providing access related to nutrition. For example, JrF1 stated,

> "I find that they do [get involved]…when it's too late…when people have gained 20 pounds and need to lose it in a month or when people have actually failed the PT [physical fitness] test. I don't think they usually get a jump on it very early and I think it'll be more beneficial if they did."

FrF2 also discussed wanting to see more involvement from the cadre, stating she would like them to ask, "… 'raise hands, how many of you work out?...how many of you go to the gym?

How many times in a day?'…it can get really specific and not broad," stating she felt the current class was too broad whereas cadets may benefit from more specific guidance. So, while cadets seem to agree that what the cadre do is helpful, some cadets would also like to see more involvement from the cadre, earlier, with specific guidance, so that nutrition is made a priority in ROTC.

Cadets described the role they felt cadre played in terms of nutrition and their eating behaviors. Many cadets reported receiving a nutrition class during their first year of the program which appeared to be focused on the food guide pyramid. The evidence suggests that some cadets found this helpful, while other cadets felt that that the guidance was not specific enough to be actionable. Cadets also viewed the cadre as role models and mentors, with the findings suggesting that the cadre tended to emphasize physical fitness over nutrition. The cadets also stated they thought the cadre focused more on cadets struggling to meet physical fitness and body composition standards rather than most cadets who did not struggle. The overall findings suggest that while the cadets look up to cadre, and believe them to be good role models, they do not feel that what is in place is currently helpful to their personal eating behaviors. The cadets would like the cadre to be more involved with eating behaviors, especially providing specific guidance earlier in the semester that can be acted upon rather than right before a physical fitness assessment or right after failing one.

2) The ROTC context in general

Cadets described different ways participating in ROTC related to their eating behaviors. For some cadets, they had to make a lot of changes to their eating behaviors in order to participate in ROTC. For example, JrM1 reported finding out there were specific weight requirements to participate in ROTC when he received an ROTC scholarship. He stated,

> "I lost a lot of weight…I was only eating about fifteen to eighteen hundred calories a day…intentionally…but same foods…I would eat…I would just…count the calories and once I got to between fifteen and eighteen hundred [calories]…that would just be…it for the day…so, that allowed me to lose weight…so, I would say…that [participation in ROTC] influenced me for a little while, and then I just kind of like went back to how I used to eat…"

For SoM3, this entailed making changes in high school, stating,

> "I cut…all sugary food out of my diet completely and I ate strictly…what quote end quote healthy food…that was all in prep for ROTC…I was trying to be…in best shape as I possibly could be."

Many cadets, in particular cadets that are overweight or obese and above their table screening weight, reported changing their eating behaviors prior to and because of participation in ROTC, usually focusing on cutting out "unhealthy foods," and replacing them with "healthy foods" in order to lose weight.

For other cadets, regular physical training has had some influence on their eating behaviors. For example, some cadets report eating breakfast because of physical training. JrF2 stated, "…there's not much of a difference…I just always try to eat breakfast because we exert our body so early in the morning, but that's…about it." Other cadets report being hungrier because of physical training. For example, SrF2 stated, "I feel like whether I was in ROTC or not I'd still eat the same…I would say that…I am more hungry because of the exercises and the training that we do." For some cadets participating in ROTC meant they participated in regular physical fitness training. As a result of regular physical fitness training, some cadets reported eating breakfast more frequently, while other cadets reported being hungrier at breakfast and eating larger breakfast meals.

And, yet, other cadets report being more conscious about what they are eating because of physical training. For example, FrF1 stated,

> "…by working out more…in the mornings, has made me feel a lot better about my body…I find…I really don't want to eat some of…the super sugary things just because…I don't want to have that... I feel like I have more control over…what I can do."

FrM3 also stated,

> "…as far as specifically for ROTC…I've made the health changes just 'cause ROTC demands a lot more physically then…what I've done in the past…since you have to perform physically, like very well for ROTC and for the Army…mainly it was learning how important the physical performance and my like mental performance was and…just hearing about, how much…better…you feel and how much better off your body is for eating healthier…so…just like changing out…instead of eating…regular chicken sandwich, it'll just be the chicken patty and um vegetables so like green beans instead of fries or a side salad instead of uh like a traditional side."

For some cadets, participating in ROTC, and in ROTC physical training, has made them more conscious of their eating behaviors, meaning they report substituting out unhealthier food choices with healthier food choices as well as making specific food choices focused on their performance.

For many cadets, participation in ROTC, and specifically participation in ROTC physical training, has brought about changes to their eating behaviors. For some cadets, this entailed making changes to their eating behaviors prior to participation in ROTC in order to meet the physical fitness and body composition requirements. For other cadets, participation in ROTC has made them more aware of their breakfast meals resulting in them being hungrier at breakfast or consuming a breakfast when they normally would not. And yet other cadets have become more conscious of their eating behaviors, opting to select healthier food choices over unhealthier food choices, as well as food choices they perceive will benefit their ROTC physical training. The evidence suggests that participation in ROTC in general influences eating behaviors in many ways, suggesting ROTC represents an important socioenvironmental aspect to consider when

seeking to understand the eating behaviors of ROTC cadets. Furthermore, the ROTC context represents a way to potentially influence positive eating behaviors.

3) The role of other cadets

Cadets also discussed how other cadets relate to their eating behaviors. Most cadets stated that other cadets provided advice, encouragement, and motivation related to eating behaviors. For example, SrM1 stated,

> "…in terms of a cadet that's not passing [their physical fitness test]…they [other cadets] are going to encourage [them]…one of them [his cadet mentees] was not passing the PT [physical fitness] test this year…he was struggling with the run…so…I'm just making sure they're having good form… you know, like, 'hey…let's go for a run and like exercise…I want to see you succeed, I want to see you pass this PT [physical fitness] test.' "

Another example was provided by SrM2, who stated,

> "I might…have…like a workout buddy and that…makes sure…I…push myself even more 'cause…I like to…have other people…motivate me and push me, so that I feel, like I get…a harder and better workout for it."

SoM3 stated,

> "I've gotten…a lot of information from some of my fellow cadets in ROTC as well…some guys…who have done a lot…they've given me some nutritional advice as well for…what I should eat…to keep me good…one of the things that always come up when I'm talking to those people…is, beet juice…so…every once in a while, I'll try to throw that in my diet 'cause, apparently that's really good for you, according to them…"

Cadets discussed how other cadets encouraged and motivated them, especially with regards to eating behaviors and exercise. Many cadets reported that other cadets have encouraged them to eat healthier foods. Other cadets reported that their peers have assisted them with working out and training for the physical fitness assessment. Some cadets have even changed their eating behaviors to follow specific eating recommendations provided by other cadets.

While most cadets described the interaction with other ROTC cadets as positive, a few discussed these interactions as potentially problematic. For example, SrF2 stated,

> "…some of the students see what the other cadets look like and they…might want to look like them and so they ask them about their nutritional…what they do during a daily basis…and…I wouldn't say it's a problem, but, I wouldn't also say that it's helpful because everyone's different…you can't tailor your diet based on someone else's looks or their diet because that same thing might not help that person…if we aren't knowledgeable to send them in the right direction for themselves it might not help at all."

A few cadets discussed some potential problems with receiving advice from other cadets. For example, it was described that some cadets might seek out nutrition information from people who look and perform a certain way, not necessarily people who have education and training to give appropriate nutrition advice.

Some cadets also described their general perceptions of other cadets in ROTC. For example, FrM3's perception was that he could trust nutrition information from other cadets more than from other sources because he could see how his friends look and how they perform. He stated,

> "…my friends like they did their own research… and they just told me what worked for them…if you get like a first-hand account from your friends that you…know and you respect, and…you've seen how they are… a lot of my friends are…really physically fit and…they just have a healthy lifestyle and…if it's worked for them then, you expect at least some of the same results…for me."

Other cadets described how they perceive their peers in relation to eating behaviors in ROTC, with some cadets describing that ROTC cadets in general appear to be more self-aware in terms of being physically fit and their body image. Other cadets suggest that they rely on their peers for information on nutrition and training.

A few cadets also discussed how being around other cadets made them more self-conscious about their own eating behaviors. JrF1 described a "negative culture…for anybody

who does less than the absolute best at PT [physical fitness assessment].” She provided an example, stating,

> “…if you get somebody who gets a 290 [300 is the maximum score on the physical fitness assessment], it's like they're completely separate and everybody feels negatively about them…I think that’s not helpful because the people who do really well don’t really welcome people into their group…”

SoM2 stated,

> “I was in that situation where I'd go eat with all these guys…after lab…you can kind of see what everyone else got 'cause you got all of those options…and you kind of compare to yourself and what you got…if you don't have the healthiest meal on the table…there's other guys where they're really paying attention to what they are eating…so maybe I should focus on it a little more…so…it's just makes you a little more conscious of what you’re going to eat and seeing that other people are doing it…”

Some cadets described feeling compared to or judged by other cadets because of their eating behaviors or physical performance.

Other peers in ROTC appear to represent an important dynamic in terms of eating behaviors in ROTC. These interactions have been described in both positive and negative terms. For example, some ROTC cadets report that other cadets provide advice in terms of food choices and physical training to assist with meeting physical fitness standards. Other cadets describe these interactions as problematic because certain cadets tend to be sought out because of how they look and perform, rather than their actual knowledge and competence in nutrition knowledge. Some cadets described perceptions of peers in ROTC in terms of physical fitness and body image, while other cadets described feeling judged because of their eating behaviors or physical performance. The evidence suggests that ROTC cadet peers represent an important aspect to understanding the eating behaviors of ROTC cadets. Cadets may rely on the advice of other cadets because of the lack of other options in ROTC. Furthermore, the findings suggest an important role in understanding eating behaviors and body image by examining how other cadets

interact. The role of other cadets can potentially be leveraged as a way to engage and influence the eating behaviors of ROTC cadets. This should be done, however, in a safe, systematic, and evidence-based manner, so as to address unhealthful dieting and body image issues.

4) ROTC physical training

Most cadets discussed that participating in ROTC physical training has also had an impact on their eating behaviors. For some cadets, this entailed being more aware of their nutrition needs for their activity levels. For example, SoF2 stated,

> "I know what nutrition standards look like for someone of my…race, and age…with the amount of physical activity that I'm doing…I'm able to do all my daily physical activities that I need to without being overly exerted…I'm able to work out and afterwards I feel energized and rejuvenated…when I'm eating healthy…anytime we have a break…if I'm not working or if I'm not doing a lot, I know that I tend to be a lot less regulated and a lot less careful about what I eat…which does seem to affect my energy level and then my…physical fitness ability too."

Many cadets described awareness of having different energy and nutrient needs because of their physical activity levels. However, each cadet went about different ways to meet these needs, although most cadets described having higher energy needs and trying to include more foods with protein in them.

For other cadets, being physically active meant changes to their appetite and resulted in making different food choices. For example, SoF1 stated,

> "…like pizza…if I were just to have…something sugary [or unhealthy]…I don't feel as well…I don't perform as well in PT [physical training]…but once I was able to figure out where things were [in the cafeteria] and…I was able to make…some more of those healthier choices…with my meals…I noticed…a significant difference…in my PT [physical training] performance…"

For some cadets being more active made them have less of an appetite in general, but in particular for specific kinds of foods, such as unhealthy foods, or smaller portions of their usual

foods. For these cadets, eating foods they perceived as unhealthy resulted in worse physical performance during physical training for them.

Some cadets report being more conscientious of their food choices. For example, SoM2 stated,

> "I…try eat a little healthier…compared to what it used to be like back in high school…I'm a little more conscious about it just for…myself and my physical health and knowing that eating certain foods will allow me to perform better in ROTC rather than eating other foods that might kind of hurt you…you don't want to go to eat a donut before you run ten miles…just being a little more conscious about how that food will affect me and my performance so…I'm going to pretty much just drink a lot of water…stay away from going to McDonald's or…from eating way too much at one time…I might just maybe not eat that box of macaroni and make a sandwich instead or you know not eat too late.."

Other cadets report being freer with their food choices. For example, SrM2 stated,

> "…if I…had…a pretty good…workout or…a heavy workout, I'd be like…today…I did pretty well, so…I'm okay with…going to get…a bite to eat, or…I'd be…pretty hungry, so…I'll make…a bigger meal than I usually do."

Some cadets reported that being physically active made them more conscientious of their food intake. For these cadets, this conscientiousness resulted in improving their food choices from less healthy choices to healthier choices. For other cadets, being physically active meant they could be freer with their diet, allowing themselves to have the foods that they wanted.

Participating in physical training through ROTC also resulted in important impacts to eating behaviors. For many cadets, participation in physical training resulted in adjusting eating behaviors to account for additional calorie and nutrient needs with physical activity, especially protein. Similarly, participation in physical training also resulted in changes to usual appetite, resulting in changes in meal patterns and meal sizes. Furthermore, many cadets also adjusted their food choices to improve their physical performance. A few cadets felt their higher than normal physical activity level justified having a less restrictive approach to eating. The evidence

suggests that ROTC cadets acknowledge that physical activity plays an important role in eating behaviors, with many cadets engaging in eating behaviors related to increased nutrient needs for physical activity, as well as food choices that enhance physical performance. Despite the importance of physical activity, not all cadets acknowledged the importance of specific nutrients, primarily carbohydrates and proteins, as well as hydration and micronutrients, for meeting nutrition needs with a highly active lifestyle. A few cadets also suggested that being active meant they didn't have to pay as much attention as to what they need to eat. These findings suggest that cadets may potentially have a gap in knowledge in relation to nutrition needs for physical performance and may benefit from future education on actionable ways to improve eating behaviors to meet physical performance needs.

5) Preparation for physical fitness and body composition assessments

Cadets report differing levels of preparation when they know they have a physical fitness and body composition assessment coming up. Many cadets report making significant changes to their eating behaviors one to two weeks prior to an upcoming physical fitness and body composition assessment. Some of the cadets making significant changes in eating behaviors reported they eat healthier in order to try to lose weight prior to the physical fitness and body composition assessment. For example, SoF1 stated,

> "I cut out…like sugary drinks, and all…ice cream…sugary…breads, like donuts, and cake…I cut all of that out and pretty much only ate…chicken, beef, eggs, for protein, and…vegetables and fruits…probably for about a week before the PT [physical fitness] test…I'm much more…conscious…a little bit more disciplined…I'm just very careful and watch it very carefully…to make sure…my body only has what it needs…the only other goal would be…to lose a little bit of weight…I do have to…get taped at every height and weight [weight for height screening]…[I'm] always…two pounds…three pounds over…and I've never…failed…the tape test [percent body fat using body circumferences] at all…but…it is kind of frustrating because I do work very hard and have tried for a very long time to not have to get taped."

JrM1 also stated,

> "…we had our weigh in for the PT [physical fitness] test last week, so a couple weeks before that I was trying to eat like smaller portion sizes…to make sure I was the correct weight…and then…we got the PT [physical fitness] test this week, so I usually try to eat more healthy…the weeks prior to that…I will eat more like grilled chicken and vegetables than…what I usually do… just because…[it's] lower in calories but…it's still filling…I'll try to do it for…the two weeks prior…usually I'm able to drop about like five pounds, depending on…if I actually like stick to that plan…if I actually just eat…grilled chicken and vegetables instead of like eating the usual meals like sandwiches and stuff…I don't necessarily always stick to it…eating just like the grilled chicken and vegetables that usually is a good way for me to…decrease my weight a little bit…but I usually don't sustain that for very long…I just don't really have the motivation to do it now because like I'm already in the program…I'm already contracted so…I realize that like you don't necessarily have to be…that certain weight [weight for height screening] as long as you pass the…tape measure requirements [percent body fat from body circumferences]."

For the most part, cadets report taking about one to two weeks to make changes to their usually eating behaviors in order to result in some weight loss. Most of these changes consisted of limiting "unhealthy foods" such as sugary foods, baked goods, alcohol, and fatty foods and substituting these for "healthy foods," such as chicken, vegetables, fruits, and some carbohydrate foods, as well as increasing physical activity. Almost all cadets report making these changes to help them lose weight in order to improve their performance in the body composition assessment.

One cadet describes her experiences preparing for the body composition and physical fitness assessments. SoF2 reported,

> "I do struggle…with weight just as far as height and weight goes [weight for height screening]…I typically have to lose about five pounds right before a weigh in…it [my weight] tends to consistently stay about five pounds above what the military standard is for my height, and so, I…try to watch it and make sure that I'm eating healthy still and working out, but it's not anything that I obsess over it too much, I just have to realize that any time I have a weigh in…my body's set weight is a just a few pounds over what the military would like me to be, like, so any time we have a weigh in I just make sure that I eat less those couple days before and I work out a little bit more to drop those couple pounds for the weigh in…occasionally…if I'm close… I will accompany that

> with…possibly…not drinking or drinking diuretics the day before, just to make sure that I am under that weight, but for the most part…I just try to increase physical activity in the week leading up to [the physical fitness and body composition assessments]…usually, I'll be…within a pound of the day before and…I'll just combat that by…not drinking anything for the day, not eating anything for the day before…it's not too difficult just for one day to do something like that…I realize that it's not healthy to do consistently…so I do my best not to, but…if it does ever come down to that, which it has…the past couple weigh-ins, that's something that I'm able to do to make sure I'm making weight [weight for height screening weight]…I've taped [percent body fat using body circumferences] myself just to see what that standard would look like, and just because how my body is…I'm not able to pass the tape [meet the percent body fat determined from body circumferences], so, I have to make sure that I pass the weight [meeting weight for height screening weight], so that I'm passing those standards."

For this cadet, changes to her eating behaviors went beyond just substituting foods to using other methods to induce weight loss, including not eating foods, not drinking to dehydrate herself, and even taking a diuretic. While the cadet acknowledged that this was a short-term solution to induce weight loss and they are unhealthy, it is problematic that cadets are using these behaviors.

Other cadets report making changes to their eating behaviors prior to physical fitness and body composition assessments to improve their physical performance. For example, SrF1 stated,

> "…a week before it…I just try not to eat cookies or ice cream…but other than that, diet stays about the same. I might eat…pasta…the night before…trying to eat a good solid meal the night before…I just try to cut those out just 'cause I want to…give myself the best shot that I can, and I don't feel like…those things really help me perform better…mentally, if I know that I haven't eaten those [cookies and ice cream] for a week, then I'm like, 'oh, yeah, I'm ready to go,'…"

Similarly, FrM3 stated,

> "…so, I always try to…eat healthy…year-round, but, specifically…the weeks coming up…from the PT [physical fitness] test, I always try to…eat a lot more…fruits and vegetables…specifically, bananas to help…make sure I don't cramp up…during the run…and drink a lot more water, so I'm hydrated…just try not to stray away from…simple, grilled chicken or turkey…with the salad and fruits…and rice and potatoes…I'll make sure that I eat better, but…I'm not too worried about it."

JrF2 stated she prepares by,

> "…intaking a lot of water and…making sure I'm getting some carbohydrates in…just stuff for energy, some calories to burn…like a pasta…maybe like granola…the day of, the morning of….[to] provide enough energy to get through the test…it makes me feel full and not tired."

While, SoM2 stated

> "…when I've got a PT [physical fitness] test coming up and it's…pretty imperative that I do well, I'm going to pretty much just drink a lot of water…stay away from going to McDonald's…or stay away from eating way too much at one time…the meals don't change too much…I might just maybe not eat that box of macaroni and make a sandwich instead…so…in my…set of meals that I'll eat…there's a couple that I'll just drop…I won't eat as much cheese or…I won't make these like more fatty meals…I would eat a little more pasta…I still get to eat these things that I want and these things that I would make typically…it's a week or two…I'm just…more conscious about drinking water…freshman year I tended to not do those changes…and…you wake up and you feel kind of crappy…opposed to…when I made those changes…I feel a little more energetic and…a little more prepared going into that."

Many cadets focused on making dietary changes to improve their physical performance on the physical fitness assessment. Most of these changes focused on limiting "unhealthy foods," such as desserts, fast foods, and fatty foods, and increasing intake of "healthy foods" such as fruits, vegetables, chicken, and carbohydrate-based foods. Many cadets talked about including a source of carbohydrates, such as pasta and granola bars, the day before and the day of, to improve their physical performance. Many cadets also talked about making dietary changes such as eating more fruits with electrolytes, such as bananas, and limiting convenience or foods, to prevent cramping or discomfort during physical activity.

Yet, other cadets report making minimal changes to their eating behaviors, focusing instead primarily on changes to their physical activity habits. SrF2 stated,

> "…before I wasn't necessarily comfortable taking the PT [physical fitness] test…I tried to…the day before eat a lot lighter… the day before I would only have a salad for dinner or for lunch…maybe just have a sandwich…or I would just drink a ton of water before…but, now that I'm more comfortable, and I think I'm more physically fit…I don't have to really make those dramatic changes leading up to the PT test…I still try to stick to my normal routine and...try to drink a little bit more water than before, just so I can be

> more hydrated…but, I don't focus so much on taking away…my protein or, any starches, or things like that."

SoM2 also stated,

> "…when I know something like that is upcoming up…it's not a really big factor 'cause…my eating habit always stays the same….[I] never change my eating habit whatsoever…more of the time, it's my workout habit that maybe changes if I want to…improve workout items that are affected, but my eating habits stays the same."

A handful of cadets described not really making changes to their eating behaviors to prepare for a physical fitness assessment and focused more on being adequately hydrated and their physical preparation.

Many cadets report not being stressed about an upcoming body composition assessment. SrM1 reported not being stressed with the body composition assessment, stating, "No… 'cause I have a scale, so, I can see I'm good…I only change my eating habits…because of the weight I see on a scale." SrF2 stated, "I've always…been like the average between...the minimum weight and the maximum weight…so, I've never put too much thought into…the height and weight aspect of ROTC…" FrM3 stated,

> "I always get…taped every time…I don't meet the height and weight requirements [weight for height screening], but…I meet the standards…I max [get the maximum score, 300/300] the PT [physical fitness] test every time, so I just get taped and I'm, like, cleared…I'm…one of the most physically fit in my grade, and it's just…a bother to have to go in, and…spend an extra fifteen minutes waiting to get taped [determine percent body fat from body circumferences] and…being fine and meeting the standards [body composition standards]."

Many cadets reported that they were not stressed about the body composition assessment. This group included cadets that met and did not meet the weight for height screening table weight. For those meeting the screening table weight, they generally were not concerned at all. For those not meeting the table weight, they were also not worried about passing the body composition assessment because they always passed the tape [body fat determined from body

circumferences]. However, those that "passed the tape" and were not worried tended to be males without a high level of body fat.

However, some cadets report being very stressed about upcoming body composition assessments. For example, JrM1 stated,

> "I get kind of stressed out…I mean I'm not…at risk of failing but it always kind of stresses me out…I'm above the one-eighty-five (185 lb.) mark [weight for height screen], so I get taped, but I pass tape [percent body fat using body circumferences].

SoF2 reported, "…yeah, typically I stress out about it the day or two before hand…I would say…it just depends on where my weight is at right before…so obviously that varies a little bit between weigh-ins." Cadets that did report being stressed about the body composition assessment tended to be cadets that were on the border, meaning, they were very close to their table screening weights or body fat percentage limits.

Some cadets report that physical fitness and body composition assessments are important to them because of the scholarship money they receive for being compliant with physical fitness and body composition standards. FrF1 stated,

> "I've been feeling better about it [physical fitness assessment] recently 'cause I've been passing it…more and more….there's a lot of scholarship money on it…the scholarship money that allows me to continue to…go to MSU…comes from…passing the test…so…I feel like there's a lot of pressure to…continue to do well because…that's a lot of money for tuition…"

SoF2 also stated,

> "as far as, like, scholarships and any schools that you're going to or anything you apply for, they take into account your PT [physical fitness] score and your height and weight [body composition assessment] and it's frustrating to me that even though I can max [achieve the maximum score on] all of the physical fitness standards for the PT [physical fitness] test, I'm still struggling with weight, and so, it just seems, like, unrealistic for them to put that much emphasis on something that doesn't necessarily directly correlate with your physical fitness and your physical abilities."

Some cadets reported feeling pressure and stress with the physical fitness and body composition assessments because they were tied to monetary compensation in terms of competing for scholarships as well as developmental opportunities (military training).

Yet other cadets describe perceptions and concerns they have with the body composition standards. For example, JrF1 stated,

> "…we have to take the PT [physical fitness assessment] at least every semester and you absolutely have to be within the standard to commission when you graduate …if anybody is over the weight limit and they're close to busting tape…they have really, really intense demands on those people…it does seem like a large amount of people who lose a ton of weight really quickly and I just don't know if that's healthy…but I do understand the Army standards…so, I guess the only way to combat that unhealthy loss in weight is to catch it earlier… if you notice people start gaining weight or sliding back into to old habits then maybe they should get a jump on it a little bit earlier so that you don't run into those emergencies before commissioning because obviously it's really not healthy to lose twenty pounds in a month...so maybe they could do a little bit better about mentoring people who are just a little bit overweight so that they can get a handle on it sooner... they do that usually when it's too late…when people have gained twenty pounds and need to lose it in a month or when people have actually failed the PT [physical fitness] test…I don't think they usually get a jump on it very early and I think it'll be more beneficial if they did."

SoF2 also stated,

> "I do struggle…with just with weight just as far as height and weight goes…I typically have to lose about five pounds right before a weigh in [weight for height screening]…which can be frustrating because I max [achieve the maximum score] my PT [physical fitness] test and I do really well as far as my physical fitness, and so…it seems a little bit unrealistic that I could be that physically fit and still be struggling with their height and weight standards [weight for height screening weight], so that does seem somewhat unrealistic to me as far as those standards…as far as…scholarships and any schools that you're going to or anything you apply for, they take into account your PT [physical fitness assessment] score and your height and weight [body composition assessment] and it's frustrating to me that even though I can max [achieve the maximum score] all of the physical fitness standards for the PT [physical fitness] test, I'm still struggling with weight, and so, it just seems, like, unrealistic for them to put that much emphasis on something that doesn't necessarily directly correlate with your physical fitness and your physical abilities…we've talked about in some of my nutrition classes, those don't tend to be incredibly accurate measurements…so I'm not typically incredibly concerned about that, I just have to know that, for me, that means that I need to make

> height and weight standards [weight for height screening weight], so that I don't get taped [percent body fat determined using body circumferences]."

Cadets reported different perceptions related to the body composition assessment. One cadet reported that while she understood the process was an important part of military standards, yet she felt the way it was implemented could be improved so as to not require people to lose a large amount of weight in a short amount of time using unhealthy eating behaviors. Other cadets that reported struggling with meeting their weight for height screening table weight had concerns that the body composition assessment did not reflect nor consider their physical fitness performance. They communicated doubts about how realistic the standards are if someone can be in peak physical shape and still not be compliant with the standards. All cadets sharing concerns about the body composition standards described dangers related to the current enforcement of body composition standards in terms of unhealthy eating behaviors such as dieting, and use of unhealthy weight control behaviors, such as fasting and diuretic use.

Cadets report preparing for the physical fitness and body composition assessments using a variety of methods. Many cadets report making significant changes to their eating behaviors one to two weeks prior to an upcoming physical fitness and body composition assessment. Some cadets report making these changes to their eating behaviors in order to lose weight prior to the assessments. Most of these changes consisted of limiting "unhealthy foods," such as sugary foods, baked goods, alcohol, fatty foods, and fast foods, and substituting these for "healthy foods," such as chicken, vegetables, fruits, and sometimes carbohydrate-based foods, as well as increasing physical activity. The evidence suggests that many cadets are making changes to their eating behaviors one to two weeks before a physical fitness assessment in order to lose weight by substituting unhealthy food choices with healthy food choices. While this method may help to induce short term weight loss, it can also potentially be problematic in terms of adequate nutrient

intake, particularly carbohydrates and protein with higher activity levels. It can also be problematic in that such a drastic change is usually not sustainable and may, in the short term, lead to rapid weight regain. In the long term, these types of eating behaviors may result in a pattern of dieting, binge eating, and weight cycling that may increase the risk for both long term weight gain and development of eating disorder symptoms.

Further evidence for the above statement is provided by the experience of one cadet who went beyond substituting food choices to induce weight loss to actually not eating foods, not drinking fluids to dehydrate herself, and even using a diuretic. While the cadet acknowledged that this was a short-term solution for weight loss that was unhealthy, the cadet appeared to be relying on this method every time she had a weigh in. This finding suggests that this form of unhealthy weight control behavior is one of the ways that cadets try to induce rapid weight loss in preparation for body composition assessments. While engaging in these behaviors short term may not appear to be problematic, they can potentially result in fluid and electrolyte imbalances that may increase the risk for heat injuries with extreme activities. In the long term, these patterns of dieting and unhealthy weight control behaviors are known to predict long term weight gain, risk of obesity onset, and development of eating disorder symptoms.

Some cadets reported making changes to eating behaviors in order to enhance their physical performance, while some cadet reported making no changes to their eating behaviors. Cadets reporting making changes related to physical performance also focused on limiting "unhealthy foods," such as desserts, fast foods, and fatty foods, and increasing intake of "healthy foods, " such as fruits, vegetables, chicken, and carbohydrate-based foods. Unlike the first group of cadets focused on weight loss, this group of cadets discussed the functional properties of foods in terms of how the foods make them feel and perform, such as consuming water and

fruits/vegetables with electrolytes. This group of cadets also tended to emphasize carbohydrate-based foods, which are known to be important for physical performance. The evidence suggests that some, but not all, cadets are aware of the performance-enhancing benefits of foods. Taken together, these findings suggest that there is a need for education on nutrition and performance and nutrition and safe weight management amongst ROTC cadets in order to increase the number of cadets understanding and applying the performance benefits of foods and limiting the number of cadets using unhealthy weight control behaviors.

While many cadets reported not being stressed about body composition assessments, some were stressed. Those who reported not being stressed included both cadets who met and did not meet the screening table weights. Those who met the screening table weight were generally not concerned at all. Those not meeting the screening table weight who were active males also reported not being worried because they always met the tape [percent body fat determined using body circumferences]. The cadets who reported being the most stressed about the body composition assessment tended to be female cadets that were on the border, meaning, they were very close to their table screening weights or body fat percentage limits. Another contributing factor to the stress around physical fitness and body composition standards was that performance on the assessments was tied to monetary compensation in terms of scholarships and competition for developmental opportunities. The evidence suggests that the body composition standards are an important influencing factor on the eating behaviors cadets choose or choose not to adopt, in particular stress about meeting the body composition standards. Additionally, there appears to be a misperception in terms of what the body composition standards are and how they should be interpreted. There is a need to provide greater understanding and education on the process and implications of the body composition assessment.

The above findings are further supported by some of the perceptions communicated by cadets. For example, some cadets expressed concern with how the body composition assessment is currently administered, in a way that seemed to encourage cadets to lose a large amount of weight in a short amount of time using unhealthy weight control behaviors. Other cadets expressed concern that they were being punished because of their weight and body shape, since the current standards do not consider a person's level of physical fitness. Cadets expressing concern about the way the standards are currently being implementing suggested that these may result in engagement of unhealthy eating behaviors such as dieting, and unhealthy weight control behaviors, such as fasting, excessive exercise, and diuretic use. Therefore, there is a need to continue to monitor the use of these behaviors, in addition to providing education on the risks of these behaviors, and potential alternatives to these behaviors.

6) Perceptions of body image within ROTC

The cadets discussed their perceptions of body image, how body image related to ROTC, and how body image related to their eating behaviors. Body image was described in terms of body image concerns, with some cadets not having any body image concerns, while other cadets reported concerns related to having a smaller or larger than expected body. Body image was also discussed within the context of the body composition standards, which assess a weight for height screening weight and percent body fat determined using body circumferences for those exceeding their screening weight. For some cadets, their perceived body image also resulted in specific eating behaviors. Cadets also described and defined body image within the context of ROTC.

Some cadets reported not having any concerns about body image. For example, JrF3 stated, “I pretty much just eat whatever I want. I’m not like super worried about…my weight or anything.” JrF2 also stated,

> “…I know everybody is trying to have like, a lot of the guys have pretty big muscles and stuff…[but] I'm not really worried about body image as long as I look fine to myself…as long as I can fit in my clothes, I'm happy…I've always worked out my whole life…so, I usually…eat whatever I want to eat…if I was to not…work out…I've been able to maintain like the same body weight and figure.”

Cadets reporting not having body image concerns tended to report that they also ate whatever foods they wanted to eat.

Other cadets reported feeling like they were smaller than other cadets due to their body size and image. For example, SrF2 stated,

> “I've always…been very…petite in stature…been like the average between…the minimum weight and the maximum weight…so, I've never put too much thought into…the height and weight aspect of ROTC…I would say, maybe during…a ruck march, or something like that…I know I'm very, small and short, and, sometimes…it's frustrating that there's other…cadets that are a lot taller than me…and I know that it's harder for me to carry…the same exact weight, that we have to carry and knowing that they have...more help with their body to help carry the weight than I do…[it’s] just me understanding that it's a little bit more difficult for me in that aspect…I just know I have to work harder to be to the standards…I have to push just a little bit more so that I can also…work alongside those same Cadets that are also a lot taller or have a lot of more muscle mass, that are able to do some of those heavier…demanding activities. I understand that I have to push myself a little bit more to meet those requirements… I'm 5'1" in height, or 5'2" in height and, there's…other…cadets that are a foot or so taller than me, and probably weigh…slightly more than I do…and not necessarily that they are out of shape…but, I just feel that they are able to…do a bit more, just because of their build…[but] I wouldn't say that I've changed the way I ate just so that I could try to…gain more muscle or anything like that.”

Similarly, FrF1 stated,

> “[I feel]…smaller compared to a lot of the people in ROTC, I guess both in height and sort of weight and muscle mass…sometimes there are comments…made… ‘oh, what are you, like, one hundred and fifteen pounds soaking wet ?’…and so, it's not mean, but it does make me feel…smaller like I have to try and catch up…for part of the PT [physical

> fitness] test, you have to…hold people's…feet for sit-ups…[and] for the past couple times…the person in charge tells someone else to come up and hold their feet [instead of me]…so…that sort of makes me feel smaller too…at first, it was really hard because I had never felt small…in both meanings, like, smaller in height and…kind of weaker…because I was smaller and everyone else was much taller and…more muscled definitely and in better shape…it's definitely not a good feeling…especially because you're told that you have to…look out for your battle buddies…[and] feeling like…if you were in the situation where you had to take someone off the battlefield…'cause they were injured…[and] you maybe couldn't…take care of them 'cause they're taller than you or…more muscled than you I think is kind of scary…because you don't want to ever be in that position…I feel…like rather than weight…which I've heard a lot of girls my age and younger talk about…I feel like muscle mass is more important for physical fitness and…being strong is more important than…being thin…I don't think I think about it…daily, but…every so often I do think about it."

For cadets that are smaller or weigh less than other cadets, they are more self-aware of their size compared to other cadets. Some cadets, particularly female cadets, perceive this size difference as also resulting in less ability or "weakness" compared to larger, more muscular, and taller male cadets. Cadets that reported feeling smaller also reported being more self-conscious about their physical performance in terms of matching the physical capabilities of cadets that were larger and stronger.

Yet other cadets reported feeling like they were larger than other cadets due to their size and body image. For example, SrM2 stated,

> "I'd say, in ROTC…I'm one of the…bigger…cadets…'cause I'm also…one of the more shorter ones…it runs in my family to be…more short and stocky…I notice that everyone is…thinner, but…I push myself to…make sure…[I] compete with them and…make sure…I'm still able to do everything that they can do…I want to keep up with…the faster guys and…I always try to…push myself to either be on their level or…ahead of them."

SoM2 also stated,

> "…I'm definitely more of a heavy-set guy compared to a lot of those guys…the Army is just so based on…not really a weight lifting kind of program…it's a lot of running…these guys are a little more…toned than what I'm used to…I would play defensive end for my football team and…I was a big guy…but in the Army, I'm a big guy…I know I'm not going to meet those standards…I know I'm going to have to kind of go off to the side,

> with just a few other guys that get taped…[but] I'm happy with…the weight I am and…the height I am…the only thing I tend to try to improve on is limiting body fat content…[but] I'm happy with my…muscular abilities…at the same time, I'm not trying to…be a body builder…just as long as I know I can perform to the level that's expected of me…I'm pretty happy with that…I honestly enjoy being the big guy…I've never wanted to be that slim guy that runs twenty miles no problem…I've wanted to be the guy who…carries the big machine guns or…carries the heavy stuff…[so] I…have this image of myself of being that bigger guy who can't run very far very fast but…can carry those things…but you know I'll go get taped and I'll have a member of the cadre like comment on it or…some members in ROTC comment on, 'oh wow you weigh two hundred thirty (230 lbs.)…you're so heavy'…it's really just kind of a joking matter…but at the same time…it's got that underlying…they're trying to let me understand um, that this is just Army standards…even though you weigh two hundred pounds (200 lbs.) at six foot (6 ft.)…you are going to have these certain things…like running…where it's going to be more difficult for you just 'cause you're moving more weight. So, you have to be conscious of that…it kind of motivates you to watch what you eat and…know how to work out to where you can get better at those things."

Cadets who perceived themselves as larger tended to focus on their physical performance capabilities compared to cadets who they perceived as smaller, thinner, or more toned. Both cadets reported pushing themselves to make sure they're able to compete at the same levels as cadets who appear thinner and more fit than them.

Many cadets described their body image within the context of the military body composition standards. Some cadets reported making drastic changes to their eating behaviors to change their bodies to meet the body composition standards. For example, SoF2 stated,

> "…as far as body image, I'm pretty comfortable with myself…I feel healthy…I'm able to do all the physical activities that I would like to, and…that's never been something that anybody's asked me to change…I do struggle…a little bit…with weight just as far as height and weight goes…I typically have to lose about five pounds right before a weigh in…and I try to keep that down, but sometimes that's something that I have to work on…which can be frustrating because I max [achieve the maximum score, 300/300] my PT [physical fitness] test and I do really well as far as my physical fitness, and so…it seems a little bit unrealistic that I could be that physically fit and still be struggling with their height and weight standards…it [my weight] tends to consistently stay about five pounds above what the military standard is for my height…[so I] try to watch it and make sure that I'm eating healthy still and working out, but it's not anything that I obsess over it too much, I just have to realize that any time I have a weigh in…my body's set weight is

> a just a few pounds over what the military would like me to be…so any time we have a weigh in I just make sure that I eat less those couple days before and I work out a little bit more to drop those couple pounds for the weigh in…occasionally…if I'm close…I will accompany that with…possibly…not drinking or drinking diuretics the day before, just to make sure that I am under that weight, but for the most part…I just try to increase physical activity in the week leading up to…usually, I'll be…within a pound of the day before and…I'll just combat that by…not drinking anything for the day, not eating anything for the day before…I realize that it's not healthy to do consistently…so I do my best not to, but…if it does ever come down to that, which it has…the past couple weigh-ins, that's something that I'm able to do to make sure I'm making weight…I've taped myself just to see what that standard would look like, and just because how my body is…I'm not able to pass the tape, so, I have to make sure that I pass the weight, so that I'm passing those standards."

SrM1 also stated,

> "…there are times where I pay closer attention [to my eating]…than other times, like right after a break…I might gain…more weight over the breaks…and then when I get…back to school…before height and weight…I pay more attention to what I'm eating, exercise a little bit more, get back to one seventy-five and then…it doesn't bother me anymore…I probably won't have too much dessert…probably cut back…alcohol consumption-wise…so I just…stay safe and keep it under one eighty (180 lbs.) and one seventy-five (175 lbs.) is a good weight for me…I don't like getting taped, so, I just stay under one eighty (180 lbs.)…I just don't like people touching my belly…I would never say I'm really on a diet, ever…even when I'm trying to cut more weight…I'll still have like a bowl of ice cream…sometimes…like I eat pretty much whatever I want and I'm fine with that…I don't really have any problems with the way my body looks…there are people who work out more than me who are more regimented in their diets than me…[but] we all do pretty well on the PT [physical fitness] test and we all pass height and weight [body composition assessment], so, that's all I really care about…I want to look good…[but] it's not the most important thing to me…I only change my eating habits…because of the weight I see on a scale."

Some cadets interact with their body image by being more self-conscious of their weight and making deliberate, sometimes harmful, changes to their eating behavior in order to lose weight for the body composition standards.

How cadets performed on the body composition standards also influenced their body image perception. One cadet, SoF1, reported a more negative body image because of how she performed on the body composition assessment, stating,

> "I've been pretty much the exact same weight for several years…[but] I do have to…get taped [percent body fat determined from body circumferences at every height and weight [weight for height screening]…[I'm] always…two…three pounds over…and I've never… failed…the tape test [percent body fat determined from body circumferences] at all…[but] it is kind of frustrating because I do work very hard and have tried for a very long time to not have to get taped [percent body fat determined from body circumferences]….even though…my appearance has changed a lot but I'm still at the same weight…friends and…family…consistently tell me, 'you don't look overweight'…[but] it's just not quite up to the standard…it's because it seems like…you're just kind of, lumped in with…the overweight group, the too heavy group…it's kind of discouraging…especially when…you're…so close and…it doesn't really matter…we're really not…it's just more of the Army's standards of we get dumped into the overweight group…I have made a…really significant amount of progress…but, it still feels like you're falling short of the mark and it still feels like you're almost failing, even though…you've made all this progress and you're working at PT [physical training]…but you can't quite make…the standards…the numbers."

Another cadet, SoM2, reports not having as negative of a body image perception, stating,

> "…for the two years I have been in ROTC…every height and weight…I've technically failed it…I do get taped and I pass it…I never been stressed about that because I know like I'm a pretty hefty guy…but, I also know that I'm not fat… [so] as long as I don't feel like I'm getting fat…I'm okay being two hundred pounds, six foot, 'cause I know that…it's more of a healthy…two hundred pounds…I've always been more of a bigger, heavier guy…but not in the sense of…I've got beer gut or I'm not ripped by any means…I don't got the huge six pack, or…giant pecs or anything like that…but, I can look in the mirror and go…I'm like not chunky…I don't got rolls…I do notice during certain times…whenever that kind of fluctuates…it changes my attitude towards what I eat, how often I work out…what kind of workouts I do…"

Although both cadets exceed the weight for height screening table but met the percent body fat standard, how they respond to that knowledge influences their body image perception. For one cadet, a female, she feels more overweight and like a failure, despite not being overweight, while the male cadet, acknowledges being bigger, but not being fat.

Cadets described different ways they changed their eating behaviors to influence their body image. Some cadets described intentionally eating a certain way to build muscles. For example, FrF1 stated,

> "I was…on the…lower level of…my height, like, one-sixteen (116 lb.)…[and] people [were] telling me, 'oh, you don't eat enough'…I was kind of worried that when I was working out I might have been…losing muscle or just not feeling like I could build muscle, so I was trying to eat a little more…I would go…back to the caf [cafeteria] for….a second breakfast…maybe a bagel with…peanut butter and banana…and then sometimes I would go back to the caf [cafeteria]…after dinner and have a little…snack after while I studied…I feel like I need to eat more to maybe have that ability to sort of gain the muscle mass…I do…eat more and try [to]…after workouts, eat protein."

SrF1 also stated,

> "…I am…more worried about just getting strong and…maintaining and building that strength…[so] I eat…I'll eat as much of that as I want…I always try to eat a protein, try to get some protein in me within forty-five minutes, just to…build my muscles up."

Cadets seeking to increase their muscle mass discussed including more protein-rich foods after workouts.

Other cadets described changing their eating behaviors to lose weight intentionally. For example, JrM1 stated,

> "…before…starting freshman year of college, I lost a lot of weight…when I found out I got the scholarship…I found out that for like my height and age I was supposed to weigh one eighty (180 lb.) and at the time I was two hundred (200 lb.)…I ended up…dropping down to about one-seventy (170 lb.)…now I'm back at about two hundred (200 lb.)…in high school…I was able to maintain that…low calorie diet for a longer amount of time…but, I just don't really have the motivation to do it now because like I'm already in the program. I'm already contracted…[and] you don't necessarily have to be…that certain weight as long as you pass the…tape measure requirements…[so] me realizing that it's not imperative…it's just allowed me to be more relaxed in how I eat…it's not really your appearance…that is important…[it's] how you're able to perform on the PT test or perform doing…physical tasks…that's what's more important."

In contrast, SoF1 stated,

> "…it still feels like you're falling short of the mark and it still feels like you're almost failing…[when] you can't quite make…the standards…the numbers…it makes me want to eat less…which I know is pretty dangerous…I was always the bigger girl, and I wanted to be smaller…[so] I just…ate as little as possible…but that's not healthy either, especially when…you've got a lot going on and your body requires a lot of fuel, you know…so, you can't…but, it does definitely make, make you want to try and do that…to try and meet the standards because it feels like you're running out of options."

For one cadet, knowing he could meet the meet the standards without having to be at his screening weight resulted in him relaxing his eating style, while for another cadet, not meeting the screening weight made her feel like she had to be more extreme in her weight control behavior.

Some cadets also defined and described body image within the context of ROTC. Some cadets described the type of body image that was expected in ROTC. For example, JrF1 stated, "I think…most of my peers in ROTC…are more aware of that kind of stuff [body image and weight] than the average college student." She also stated,

> "most of them [my peers] are going into combat arms…so they're more aware in trying to…have absolutely the leanest muscle possible…a lot of ROTC are the guys who are wanting to go infantry or field artillery [combat arms]…so they absolutely have to have the best PT [physical fitness] scores…they're the people who work out every day, lift…"

JrF3 stated,

> "MSU's ROTC people are…usually in pretty good shape… I think…they…expect us to know, that you just need…to PT [physical training] and eat healthy and then you'll pass height and weight…and your PT [physical fitness] test…'cause they just expect us to know how to eat…'cause they just know that we know we have to pass our PT [physical fitness] test…[so] they basically think…we know what to eat, which I do think is kind of common knowledge…if you need to lose weight you eat…vegetables and just don't eat…a bunch of sweets and…a bunch sugary stuff…and work out…I definitely think that…it is expected to be in shape…you're expected to…look in shape…with females…they just expect you to look skinny…they expect you to be skinny not fat…but, with females there's not…a whole lot of like body image expectations…guys on the other hand…I do think that guys in general just try to be…more muscle-y and stuff…I know…in the weight room…a bunch of guys have their names on the board and then…they had written like how much weight and reps they did for…like a dead lift, or a bench press…so, it's kind of…to keep track of like how much you're weighing and comparing yourself to everyone else…and I think that's kind of like a motivation thing…no one…said the guys had to do this…they just did it themselves."

Other cadets felt that body image was not that big a deal in ROTC. SoF1 also stated,

> "I feel like, ROTC doesn't really even put as much of an emphasis on it [body image]…as the world does…but as far as the people in ROTC…I feel like the focus has always been

> on getting your score better…and improving yourself…your capabilities…rather than your appearance."

Cadets appear to report more self-awareness regarding weight and body image. They also report that there is a certain type of body image expected in ROTC, which for males tended to be lean and muscular and for females tended to be thinner. However, other cadets disagreed in terms of the importance of body image stating that physical performance was more important, and that body image was only a concern related to the body composition assessment.

However, some cadets described how body image was important within the context of ROTC. For example, FrM3 stated,

> "…so, definitely ROTC places a lot of stress on how you look because if you don't look physically fit, then…people might think lesser of you as far as PT [physical fitness], there's a PT [physical fitness] standard and requirements…if you don't have the…physical definition or muscle mass…I feel like if you…can see…someone has a gut, then it is…like…they lack the discipline to eat healthy or…maintain….a certain physique…if you don't really look physically fit…or people see you…dining out and just smashing out…a burger and havin' a milkshake, [they] might think…you're not as disciplined…[compared to] someone who goes and is eating a salad and…a grilled chicken or turkey…"

SoM3 provided the following example, stating,

> "…someone who eats predominantly…McDonald's…or junk food…they have the…propensity to have a more heavy set…body type…which in turn could result in more…ridicule from people around them…alternatively…people that ate more healthy…have better body types…less excess fat…and that can be seen…in a positive light…and boost a person's…self-confidence…"

Cadets seem to agree that how you eat relates to how you look, how you eat and look results in some degree of judgment, and that people will change their diet to look a certain way.

Some cadets expressed concern over body image perceptions in ROTC. For example, JrF1 stated,

> "…so we have to take the PT [physical fitness assessment] at least every semester and you absolutely have to be within the standard to commission when you graduate… if

> anybody is over the weight limit and they're close to busting tape [exceeding percentage body fat estimated from body circumferences]…they have really, really intense demands on those people…you have to be within the Army standards…[but] I know that it's been unhealthy for at least a few people to try to lose weight so quickly…if you notice people start gaining weight or sliding back into to old habits then maybe they should get a jump on it a little bit earlier so that you don't run into those emergencies before commissioning because obviously it's really not healthy to lose 20 pounds in a month...so maybe they could do a little bit better about mentoring people who are just a little bit overweight so that they can get a handle on it sooner…it does seem like a large amount of people who lose a ton of weight really quickly and I just don't know if that's healthy…I think it would help a lot of people because…there are quite a few ones and twos [MS1 and MS2] who don't perform as well at PT [physical training] and…they have a little bit more body fat…and they don't have as much of a background for nutrition…so, they just don't know what to do...they don't know how they're supposed to lose weight."

FrF1 instead discussed how body image was discussed in ROTC. She stated,

> "I wonder…[if] there could be something that would…promote a better understanding of…healthy weights and…what that means for each individual because I know a lot of people are actually considered overweight by the Army standards…because they actually have too much muscle…I don't think that they're overweight at all…when they're asked to be taped…it sort of...creates an anxiety for 'em. I wonder if there couldn't be anything done about that and perhaps not make so many…comments about…being smaller…in size…it's important to be…physically fit as both…an image of the military and as…a potential officer and for your own health…but I feel like there's some…repercussions for…mental health or safety…as a result perhaps for…how it's discussed…I think sometimes…it's viewed…not as getting stronger, but rather as…losing weight and appearing thinner so that people…respect you more…and that was something that happened a little while ago and…when talking about being an officer…your appearance does change how people think of you…I think…that's true…but it's sort of kind of maybe not…it's dangerous to teach it…in that kind of way to say that being larger, people will view you maybe not...as much of a leader…not as positively. I think that might be a little dangerous to…imply…in a class setting."

A few cadets communicated concern with how the body composition standards were implemented and how body image was addressed within the context of ROTC. For example, one cadet described that body composition was monitored only during the semi-annual assessment periods, suggesting that was not enough time to provide feedback for making lifestyle changes that resulted in engaging in extreme and unhealthy weight loss behaviors to promote rapid

weight loss. Another cadet described concern that a negative perception of body image was being perpetuated by ROTC by suggesting that how someone looks influences the respect they will command as leaders.

Cadets discussed their perceptions of body image, how body image related to ROTC, and how body image concerns related to their eating behaviors. Body image was described in terms of body image concerns. Some cadets reported not having any concerns about body image, while other cadets described body image concerns around perceiving themselves as larger or smaller compared to other cadets. The evidence suggests that cadets who perceived themselves as larger or smaller compared to other cadets focused on what these differences suggested, that they had different physical capabilities. For example, smaller cadets perceived themselves as less muscular and weaker, while larger cadets perceived themselves as slower and needing to keep up with other cadets. These findings suggest that body size perception is an important aspect of body image within the context of ROTC especially in terms of its relation to physical performance and capabilities.

The cadets also discussed their body image within the context of the body composition standards. For some cadets, this resulted in changing their eating behaviors in order to change their weight/shape to be in compliance with body composition standards. For example, a few cadets reported engaging in dieting behaviors, and even unhealthy weight control behaviors, to be in compliance with body composition standards. For other cadets, how they performed on the body composition standards influenced their body image perception. One cadet, a female, described how failing to meet her screening weight made her feel overweight and like a failure, while another male cadet described that failing to meet the screening weight didn't make him

feel fat or influence his body image perception negatively. The findings suggest that how cadets perform on the body composition assessment influences their personal body image perceptions.

Cadets also discussed how body image related to their eating behaviors. Some cadets described eating a certain way, such as including more meals, and meals with protein, to help them build muscle mass. Other cadets described changing their eating behaviors to lose weight intentionally. While one cadet described that knowing he could meet the standards without having to lose a lot of weight resulted in him relaxing his eating behavior, another cadet described that even though she could meet the standard [body fat percentage estimated by body circumference], the fact that she couldn't meet the table screening weight made her want to use more extreme and unhealthy weight control behaviors. The evidence suggests that both males and females engage in changes in eating behaviors to influence their body image and to be in compliance with body composition standards. However, females may perceive a need to make changes to eating behaviors because of a more negative body image perception sometimes relying on unhealthy weight control behaviors such as dieting, fasting, or diuretic use, whereas males may engage in changes to eating behaviors because of a more positive body image perception.

Cadets described and defined body image within the context of ROTC. Many cadets described the type of body image that was expected in ROTC. Cadets discussed that in general ROTC cadets are more self-aware of their body image and weight, with many cadets, particularly male cadets, striving to be lean and muscular, while male and female cadets are expected to appear thin and in shape. At the same time, some cadets felt that physical appearance was not as important in ROTC as physical fitness and physical performance. The evidence suggests that cadets are more self-aware of body image than perhaps other college populations, with a greater

importance placed on leanness and muscularity for males and thinness for females. However, there was disagreement in terms of the role of body image compared to physical performance, with some cadets reporting that performance was more important than body image. Cadets also discussed how one's body image had implications in terms of one's eating behavior. This disagreement and confusion on the issue can be expected given that cadets are held to both standards, physical fitness and body composition/appearance standards, but it is not usually discussed which is more important, physical appearance or physical performance, or how they are related or are not related to each other. This means that there is a need to address physical performance and body image within the context of ROTC.

Finally, some cadets discussed concerns over body image perceptions within ROTC. For example, some cadets reported that the way the body composition standards were currently implemented resulted in the systematic enforcement of unhealthy weight control behaviors in order to meet said standards because there were no other checks and balances in place, such as screening and monitoring when healthier eating behaviors could have been adopted. Another cadet expressed concern that body image was communicated in a negative light, implying that the way someone looked, particularly their body size, was reflective of their leadership ability. Both of these findings, taken together, suggest that there is a need to consider body image within the enforcement of body composition standards, as well as within the context of ROTC. The findings suggest that it may be necessary, in general, to promote a more positive body image, regardless of body size, that would motivate adoption of healthier eating and lifestyle behaviors and promote overall wellbeing. The findings suggest that the current system may instead result in stigmatization and adoption of unhealthy weight control behaviors for those susceptible to

negative body image that result in increased risk for weight gain, obesity, and development of eating disorder symptoms.

E. Discussion

This qualitative study was conducted to describe the eating behaviors and mediators of eating behaviors of ROTC cadets, particularly with consideration to the ROTC context, preparation for physical fitness and body composition assessments, and the perception and experience of body image within the ROTC context. In order to provide deep, rich, and broad descriptions of these experiences within the ROTC context, purposive sampling was used to select potential participants in this qualitative study. Purposive sampling considered sex, ROTC year group, performance on physical fitness and body composition assessments, stress relating to the assessments, and weight loss-attempts. Using purposive sampling, "information-rich", extreme, and negative cases were selected to provide a broader representation of the US Army ROTC cadet population at MSU (Patton, 2002; Pope & Mays, 1995). The demographic characteristics on the qualitative participants were similar to those of the entire sample from the broader study of eating behaviors and mediators of eating behaviors. Similarly, there were no significant differences between qualitative participants and the entire sample on indices of adiposity, including BMI and percent body fat determined using body circumferences, as well as measures of eating disorder symptoms. These quantitative findings suggest that the qualitative participants selected are not significantly different from the entire sample of ROTC cadets from which they were drawn. This evidence supports the notion that the points of view presented are likely similar to other perspectives of the US Army ROTC population at MSU.

In terms of eating behaviors, ROTC cadets may experience many of the same influences on their eating behaviors that are experienced by other college students, particularly eating

behaviors related to dieting and body image. For example, there were many similarities between the major themes of the study, usual eating behaviors and determinants of eating behaviors, and the eating behaviors of college students reported by other studies (Deliens, Clarys, De Bourdeaudhuij, & Deforche, 2014; LaCaille, Dauner, Krambeer, & Pedersen, 2011; Nelson, Kocos, Lytle, & Perry, 2009). However, we identified three unique themes that described what shaped ROTC cadets eating behaviors: the ROTC context, preparing for physical fitness and body composition assessments, and ROTC cadets' perceptions and experiences of body image.

When describing their usual eating behaviors, cadets discussed their usual meals, their perceptions of healthy foods, and unhealthy foods. Cadets' descriptions of their usual meals included descriptions of what they ate and how they ate focused on environmental factors of the socioecological model. For example, how they described their usual meals and their access to food differed by whether they reported living on campus and accessing foods through the MSU cafeteria or whether they lived off campus and had to purchase and prepare these own foods. Cadets also discussed ways in which their schedule influenced their usual meal patterns, both by some cadets eating more breakfast as a result of their physical training schedule, as well as some cadet skipping meals due to a lack of time in their schedule. These findings are in agreement with previous studies in college students which also examined eating behaviors from a socioecological perspective and described the roles of eating environments, which include food access, food availability, and time, in influencing eating behaviors (Deliens et al., 2014; LaCaille et al., 2011; Nelson et al., 2009). Similarly, one study in a military population discussed how facets unique to military environments, such as different eating environments and time constraints on eating, influenced the eating behaviors of military veterans (Smith et al., 2009).

These findings suggest that the eating environment is an important consideration for understanding the usual meals and eating behaviors of ROTC cadets.

In discussing their usual eating behaviors, cadets also discussed healthy and unhealthy foods. Both healthy and unhealthy foods were defined in terms of their nutrient content, their dietary quality, as well as the degree of food processing. Examples of healthy foods and unhealthy foods were also consistent with the definitions provided for each. Reasons for including healthy foods and excluding healthy foods also appeared to be similar but in opposite directions. For example, cadets reported feeling better, having improved physical performance, and having satiety and weight loss benefits from eating healthy foods. In contrast, cadets reported not feeling well, not feeling satiated, feeling more tired, feeling a negative impact on their physical performance, and even feeling more "out of shape" from eating unhealthy foods. These findings are consistent with a systematic review of qualitative research exploring how people define and interpret healthy eating, which includes concepts such as food components, food production methods, and physical outcomes of eating healthy (Bisogni, Jastran, Seligson, & Thompson, 2012). Cadets select and define foods based on their quality as well as their functional properties, especially with regards to feelings of wellness and physical performance.

Cadets also discussed reasons for including unhealthful foods in their diet and excluding healthful foods. Most of these reasons involved issues of access, cost, time, and convenience of preparing healthful and unhealthful foods. For example, some cadets that reported eating healthful foods also reported relying on unhealthful foods because of time and money limitations. These findings are in agreement with previous studies in college studies examining socioecological factors that shape eating behaviors (Deliens et al., 2014; LaCaille et al., 2011; Nelson et al., 2009). Specifically, students reporting purchasing and preparing their own foods

reported purchasing more fast/convenience foods (LaCaille et al., 2011), with some students believing that unhealthy foods were cheaper than healthy foods (Deliens et al., 2014). So, in addition to understanding why ROTC cadets include healthful foods in their diet, it is important to understand reasons they don't include those foods in those diets, as well as strategies to mitigate perceived barriers of time, money, and access.

Cadets also discussed various perceived determinants for eating behaviors which included food access and availability, feelings related to eating behaviors, knowledge about eating behaviors, time, and money. For the most part, cadets viewed living on campus as a positive aspect in terms of food access and availability. Living on campus and having a meal plan allowed students to have access to a wide variety of already prepared foods, facilitating healthier eating behaviors for many cadets. Some cadets viewed living on campus as a limitation since it prevented them from preparing or accessing their preferred foods as well as exposed them to all-you-can-eat access to foods, making it more difficult to make healthier choices. In contrast, students living off campus had negative perceptions of the time and money required to purchase and prepare foods, as well as how to actually access the foods throughout the day while on campus. Only one cadet felt living off campus was beneficial for food access, because she lived at home with her parents, and her parents would purchase and prepare her foods. These findings are consistent with previous studies in college students (Deliens et al., 2014; LaCaille et al., 2011), but were also contrasting with these findings, since college students reported perceiving that foods served through college/university meals plans were more unhealthy. College students had differing perspectives and levels of agreement on which is more advantageous in terms of eating behaviors, living on or off campus. Overall, these findings

suggest that cadets and college students may benefit from nutrition education that informs them on accessing affordable, convenient, and nutritious foods both on and off campus.

With respect to feelings related to food, cadets focused on feelings of hunger/satiety and food preferences. Most cadets reported eating when hungry and stopping eating when full. Cadets also report selecting foods with more satiating properties. These findings suggest hunger/fullness is important to cadets, with some cadets already eat according to hunger fullness/cues. However, unlike most college students, cadets participate in mandatory physical training, which functions to alter the appetite of cadets potentially compared to other college students. In comparison to ROTC cadets, none of the studies of college students discussed the role of hunger/satiety in terms of eating behaviors (Deliens et al., 2014; LaCaille et al., 2011), while one study in a military population discussed how hunger related to eating behaviors in veterans (Smith et al., 2009). Another important aspect to cadets' eating behaviors were food preferences, such as taste and food cravings, which are similarly cited as an important determinant in college students (Deliens et al., 2014; LaCaille et al., 2011). Taken together, the findings suggest that nutrition education and interventions in cadets would benefit from including education on hunger/satiety and the satiating properties of foods. Education and interventions should also be respectful of cadets' taste preferences, providing healthful alternatives to meet nutrition needs.

Few cadets reported selecting their eating behaviors based on previous nutrition knowledge. Most of this knowledge involved nutrition for athletic performance, unhealthful food choices, and home recipes about foods to prepare. Furthermore, some cadets also reported having limited knowledge about nutrition. These findings are consistent with previous studies in college students (Cluskey & Grobe, 2009; Deliens et al., 2014) and ROTC cadets (Nevarez, 2017).

Studies in college students suggest that students with the highest levels of nutrition knowledge tend to make healthier food choices (Yahia, Brown, Rapley, & Chung, 2016). Furthermore, studies suggest that college students may lack adequate knowledge for making healthier food choices (Cluskey & Grobe, 2009; Deliens et al., 2014), while also acknowledging that nutrition education will not inevitably result in healthier food choices. Studies in military populations suggest low levels of nutrition knowledge, despite increased nutrient demands due to physical activity (Bovill, Tharion, & Lieberman, 2003; Nevarez, 2017).

Cadets also discussed their sources of nutrition knowledge. For many cadets, their primary sources were family members, previous education provided in classes or sports programs, the internet, as well as other cadets. Most of these sources are likely not reputable, in that these sources do not likely have formal training on credentialing to provide nutrition education. These findings are consistent with other studies which suggest that friends/teammates and the internet are common sources of nutrition information for military personnel (Bovill et al., 2003). One qualitative study suggested that ROTC cadets that were kinesiology majors also served as sources of nutrition information for other ROTC cadets (Nevarez, 2017). Surprisingly, no cadets acknowledged accessing nutrition information from credentialed nutrition professionals, such as registered dietitian nutritionists, or even other health care practitioners, such as physicians or nurses. These findings suggest that ROTC cadets need access to more reputable sources of nutrition information, and that ROTC cadets are an understudied and underserved community within the nutrition profession.

As was previously reported, money and the cost of food was an important determinant of eating behaviors primarily for cadets living off campus. While some cadets reported relying on cheaper, convenience foods due to the perceived costs of healthier foods, other cadets found

ways to balance healthy food choices with the cost of food. For example, many cadets prepared their own foods or prioritized eating at home over dining out. Even cadets living on campus prioritized dining on campus and limiting dining out in order to save money. These findings are consistent with findings in college students (Deliens et al., 2014; LaCaille et al., 2011) and ROTC cadets (Nevarez, 2017), that suggest that the perceived cost of food is a significant environmental factor influencing eating behaviors.

Similarly, time, as in schedule to access meals, as well as in time to purchase and prepare meals, was also reported as an important determinant of eating behaviors. Time impacted eating behaviors in a variety of ways, ranging from relying on convenience, on-the-go foods, to skipping meals altogether, or relying on dining out more often. Time is also commonly reported as an important environmental determinant of eating behaviors in college students (Deliens et al., 2014; LaCaille et al., 2011) and ROTC cadets (Nevarez, 2017), similarly resulting in skipped meals or meals of lower dietary quality. When considered together, time and money are two of the most important determinants of eating behaviors for college students and ROTC cadets. These findings suggest that there is a greater need to develop and deliver nutrition education specifically targeted at college students and ROTC cadets that focuses on providing strategies for making nutritious, affordable, and convenient food choices when time and money are both constraints.

While many of the determinants listed above are also common in college student populations (Deliens et al., 2014; LaCaille et al., 2011; Nelson et al., 2009), there were unique aspects of the ROTC culture and context that nuanced how ROTC cadets experienced these various determinants. For example, unlike most college students, ROTC cadets participate in regular and mandatory physical training. In this study, physical training had an impact on

hunger/satiety, time/schedules, and knowledge related to foods. This suggests that although currently existing resources for college students related to preparing nutritious, affordable, and quick meals may be used by ROTC cadets, these would most likely have to be adapted to address the unique needs of ROTC cadets.

Unlike previous studies in college students, this study also examined the role of the ROTC context in shaping eating behaviors. The ROTC context included various factors that are unique to ROTC cadets, including their program cadre, participation in ROTC, other cadets, physical training, preparation for physical fitness and body compositions assessments, and perceptions of body image. For example, program cadre are military enlisted non-commissioned and commissioned officers that serve as class instructors, as well as mentors and role models in all aspects military training for ROTC cadets. The cadre were described as instructors, mentors, and role models given they taught the only nutrition class offered at ROTC, as well as provided extra assistance and guidance to cadets who were struggling to meet the body composition standards. Although there is no comparable resource available to college students, the role of the cadre in influencing eating behaviors was addressed in one previous qualitative study with ROTC cadets (Nevarez, 2017). Nevarez reported that chocolate milk consumption after morning physical training was recommended to cadets to assist with recovery (Nevarez, 2017). Although no previous study has ever examined nutrition from the perspective of ROTC cadre, one military study examined the role of drill sergeants in the nutrition behaviors of soldiers attending basic training (Jayne et al., 2019). Drill sergeants are Army non-commissioned officers that are responsible for the training and discipline of recruits attending Army basic training. Jayne et al. reported that despite reporting that their primary duty was to train and develop civilians into soldiers, drill sergeants reported lacking confidence in their nutrition knowledge and their ability

to give nutrition instruction (Jayne et al., 2019). Drill sergeants also reported that they don't feel it is their job to tell other soldiers what to eat and that regulations might even prevent them from telling soldiers what they can and cannot eat (Jayne et al., 2019). While not examined in this study, it is likely that ROTC cadre also lack the appropriate nutrition knowledge and training to give nutrition instruction to ROTC cadets. These findings suggest that there is also a need for qualitative studies with ROTC cadre in order to learn their perspectives to develop improved training and education of ROTC cadre, who have the potential to be an important resource for improving and sustaining the eating behaviors of ROTC cadets.

Other aspects of the ROTC context that were discussed in relation to cadets' eating behaviors included participation in ROTC, which includes physical training, as well as the role of other cadets. For example, when discussing participation in ROTC, cadets focused on physical training. For some cadets, participation in ROTC resulted in replacement of unhealthy food choices with healthy food choices in order to lose weight in preparation for ROTC. Discussing how ROTC influenced their eating behaviors brought to mind physical training for many cadets, which resulted in changes to their eating behaviors, such as eating more breakfast. Specifically, participation in physical training also brought about changes in eating behaviors for some cadets. For example, cadets discussed being more cognizant of energy and nutrient needs for physical activity and using this knowledge to plan their eating behaviors. For other cadets, physical training resulted in them being more conscientious in making healthier food choices, especially food choices that help with physical performance. Similarly, other cadets reported having less of an appetite for unhealthy foods because of their perceived negative impact on performance. Finally, a few cadets being less restricted in their eating behaviors because of their higher level of physical activity. Similarly findings were reported by Nevarez in a sample of EIU ROTC

cadets (Nevarez, 2017). Nevarez reported that cadets stated making changes to their eating behaviors because of participation in ROTC, such as eating breakfast and eating larger breakfasts, eating more nutritious foods, and drinking chocolate milk after ROTC physical training (Nevarez, 2017). These findings suggest that physical training represents an important opportunity to provide performance-related nutrition education, especially with regard to nutrient needs and pre- and post-workout fueling.

Another unique aspect of the ROTC context was the influence of other cadets on cadets' eating behaviors. This involvement was discussed as both positive and negative. For example, positive ways cadets influenced other cadets eating behaviors were by providing encouragement and motivation. Other cadets encouraged the eating of healthy foods and also served as work out partners for cadets struggling with physical performance. Other cadets even provided more specific fueling-related advice than cadets would normally receive. On the other hand, some cadets negatively described the involvement of other cadets. Cadets provided example of how specific cadets were sought out for advice because of the way they look and perform rather than what they know. Similarly, there was a perception that ROTC cadets in general are more self-aware of their body image and physical performance and that they might judge each other based on their eating habits. Peers have also been reported as important sources of influence in relation to eating behaviors for college students (Deliens et al., 2014) and ROTC cadets (Deliens et al., 2014; Nevarez, 2017). For example, Deliens et al. explored how peers can be both a source of social support to facilitate eating behaviors, as well as a source of peer pressure to engage in certain eating behaviors (Deliens et al., 2014). In the ROTC context, other ROTC cadets, in particular ROTC cadets with a kinesiology background, were sought after for advice on foods and exercises to gain or lose weight (Nevarez, 2017). Taken together, these findings suggest that

the involvement of peers can have both a positive and negative influence on eating behaviors, either providing a supportive environment or encouraging unhealthy attitudes towards eating behaviors and body image. Therefore, there is a need to understand how peer interactions influence eating behaviors, as well as leverage peers as a way to disseminate and support positive eating behaviors and positive body image (i.e. Peer Body Project) (Stice, Rohde, & Shaw, 2012).

One important facet of the ROTC context related to cadets' eating behaviors was their reported preparation for physical fitness and body composition assessments. Enforcement of the semi-annual physical fitness and body composition standards involves a physical fitness assessment on muscular strength and endurance through assessment of two-minute push-ups, two-minute sit-ups, and a timed two-mile run (Department of the Army, 2012). Enforcement of the body composition standards involves a two-step process of screening for weight-for-height, followed by estimation of percent body fat using body circumference methods for individuals exceeding age- and sex-specific weight-for-height (Department of the Army, 2013). If both the screening and percent body fat estimations exceed maximum allowable weight and percent body fat, individuals are determined to be over the standards or not in compliance with body fat standards (Department of the Army, 2013). In ROTC, cadets are expected to meet these standards in order to remain in good standing within the program, compete for scholarships, and to commission upon graduation (US Army Cadet Command, 2018). Therefore, semi-annual physical fitness and body composition assessments are an important aspect of the ROTC context related to cadets eating behaviors.

Cadets described different ways preparing for physical fitness and body composition assessments related to their eating behaviors. For example, some cadets reported making significant changes to their eating behaviors, while other cadets reported making minimal

changes to their diet, focusing instead on physical preparation. For cadets making significant changes to their eating behaviors, some cadets focused on eating healthier, and more satiating foods to intentionally lose weight. One cadet even described fasting from foods and beverages for a day and even taking a diuretic to lose weight. Other cadets focused on replacing unhealthy foods with healthy foods and including more carbohydrate-based foods to enhance performance and prevent fatigue and cramping. Many of these changes to eating behaviors are similar to changes previously reported by Nevarez in a sample of ROTC cadets (Nevarez, 2017). Cadets reported also cutting back on refined and processed foods and eating more chicken, fish, and salads in order to lose weight (Nevarez, 2017). Some cadets even reported fasting the day before their body composition assessment to meet the body fat standard (Nevarez, 2017). These findings suggest that cadets are willing to undergo changes in eating behaviors, and even engage in extreme and unhealthy dieting behaviors in order to meet body composition standards. Some of these behaviors can cause short-term risks to both performance and health, such as increased risk for injury, as well as increase long term risk for development of eating disorder symptoms. Therefore, there is a need to educate ROTC cadets on the health risks of these behaviors, as well as to provide healthy and safe options for modifying eating behaviors to meet the standards.

With regards to preparation for the physical fitness and body composition assessments, cadets also discussed their stress level regarding the body composition assessment and their perceptions about the process. There were cadets that were stressed and not stressed about meeting body composition standards. Generally, cadets that met their table screening weight, which falls between a BMI range of 25.6-26.4 kg/m^2 for males and 24.9-25.3 kg/m^2, for females, were not at all stressed about the body composition assessment. For cadets that exceeded their screening weight but met the percent body fat standards of 20-22% for males and 30-32% for

females, results were slightly different. Males exceeding screening weight but meeting the standards tended to report not being stressed about the assessment, while females exceeding the screening weight yet still being compliant with the standards reported being extremely stressed about the standards. Similarly, Nevarez reported that ROTC cadets that are on the border of meeting the body composition standards will be stressed and will engage in behaviors such as limiting carbohydrate-based foods, limiting high calorie foods, and fasting before a body composition assessment (Nevarez, 2017). The evidence suggests that cadets that are on the edge of meeting the standards will experience more stress and may potentially engage in more unhealthy weight control behaviors, such as fasting or taking a diuretic, in order to meet the standards.

Cadets also discussed perceptions related to the body composition assessment process. Some cadets discussed stressing out about the assessments because they were tied into scholarship and developmental opportunities, such as attending military training schools. Other cadets described that the way the standards are currently implemented, with occurring only one time per semester, may result in unhealthy weight control behaviors because cadets are not monitored regularly, and therefore are not receiving timely information on making safe changes to their eating behaviors. Yet other cadets felt the standards were not realistic because they don't consider someone's physical fitness ability. For example, cadets discussed the body composition standards were not realistic if you could be a top performer on the physical fitness assessment and still struggle to meet the standards. While these perceptions have not previously been investigated in ROTC cadets or military service members, one qualitative study reported that for individuals failing to meet the body fat standards, their cadre will ask them to, "stay on ellipticals and treadmills and do as much cardio as they can" when ROTC has physical training at the gym

(pg. 35)(Nevarez, 2017). Taken together, the evidence on the body composition assessment standards and process suggests a need to further examine the role of the body composition standards and the eating behaviors of ROTC cadets and military service members. For example, there are no standardized interventions or processes for ROTC cadets exceeding body composition standards. Furthermore, there is a need to understand the relationship between body composition and physical performance, and perhaps even evaluate if there is truly a need for body composition standards from the perspective of operational readiness. Currently, as the standards are implemented, semi-annually, without constant monitoring, prevention, or intervention, may potentially increase the risk for engagement in extreme and unhealthy dieting behaviors which long term may result in development of eating disorder symptoms that compromise operational readiness.

Overall, in relation to the body composition standards, the evidence suggests that the standards, as they are currently being perceived and implemented, are failing to meet their original intent which is to promote nutrition and physical activity habits (Friedl, 2012). In other words, the standards were designed and implemented as a gage on operational readiness. It was presumed that in order to meet the standards, service members would have to engage in regular physical activity and in healthful nutrition (Friedl, 2012). That cadets are expressing concern that not only do the standards not reflect someone's engagement in physical activity and nutrition, but that their semi-annual cyclical nature results in adoption of unhealthy eating behaviors for quick weight loss suggests that there is a need both for further education on healthy eating and physical activity behaviors within ROTC, as well as an in depth examination into whether the standards, as currently implemented, truly reflect operational readiness, physical fitness, and optimal nutrition status, without promoting unhealthy eating behaviors, and extreme weight loss

behaviors, which not only result in impaired physical performance, but long term weight gain and risk for eating disorder symptoms. So far, there has not been an in depth program evaluation on how the current body composition standards and their implementation are tied to the military goals of operational readiness, physical fitness, and health.

Another unique aspect of the ROTC context related to cadets' eating behaviors was their perception of body image within the context of ROTC. Cadets discussed body image concerns they have of themselves in relation to their participation in ROTC. For the most part, cadets discussed that they did not have any concerns or worry about their body image. However, some cadets that perceived themselves as smaller, usually shorter and thinner females, reported feeling weaker than larger, muscular, and taller male cadets. Similarly, cadets who perceived themselves as larger reported feeling like they might be slower or not as fit as cadets that were thinner, and more toned. Both cadets that felt smaller or larger than other cadets reported pushing themselves harder to make sure they are able to compete at the same level as cadets who are taller and muscular, or thinner and more toned. No previous studies have reported on body image in military related populations. However, the findings suggest that cadets associate body size with physical performance capabilities and it may be beneficial to focus on physical performance capabilities regardless of body size, as the Army has done with its shift towards more universal physical fitness standards with the new Army Combat Fitness Test (US Army, 2019a).

Cadets also discussed changing their eating behaviors in relation to their body image perceptions. Some cadets, particularly male and female cadets with lower BMIs, prioritized eating more meals, more calories, and more protein in order to try to build muscle. Similarly, cadets with BMIs on the cusp of passing/failing the body composition standards, reported being more self-conscious of their weight and engaging in more restrictive eating behaviors to try to

change their weight. A few cadets that reported not having body image concerns, discussed that how they performed on the body composition assessment made them feel labeled as overweight and like a failure for not being able to lose weight to meet the weight for height screening table. Similar findings were reported in college students, who reported that their body image influenced their self-concept, which in turn affected their eating behaviors (Deliens et al., 2014). These findings suggest that body image is an important, yet under-investigated, factor related to eating behaviors, in particular, unhealthy dieting behaviors associated with increased risk of eating disorder symptom development.

Cadets also discussed their experience related to body image in ROTC. Some cadets reported that body image, in general, is something cadets are more aware about and care about. Many cadets reported the perception that cadets, especially males in ROTC, are expected to look lean, muscular, and physically fit. Some cadets even discussed perceptions that how you eat relates to how you look, with some cadets changing their diet to change how they look. Finally, one cadet discussed an experience where she felt body image was discussed by instructors in ROTC in such a way the perpetuated a negative perception of body image. While no previous studies have reported on body image perceptions with military populations, one study reporting on the role of drill sergeants in nutrition behaviors of soldiers reported that drill sergeants defined the ideal soldier based on physical fitness and a fit appearance. For example, drill sergeants described the ideal soldier as someone who is "physically fit," "not obese," "not overweight," but "not underweight" (pg. 71) (Jayne et al., 2019) These findings suggest that, whether discussed or not, body image does play a role both in individual self-concept, as well as shaping the eating behaviors of some individuals. Furthermore, the findings point toward a perception that in addition to being physically fit, cadets and soldiers must also look physically

fit. When these distinctions are made, on function (performance) vs. form (appearance), one must ask the question, which is the priority? Evidence from previous studies suggests that having appearance as a priority for eating behaviors is associated with development of eating disorder symptoms as well as obesity (Putterman & Linden, 2004).

This was one of the first studies to describe and examine the eating behaviors and mediators of eating behaviors in ROTC cadets. As such, this study provides insight into some of the determinants of eating behaviors, in particular the ROTC context, which is unique to ROTC cadets. A strength of this study was the use of in-depth responsive interviewing to examine the experiences and perspectives on eating behaviors from the point of view of ROTC cadets. Furthermore, the use of purposive sampling allowed for a greater variety of perspectives, including information-rich extreme and negative cases.

Despite the strengths of the study, there were also several limitations. Many efforts were taken to ensure the descriptive validity of the accounts, such as the use of audio recordings, verified, verbatim transcripts, and consensus coding. Note-taking was also undertaken during and following interviews, in order to probe and follow up on all relevant information related to the research questions. The study also made use of in-depth telephone interviews to allow for a greater sense of privacy and honesty from participants. However, the lack of a face-to-face interview also may have limited the ability to develop rapport and document non-verbal gestures. Nonetheless, the content of the interviews suggests that, for the most part, most cadets were detailed and candid about their experiences related to eating behaviors within the ROTC context.

Another potential threat to validity is the interpretative validity, or how the results are interpreted. The researcher made great efforts to ground the results in the data by using a semi-structured interview guide and systematically coding and displaying the data to maintain a

connection to the original data. However, due to the exploratory nature of the study, there is always the risk that information could be misinterpreted. One way we sought to establish credibility in our findings was by having a researcher with a military background that regularly engaged with the ROTC cadets, and even conducted a similar pilot project with a smaller sample (Lincoln & Guba, 1985). We also sought to establish credibility by including quantitative findings in addition to qualitative findings. These efforts were undertaken to mitigate potential threats to interpretative validity.

Also, due to the nature of the study, a qualitative, exploratory study, these findings may not be generalizable to other ROTC populations or other military populations. However, we addressed this concern by providing thick and detailed descriptions of the eating behaviors and experiences of ROTC cadets (Lincoln & Guba, 1985). We also, as described above, used purposive sampling to include information rich, extreme, and negative cases (Pope & Mays, 1995). Furthermore, many of the findings were similar to findings reported in other military-related qualitative studies (Jayne et al., 2019; Nevarez, 2017), suggesting at least some of the main content and ideas are potentially generalizable to other ROTC- and military-related populations.

While the study relied on socioecological and cognitive behavioral models of eating behaviors, there is likely not enough evidence to establish confirmability. Future studies, including longitudinal studies, with a larger and more varied sample size, including various sites, would be needed to confirm if these findings are consistent across different ROTC- and military-related populations.

Despite these limitations, the findings of this study suggest a need for future studies and interventions related to eating behaviors in ROTC cadets. Specifically, there is a greater need to

establish the role of nutrition education as a potential determinant of eating behaviors. There is also a need for various tools, including qualitative and quantitative tools, to determine and describe the eating behaviors of ROTC cadets. There is a need for quantitative and qualitative studies that examine how eating behaviors are established and changed through the ROTC context. Finally, there is a need to determine the role ROTC plays, particularly, in relation to problematic eating behaviors that increase the risk for development of eating disorder symptoms and obesity. These studies should capture both the perspective of participating ROTC cadets, as well as their cadre and other military leadership that play a role in establishing the ROTC context of ROTC cadets.

Information based on the current and future findings will help inform the development of programs to screen, monitor, and influence the eating behaviors of ROTC cadets. Nutrition education, in particular, was expressed as a need by this group, specifically, nutrition education geared towards their specialized nutrition needs and concerns, which include nutrition and performance, nutrition and weight management, meal planning on and off campus, and body image concerns. Qualitative approaches can continue to serve as a vehicle to develop, implement, and evaluate the efficacy and effectiveness of these programs.

F. Conclusion

In conclusion, this study sought to describe the eating behaviors and mediators of eating behaviors from the perspective of ROTC cadets. The ROTC context, particularly with respect to the preparation for and enforcement of physical fitness and body composition standards, as well as perceptions related to body image, emerged as important and unique determinants of the eating behaviors of ROTC cadets. Understanding the eating behaviors and determinants of those eating behaviors in ROTC cadets is complex and challenging in particular because of their

intersection as both college students and military members in training. A better understanding of the unique perspectives and challenges experienced by ROTC cadets will assist nutrition educators, program staff, and policy makers in developing and implementing more effective and comprehensive nutrition programs that address the unique needs of ROTC cadets without further increasing risk for the development of eating disorder symptoms and obesity. Because of their future roles not only as military service members, but officers and leaders of warfighters, ROTC cadets represent an opportunity to enact more systemic changes in eating behaviors and military culture and perspectives around eating behaviors and body image.

CHAPTER 7 – Overall Summary and Conclusions

We observed that eating disorder symptoms and eating disorder risk were prevalent in a sample of US Army cadets from two Midwestern universities. We found that correlates of eating disorder risk classification included traditional factors, such as sex (biological correlate, B), BMI (B), sociocultural, dieting, body dissatisfaction, and negative affect, as well as military contextual factors, such as failing body composition assessments, dieting for body composition assessments, attempting weight loss for body composition assessments, and peer comments about weight. Furthermore, we found that eating disorder symptoms were positively associated with weight status (BMI) and that this association was mediated by two constructs of affect regulation related to body dissatisfaction and dieting, psychological inflexibility related to body dissatisfaction and psychological inflexibility related to dieting. Finally, we described important determinants for eating behaviors in ROTC cadets, which also included socioecological environmental determinants, such as food availability, time, and money, as well as military contextual determinants specific to the ROTC context, such as body image perception and preparing for physical fitness and body composition assessments. These findings suggest the need for ongoing examination into the development of eating disorder symptoms and eating disorder risk, potential determinants of these risks and how they may result in the onset of weight gain and obesity, as well as interventions to target and mitigate these risks.

A. Implications

Currently, Army ROTC produces about 60-70% of all commissioned officers that serve in the regular Army, Army Reserve, and National Guard, compared to 25% and 15% recruited

from the US Military Academy at West Point and Officer Candidate School, respectively (Henning, 2006; US Army Cadet Command Public Affairs Office, 2018). Enrollment also includes ~30,000 ROTC cadets enrolled at over 270 host schools and 1,000 partnered college campuses nationwide, organized into eight regional brigades under the leadership of US Army Cadet Command, US Army Training and Doctrine Command (Morgado, 2017; US Army, 2018; US Army Cadet Command Public Affairs Office, 2018). In contrast to enlisted member recruitment and training, which consists of 10 weeks of basic combat training and up to 6 months of advanced individual training related to specific military occupations, Army ROTC cadets may be in training for up to four years through college and university ROTC programs (US Army, 2019b). The goal of these training programs is to produce second lieutenants with "character and accountability, comprehensive fitness, adaptability and initiative, lifelong learner, teamwork and collaboration, communication and engagement, cultural competence, and tactical and technical competence" (pg. 104) (Morgado, 2017; U.S. Army Assymetric Warfare Group, 2013). Cadets are evaluated on these components through the accessions process, or Order Merit List, that evaluates various aspects of cadet performance in order to rank and branch cadets into their respective preferred branches (Combat Arms, Combat Support, Service Support). These include: academic outcomes (40%), leadership outcomes (45%), and physical outcomes (15%) (US Army Cadet Command, 2018). For example, under physical outcomes, cadets are awarded up to 3 point for their fall semester Army physical fitness assessment (APFT), 3 points for the spring semester APFT, 6 points for their Advanced summer camp APFT, and an additional 3 points for participation in athletics (US Army Cadet Command, 2018). Therefore, it is evident that US Army ROTC cadets represent an important component of the military leadership and strategic structure, and that while physical fitness (which includes body composition) is an important

capability necessary for leadership and combat, it is only one of many components on which ROTC cadets are evaluated.

Given that physical training is an aspect that ROTC cadets perform on a regular basis, that contributes to their operational readiness and tactical training, and is evaluated for determining commissioning selection, it is not surprising that most studies in ROTC cadets have investigated some aspect of physical readiness training (Bigelman et al., 2010; Crombie et al., 2012; Jones et al., 2012; Liguori, Krebsbach, & Schuna, 2012; Oliver et al., 2013; Schuna, Hilgers, Manikowske, Tucker, & Liguori, 2013; Scott, Simon, Van Der Pol, & Docherty, 2015; Steed et al., 2016; Thomas, Lumpp, Schreiber, & Keith, 2004). However, the role of nutrition in supporting not only physical activity, but also other valued aspects of being a leader and a warfighter, such as comprehensive fitness, adaptability, and competence, has not been acknowledged with only three studies examining aspects of nutrition within ROTC samples (Crombie et al., 2012; Jones et al., 2012; Lauder & Campbell, 2001; McClung & Gaffney-Stomberg, 2016; Nevarez, 2017). These findings suggest that despite the important role ROTC cadets will have as future commissioned officers in shaping and influencing the policies and behaviors of future troops under their command, very little is known in how nutrition may play a role in supporting the success not only of ROTC cadets, but the future readiness and preparation of the military services.

For example, ROTC cadets, as young adults, are in the life stage when there is a high prevalence of eating disorders and obesity (Eisenberg et al., 2011; Flegal et al., 2010; Hudson et al., 2007a; Racette et al., 2008). Findings in the current study are in agreement with findings in other military populations that suggest this is an ongoing phenomenon. While studies continue to find evidence for traditional risk factors, such as dieting, body dissatisfaction, and negative

affect, as well as military contextual factors, such as the military culture and preparation for and enforcement of body composition standards, very little is being done to understand how and why these risk factors contribute to the development of eating disorder symptoms and obesity, and what potential impact these may have on the health, well-being, and operational readiness of the military forces.

Because ROTC cadets do experience military contextual factors similar to those experienced by military service members, and they also have more time to develop their military-related knowledge and skills (up to four years), ROTC cadets represent an important population to continue to examine not only what increases the risk of eating disorder symptoms and obesity onset, but also what are potential ways to mitigate these risks. For example, this study identified risk factors related to dieting, body dissatisfaction, negative affect, affect regulation, and military contextual factors, such as preparing for physical fitness and body assessment, that were associated with increased eating disorder symptoms and eating disorder risk classification.

Currently, there are no interventions in military populations, including ROTC cadets, that specifically target these risk factors to reduce incidence and prevalence of eating disorder symptoms and obesity. In the present study, we identified two potential mechanisms linking eating disorder symptoms and obesity, affect regulation defined as psychological inflexibility related to body dissatisfaction and dieting, in agreement with pathways described from the Dual Pathway Model (Stice, 1994, 2001; Stice et al., 1998). These findings suggest that in addition to determining how and why eating disorder symptoms and obesity develop in ROTC cadets, it is important to develop interventions that target potential linking mechanisms, such as affect regulation, as is done in Acceptance and Commitment Therapy (ACT)-based approaches (Duarte

et al., 2017; Duarte et al., 2016; Forman et al., 2013a; Hayes et al., 2006; Lillis et al., 2009; Lillis et al., 2011; Sandoz et al., 2013). Therefore, adoption of ACT-based experimental interventions targeting affect regulation difficulties may be one way to simultaneously address the shared risk of eating disorder symptoms and obesity in military-related populations.

Another underexamined aspect identified by this study was the military cultural context. For example, ROTC cadets described various ways in which the military cultural context may contribute to and support the development of dieting and body dissatisfaction within the ROTC context. ROTC cadets described experiences related to body composition assessments, which included both preparation for the standards and enforcements of the standards. Similarly, ROTC cadets described body image-related experiences and expectations that also may contribute to dieting and body dissatisfaction. Taken together, these findings suggest that there are underlying factors, especially related to military culture, that may inadvertently be contributing to the development of dieting and body dissatisfaction beyond enforcement of physical fitness and body composition standards. Military cadre members and their leadership, as the direct instructors, mentors, and enforcers of policy within ROTC programs, may be important informants not only on the body composition assessment processes, but also on the general ROTC cultural context (Jayne et al., 2019). Therefore, a greater understanding of the ROTC cultural context, not only from the perspective of ROTC cadets, but also of their cadre members and upper levels of leadership may be necessary to understand how various factors, such as dieting, body dissatisfaction, and military contextual factors, interact to produce conditions necessary for the development of eating disorder symptoms and obesity, as well as potential solutions to address these concern from "the bottom up (ROTC cadets through higher levels of leadership) and the top down (policy levels, environmental levels, individual levels)."

One last underexamined aspect of the military cultural context and its influence on eating behaviors is that of nutrition education within ROTC programs. Currently, nutrition education and access to nutrition professionals, such as registered dietitian nutritionists (RD/RDNs), is limited. For example, ROTC cadets report receiving one nutrition class during their first (MS1) year from their cadre, followed by limited nutrition guidance (Nevarez, 2017). However, findings from the current and past studies suggest there is a gap on healthy eating behaviors, healthy weight management, and nutrition needs for physical performance that could be detrimental and potentially contribute to the development of dieting, body dissatisfaction, and unhealthy weight control behaviors in preparation for physical fitness and body composition assessments (Nevarez, 2017). Therefore, there is a need to consider how this gap in nutrition knowledge and access to nutrition-related resources might be met. For example, the US Military Academy at West Point has at least one RD/RDN assigned for a population of about 4,000 and currently US Army Cadet Command has no RD/RDNs assigned for a population ~30,000, while Cadet Command does have medical officers, including a brigade nurse for each of the eight brigades, assigned. The feasibility of assigning RD/RDNs should be explored.

Our findings suggest that dieting, body dissatisfaction, and military contextual factors are important determinants of eating disorder symptoms and eating disorder risk in US Army ROTC cadets. Additionally, our findings show that eating disorder symptoms and obesity are associated and that psychological inflexibility related to body dissatisfaction and dieting are two important pathways linking these conditions. Finally, our findings suggest an important role of the ROTC context in shaping eating behaviors, in particular dieting and body dissatisfaction, in ROTC cadets. Overall, our findings suggest the need for future studies to further confirm these findings in longitudinal trials, as well as experimental and exploratory trials to develop strategies to

mitigate dieting, body dissatisfaction, and affect regulation in order to reduce incidence of both eating disorders and obesity in military related populations. These findings also suggest the need for a more rigorous evaluation of body composition assessment programs to identify potential areas for improvement to mitigate risks related to eating disorders and obesity.

B. Recommendations for Future Research

Several studies are proposed to confirm and extend the findings reported in this dissertation. First, findings regarding eating disorder risk classification, eating disorder symptoms, weight gain, and obesity, as well as their correlates, such as dieting, body dissatisfaction, and military contextual factors, must be extended to other samples of ROTC cadets, including randomized samples. Only two studies have ever examined eating disorder risk classification and eating disorder symptoms in ROTC cadets, the present study and a study by Lauder & Campbell in a sample of female ROTC cadets at summer training (Lauder & Campbell, 2001). This study was only conducted at two universities in the seventh ROTC brigade. There are eight ROTC brigades and a total available population of ~30,000 ROTC cadets from which to draw from. One initial step may be to validate electronic versions of the instruments used in this study to facilitate widespread dissemination to include a more representative sample of ROTC cadets. Another potential option is to recruit cross-sectional time series samples of ROTC cadets at their respective summer trainings, which includes Basic Camp for MS1 and MS2 cadets, and Advanced Camp, for MS3 and MS4 cadets.

In addition to confirming findings in randomized samples of ROTC cadets, longitudinal studies are also needed to examine how and when risk factors for eating disorder symptoms and obesity develop, as well as how they contribute to the development of eating disorder symptoms and obesity. For this study it may be beneficial to continue to examine the population at the two

Midwestern universities investigated in this study to extend the current findings. Longitudinal investigations will allow identification in trends and risk periods, which will then inform future interventions to target and mitigate risk factors and risk periods. For example, the only longitudinal study in a similar population was conducted at the US Military Academy at West Point, which identified that rate of meeting eating disorder risk classification increased between the first and third year, and decreased after the third year for female cadets (Beekley et al., 2009). In addition, findings from the study prompted changes at the US Military Academy at West Point, such as: the establishment of an Eating Disorder Task Force (which included members of the cadet health clinic, a RD/RDN, and a clinical psychologist), changes to how the body composition assessment process was implemented, as well as changes to the fit of female uniforms (Wolff, personal communication, November 20, 2017). Therefore, longitudinal studies will allow identification of at-risk populations and targets for future interventions.

In addition to extending and confirming findings in randomized and longitudinal studies, further qualitative studies are also necessary. For example, in the current and past studies, qualitative studies have assisted in identifying aspects of the military cultural context that may contribute to eating behaviors and the development of eating disorder symptoms and obesity, such as enforcement and preparation for body composition assessments; body image expectations; learning to eat fast; lack of education on proper exercise, healthy eating, and healthy food choices; coping with stress and negative affect through eating; leader and peer comments about weight; and leader modeling and policies to support healthy eating behaviors (Breland et al., 2016; Breland et al., 2018; Breland et al., 2017; Hatzfeld et al., 2016; Jay et al., 2016; Jayne et al., 2019; Nevarez, 2017). Therefore, there is a need to extend qualitative studies

to include other ROTC programs, as well as other brigades, using a combination of one-on-one interviews, as well as focus groups.

One aspect of military contextual culture that remains unexplored is the perspective of ROTC cadre and other military leadership. ROTC cadre and military leadership are, in part, responsible for determining the environment, culture, and policies that ROTC cadets experience. Therefore, they represent valuable informants in understanding the military culture, policies, and implications of these on the eating behaviors and eating disorder symptoms of ROTC cadets. Only one qualitative study has explored the perspective of a related population, Army drill sergeants (Jayne et al., 2019). Jayne et al. (2019) identified that drill sergeants valued a physically fit appearance in soldiers, but felt it was not their job to instill eating behaviors and knowledge to support that fitness and that they lacked the preparation, nutrition knowledge, and confidence to influence the eating behaviors of soldiers. Similarly, ROTC cadre and military leadership, because of existing policies and doctrine, value ROTC cadets that appear physically fit, but may also lack the knowledge, resources, and preparation to healthfully support the adoption of eating behaviors and physical activity habits to develop well-rounded, agile, adaptable, and competent ROTC cadets. Therefore there is also a need to conduct qualitative studies, including one-on-one interviews and focus groups with ROTC cadre and other military leadership to gain understanding of their perspective of the military culture, as well as identify possible solutions to improve the eating behaviors, health, and operational readiness of ROTC cadets.

The information gained from the current study and proposed studies could then be used to develop experimental trials and interventions to examine and target potential linking mechanisms between eating behaviors, eating disorder symptoms, and obesity management. For example,

there are currently no standardized weight management interventions for ROTC cadets who fail to meet body composition standards. In the Active Army, Army Reserve, and Army National Guard components, soldiers who fail to meet body composition standards are referred to a RD/RDN, or other healthcare providers if a RD/RDN is not available, for nutrition counseling (Department of the Army, 2013). While the Army has attempted to develop standardized nutrition education programs to support the Army Body Composition Program, these have not been widely implemented nor evaluated for efficacy and effectiveness (Army Public Health Center, 2019). Findings from the current study suggest that interventions should focus on correlates, such as dieting, body dissatisfaction, and negative affect, as well as potential linking mechanisms, such as psychological inflexibility related to body dissatisfaction and dieting. There are currently a few projects that target dieting, body dissatisfaction, and psychological inflexibility related to body dissatisfaction and dieting that can potentially be adapted and tested in military populations, such as: Project Health (Rohde et al., 2018), the Body Project (Stice et al., 2012), Mind Your Health (Forman et al., 2016), Accept Yourself (Berman, Morton, & Hegel, 2016), Kg-Free (Palmeira et al., 2017), as well as other ACT-based interventions (e.g. to reduce body dissatisfaction and disinhibition) (Lillis et al., 2016; Lillis, Thomas, Niemeier, & Wing, 2017; Pearson et al., 2012). One of those interventions, Project Health, has been adapted to a military population, "Fit4Duty," although results are not yet publicly available (Shams-White & Deuster, 2017). Thus, another study would use pilot testing and qualitative studies to adapt existing interventions and to test the efficacy and effectiveness of these potential programs that simultaneously target eating disorder symptoms and obesity prevention by focusing on dieting, body dissatisfaction, negative affect, and psychological inflexibility.

Additionally, both the current studies and past studies have identified a need for nutrition education in ROTC cadets, and other military populations as well. Studies in military populations suggest low levels of nutrition knowledge (48-65%) (Bovill et al., 2003; Nevarez, 2017; Trent, 1992). One previous mixed methods study in ROTC cadets identified a need for nutrition education related to MyPlate, as well as fueling for performance and healthy weight management (Nevarez, 2017). The current study also identified gaps in nutrition knowledge related to balanced eating, food planning and preparation with a limited time and budget, fueling for performance, healthy weight management, and healthy body image. Therefore, findings from the current study can be used to develop and test nutrition education targeted towards the specific nutrition needs of ROTC cadets.

Overall, findings from the current study support continued research on the development of eating disorder symptoms and obesity in military-related populations, including ROTC cadets. Also needed are efforts to understand the military culture and contextual factors that interact with traditional risk factors from the perspective of multiple stakeholders, including ROTC cadets, their ROTC cadre, and other leaders that develop and enforce current policies and programs. Together, this information can be used to develop programs and interventions to enhance nutrition knowledge, while also seeking to simultaneously reduce eating disorder symptoms and obesity are in order to mitigate their potential adverse impacts on the health, physical fitness, body composition, and operational readiness of military-related populations

C. Recommendations to Policymakers

Through the present study, we confirmed a continued high prevalence of eating disorder symptoms and eating disorder risk in a current sample of US Army ROTC cadets. Currently, the Army does not regularly conduct monitoring and surveillance on eating disorder symptoms

because being diagnosed with an eating disorder is grounds for discharge from the military services and disqualification from ROTC. However, ROTC cadets and service members experiencing challenges that my contribute to development of eating disorder symptoms and obesity need access to resources and treatment without fear of reprisal, since this is not a problem that will only impact them during their time in service. For many individuals that experience eating disorder symptoms and obesity, and any associated stigma, this is a problem they may carry with them for the rest of their lives, as is evidenced in our veteran populations (Bartlett & Mitchell, 2015; Bodell et al., 2014; Breland et al., 2016; Jay et al., 2016; Mitchell et al., 2014; Rush et al., 2016; Smith et al., 2009). Hence, similar to the efforts that have been made to understand, treat, and destigmatize mental health disorders, such as PTSD, so too are efforts needed to understand, treat, and destigmatize help seeking in relation to eating disorder symptoms and obesity through regular monitoring, surveillance, and development of interventions to treat and rehabilitate service members.

Another way that eating disorder symptoms and obesity can be simultaneously targeted is through a more rigorous evaluation of the Army Body Composition Program (ABCP). The ABCP was put in place to ensure that "all soldiers achieve and maintain optimal well-being and performance under all conditions," with the secondary objectives of establishing "operational readiness, physical fitness, health, a professional military appearance" (pg. 1) (Department of the Army, 2013). However, data from how soldiers perform on the ABCP has not been compared to these outcomes. Furthermore, as data from this dissertation suggests, there is evidence that current implementation of ABCP may be contributing to eating behaviors that increase the risk for eating disorder symptoms and obesity. For example, in addition to preparing for the body composition assessment, cadets also discussed that how the body composition assessment is

implemented could also be problematic, which was also reported at West point (Wolff, Personal Communication, 11/17/2017). There is also data suggesting that body composition, as measured by the ABCP, is not related to physical fitness or physical performance (Steed et al., 2016). Therefore, there is a need for rigorous program evaluation, to include process and outcome evaluation. Process evaluation would examine if the ABCP is being communicated and implemented as intended, and if those responsible for implementing the programs have access to the training and resources needed to accurately implement the program. Outcome evaluation would then allow determination if the expected outcomes are being achieved, as described above, if there are any unintended side effects to implementing the program, and if there are potential ways to address gaps to improve outcomes (National Oceanic and Atmospheric Administration, 2019). Such studies would allow determination if the program is accomplishing its objectives as stated, or if new types of programs and evaluations are needed. For example, the US Marine Corps recently implemented changes to link physical fitness assessment with body composition assessment, such that Marines achieving a score of 285/300 or higher on their physical fitness and combat fitness assessments would be exempt from weight and body fat limits (The US Marine Corps, 2019). The implementation of a new test, the Army Combat Fitness Test, which purports to be more directly linked with readiness and injury risk, can provide the opportunity for such program evaluations to occur (US Army, 2019a).

Policy makers are also recommended to examine and identify nutrition education needs across the lifespan of soldiers. Currently, there is one project in development, Eating Behaviors and Mediators of Eating Behaviors Survey Development, seeking to measure and assess eating behaviors across the lifespan of a soldier's career (Cole, 2016). This initiative, along with the proposed studies, will be instrumental in identifying key stages and gaps in knowledge in order

to support development of nutrition education and policies that support the nutrition needs of warfighters. This will allow for development and delivery of standardized nutrition education targeted to the specific needs of various warfighter communities, such as basic training soldiers, ROTC cadets, combat soldiers, combat support soldiers, and senior leaders.

The above studies and proposed policy initiatives will not be possible without expanding the role and availability of military RD/RDNs. Military RD/RDNs are RD/RDNs who have completed coursework in food and nutrition sciences, sociology, biochemistry, microbiology and chemistry. They have also demonstrated competency in expected practice areas through supervised practice and passing of the national registration exam (Kohn, 2017). In addition, military RD/RDNs have also completed military-specific nutrition training, such as the Joint Field Nutrition Operations Course and the Joint Advanced Nutrition Symposium, as well as advanced practitioner credentialing, such as the Board Certified Specialist in Sports Dietetics credential. Therefore, there is a need to expand the role of military RD/RDNs, as well as access to their skills and resources, as is currently being piloted through the Army's Holistic Health and Fitness (H2F) initiative (Lacdan, 2017). While there is one military RD/RDN currently assigned to Training and Doctrine Command, which oversees all training programs, including ROTC, ROTC cadets, their future soldiers, and the Army, would benefit from also assigning military RD/RDNs directly to training programs, such as ROTC and US Army Cadet Command. Military RD/RDNs are an essential asset to assisting policymakers with developing and implementing policies, interventions, and studies, to truly assist warfighters at all levels in achieving "optimal well-being and performance under all conditions," as well as, "operational readiness, physical fitness, health, and a professional military appearance" (pg. 1) (Department of the Army, 2013).

D. Overall Conclusion

Through the present study, we confirmed a continued high prevalence of eating disorder symptoms and eating disorder risk classification in a recent sample of US Army ROTC cadets. These findings need to be confirmed in larger, and randomized samples of US Army ROTC cadets, as well as other military-related populations, including active duty, reserve, and national guard service members.

We also identified potential correlates of eating disorder risk and eating disorder symptoms, including factors related to dieting, body dissatisfaction, and the military context, such as preparing for body composition assessments. However, we could not examine the causal nature of this association due to the use of a cross-sectional sample. Therefore, longitudinal samples are needed both in ROTC and other military related populations. Longitudinal studies would help determine causal risk factors for both eating disorder and obesity, which could be the target of future randomized controlled trials.

In addition, we identified two potential pathways that link eating disorder symptoms and obesity, including psychological inflexibility related to body dissatisfaction and dieting. While the findings suggest that psychological inflexibility related to body dissatisfaction and dieting partially mediate the association between eating disorder symptoms and obesity, these findings needs to be confirmed in larger, randomized samples, as well as longitudinal studies that are able to establish which factors precede the onset of eating disorder symptoms and obesity. Furthermore, experimental trials targeting psychological inflexibility related to dieting and body dissatisfaction in relation to eating disorder symptoms and obesity may also support a potential causal association linking these pathways.

Our qualitative findings also provided support for the notion that the military context not only influences eating behaviors but can specifically influence onset of dieting and body dissatisfaction. Qualitative findings also suggested many potential opportunities for nutrition education in relation to eating behaviors, physical performance, body composition, healthy weight management, and body image. Therefore, future studies are needed to determine the efficacy of nutrition education in influencing important outcomes, such as eating disorders and obesity, as well as health, performance, and operational readiness, by targeting eating behaviors, nutrition and performance, healthy weight management, and body image. Practitioners, including RD/RDNs, working with military service members, such as ROTC cadets, should engage in regular screening for eating disorder risk, and monitoring of binge and compensatory behaviors, especially around body composition testing periods, in order to prevent the development of eating disorders in military service members.

While this study had many strengths, it was not without limitations. This study did not include direct measurements of two of the most prominent risk factors in current models of eating disorder development, dieting and body dissatisfaction (Stice, 2001; Stice et al., 2011a; Thompson et al., 1999a). The use of cross-sectional convenience samples also precludes determination of causal relationships to eating disorder risk, as well as generalizability to military populations. Eating disorder symptoms and eating disorder risk classification by self-report measures should be compared to a clinical interview to further establish the reliability and validity of self-report eating disorder measures, such as the EDDS, in military samples. Additionally, while the focus of this study was on eating behaviors, particularly eating behaviors such as dieting, body dissatisfaction, and unhealthy weight control behaviors, this study did not include direct measurements of other eating behaviors, such as dietary intake.

Overall, findings from these studies suggest a gap in understanding about eating disorders, eating disorder symptoms, and eating disorder risks and their association with obesity in male and female ROTC cadets. For example, it is not known why ROTC cadets may experience increased eating disorder symptoms, how these develop within ROTC populations, and how to mitigate these symptoms. There is also a need to replicate these studies in additional samples of ROTC cadets and other military populations and to further examine which military contextual variables have the greatest influence on eating behaviors and how these factors influence eating behaviors. Preparation to meet physical fitness and body composition assessments was a common finding in Aim 1 and Aim 3, suggesting an important role of this military contextual factor to the development of eating behaviors, in particular, eating disorder symptoms. However, this study did not control for timing of physical fitness and body composition assessments. Future studies examining these behaviors and correlates prior to and after completion of physical fitness and body composition assessments may be able to provide clearer outcomes to guide the development of mitigation strategies to concurrently examine, prevent, and treat eating disorder symptoms and obesity within military populations.

APPENDICES

APPENDIX A: IRB Approval letter

MICHIGAN STATE
UNIVERSITY

Initial Study APPROVAL

January 4, 2018

To: Won O Song

Re: **MSU Study ID:** STUDY00000073
IRB: SIRB
Principal Investigator: Won O Song
Category: Expedited 4, 6, 7
Submission: Initial Study STUDY00000073
Submission Approval Date: 12/30/2017
Effective Date: 12/30/2017
Project Expiration Date: 12/29/2018

Title: Military body image and eating behaviors in Reserve Officer Training Corps (ROTC) Cadets.

This submission has been approved by the Michigan State University (MSU) SIRB. The submission was reviewed by the Institutional Review Board (IRB) through the Non-Committee Review procedure. The IRB has found that this research project protects the rights and welfare of human subjects and meets the requirements of MSU's Federal Wide Assurance (FWA00004556) and the federal regulations for the protection of human subjects in research (e.g., 45 CFR 46, 21 CFR 50, 56, other applicable regulations).

Documents Approved:
- FSHN ROTC Flyer, Category: Recruitment Materials;
- FSHN ROTC Informed Consent Revised, Category: Consent Form;

Continuing Review: IRB approval is valid until the expiration date listed above. If the research continues to involve human subjects, you must submit a Continuing Review request at least one month before expiration.

Modifications: Any proposed change or modification with certain limited exceptions discussed below must be reviewed and approved by the IRB prior to implementation of the change. Please submit a Modification request to have the changes reviewed. If changes are made at the time of continuing review, please submit a Modification and Continuing Review request.

Immediate Change to Eliminate a Hazard: When an immediate change in a research protocol is necessary to eliminate a hazard to subjects, the proposed change need not be reviewed by the IRB prior to its implementation. In such situations, however, investigators must report the change in protocol to the IRB immediately thereafter.

Office of Regulatory Affairs
Human Research Protection Program

4000 Collins Road
Suite 136
Lansing, MI 48910

517-355-2180
Fax: 517-432-4503
Email: irb@msu.edu
www.hrpp.msu.edu

APPENDIX B: RECRUITMENT FLYER

RESEARCH VOLUNTEERS NEEDED

Michigan State University Department of Food Science and Human Nutrition, in cooperation with the **US Army Research Institute of Environmental Medicine** (USARIEM), is conducting a research study to learn about **nutrition-related behaviors** and their impact on **physical performance**, **readiness**, and **health** in **Army ROTC Cadets**.

We are seeking volunteers that are Army ROTC Cadets and at least **18 years of age** or older to complete **survey questionnaires** about nutrition-related behaviors, mediators of those behaviors (for example, sleep and physical activity), and thoughts and feelings about nutrition-related behaviors. We are also measuring height, weight, and body measurements using the **Army tape test procedures**.

In addition, we are seeking volunteers to complete **one-on-one telephone interviews** to provide greater details about nutrition-related behaviors and the mediators of those behaviors.

Participation in this study will include:

(1) Informed consent process with a full description of the study
(2) Screening for age
(3) Completion of four survey questionnaires
(4) Army height, weight, and tape measurements
(5) One-on-one telephone interview (optional, eligible for $20 Amazon gift card)

Time required for this participation will be **approximately 2 hours** for the survey questionnaires and **approximately 1 hour for** the telephone interview.

Volunteers not currently on Active duty will be provided with a $10 grocery gift card and nutrition-related resources for completing this study.

The researchers of this study will coordinate research study dates with **your local Army ROTC** Professional Military Studies staff and email you with these dates, times, and locations.

If you have any questions about the study, please contact:

Dr. Won O. Song, PhD, MPH, RD
Professor of Human Nutrition
Michigan State University
135A GM Trout Building
469 Wilson Road
East Lansing, MI 48824
517-353-3332
song@msu.edu
ROTCnutritionstudy@msu.edu

APPENDIX C: INFORMED CONSENT FORM

Research Participant Information and Consent Form

Michigan State University, in cooperation with the US Army Research Institute of Environmental Medicine (USARIEM) is asking you to participate in this research study because you are an Army Reserve Officer Training Corps (ROTC) Cadet 18 years or older participating in ROTC at Michigan State University, Western Michigan University, Central Michigan University, or Eastern Michigan University. Researchers are required to provide a consent form to inform you about the research study, to convey that participation is voluntary, to explain risks and benefits of participation, and to empower you to make an informed decision. You should feel free to ask the researchers any questions you may have.

Title of Research: Military body image and eating behaviors

Principal Investigator: Dr. Won O. Song, PhD, MPH, RD, Professor, Department of Food Science and Human Nutrition, Michigan State University

1. PURPOSE OF RESEARCH

The purpose of this research study is to learn about the nutrition-related behaviors of Army ROTC Cadets. Not much is known about the nutrition-related behaviors of ROTC Cadets and how aspects of military culture, such as physical fitness and performance standards, influence these behaviors. You will be asked to provide information about some of your nutrition and exercise habits, as well as some of the things you do to prepare for the Army Physical Fitness Tests, and your thoughts and feelings on some aspects of your nutrition and physical fitness. We are conducting this study in order to learn about how military culture influences nutrition-related behaviors, as well as how these behaviors impact health and performance in order to develop strategies to enhance performance, readiness, and health.

2. WHAT YOU WILL DO

In order to participate in this study, you must be an Army ROTC Cadet and at least 18 years of age. Participation in this study is voluntary, and if you agree to participate, you will complete this informed consent form.

If you volunteer for this study, we will ask you to complete four survey questionnaires. The first questionnaire asks you about your demographics, such as your background and which branch of the military you serve in. The second questionnaire asks about your nutrition-related behaviors, such as the types of food you eat, where you eat your foods, and your eating style. The third questionnaire asks about influences to your nutrition-related behaviors, such as sleep and physical activity. The fourth questionnaire asks about your thoughts and feelings related to different aspects of nutrition and physical appearance. The questionnaires should take about 60 minutes to complete. You are free to skip any questions that you would prefer not to answer.

In addition, you will have your height, weight, and body circumferences measured using the same method that the Army uses to measure body composition, which should take about five to ten minutes to complete.

Finally, you will be asked if you agree to be contacted for a one-on-one telephone interview. Not everyone that agrees to participate will be selected. You will be asked to provide a telephone number you can be reached at, as well as the best days and times to contact you. If you are selected to conduct the interview, you will be contacted to set up a date and time to conduct the interview over the phone. The interview will take about 60 to 75 minutes to complete and will ask you to describe, in your own words, experiences related to nutrition behaviors and meeting the Army physical fitness standards. The interview will be recorded for accuracy. You do not have to do the interview to participate in the study.

APPENDIX D: DEBRIEFING CHECKLIST

COVER SHEET

Please do not write on this form, it is used by study administrators to track your survey progress.

Study ID# _____

- ☐ Signed/Dated Consent Form, Initial _____
- ☐ Demographic Survey, Initial _____
- ☐ Eating Behavior Survey, Initial _____
- ☐ Mediators Survey, Initial _____
- ☐ MSU Survey, Initial _____
- ☐ Anthropometrics Form, Initial _____
- ☐ Final Checkout, Initial _____

_____

_____

_____

_____

_____

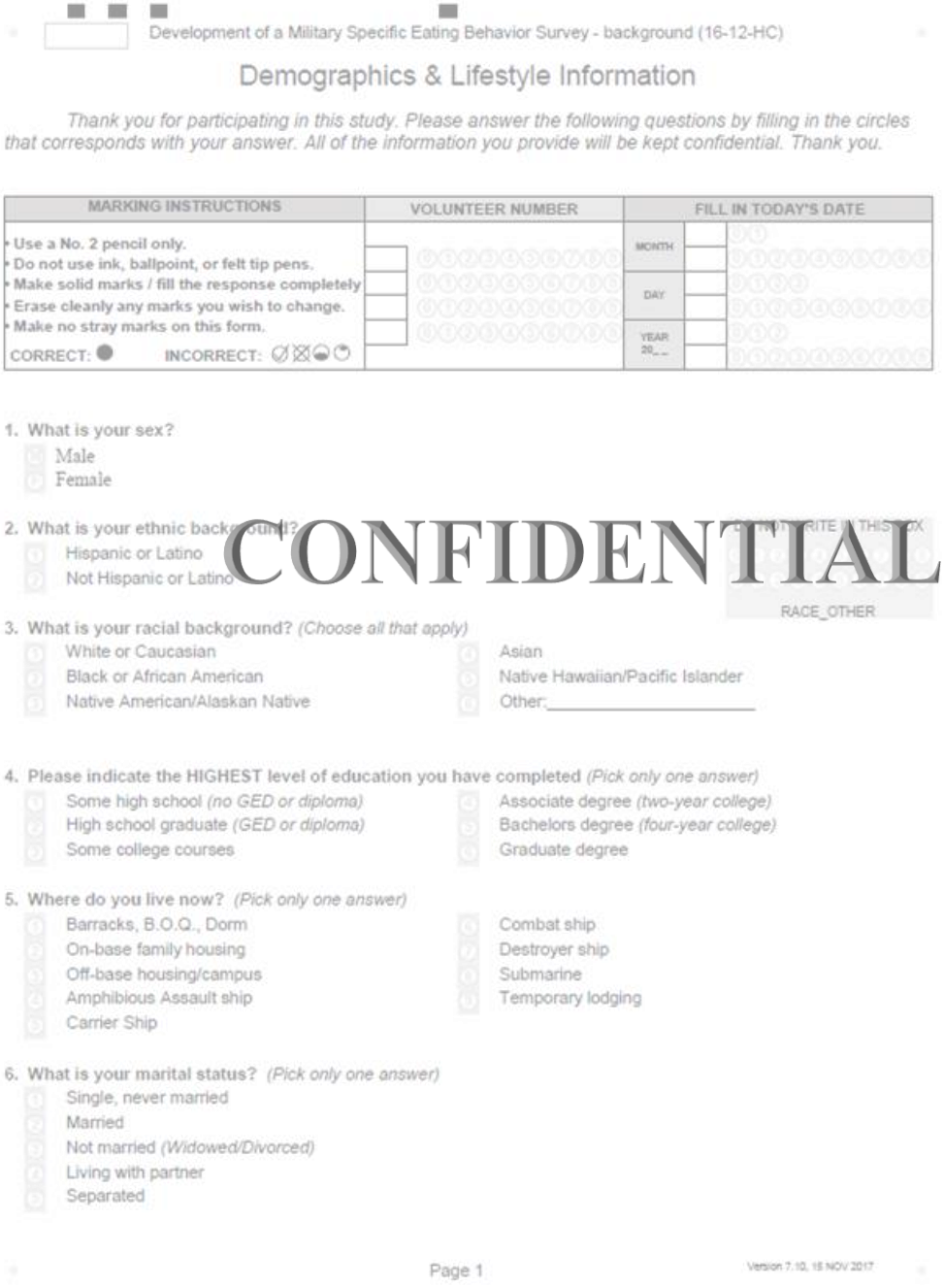
Thank you for participating in our study!

MSU ROTC Nutrition Study: Won O. Song, PhD, MPH, RD

APPENDIX E: USARIEM MILITARY SPECIFIC DEMOGRAPHICS & LIFESTYLE

QUESTIONNAIRE (Cole, 2016)

*Military Specific Demographics & Lifestyle Information Survey. Currently under development by the US Army Research Institute of Environmental Medicine (USARIEM). Survey permission granted as part of Cooperative Research and Development Agreement.



Development of a Military Specific Eating Behavior Survey - background (16-12-HC)

Demographics & Lifestyle Information

Thank you for participating in this study. Please answer the following questions by filling in the circles that corresponds with your answer. All of the information you provide will be kept confidential. Thank you.

MARKING INSTRUCTIONS	VOLUNTEER NUMBER	FILL IN TODAY'S DATE
• Use a No. 2 pencil only. • Do not use ink, ballpoint, or felt tip pens. • Make solid marks / fill the response completely • Erase cleanly any marks you wish to change. • Make no stray marks on this form. CORRECT: ● INCORRECT: ∅ ☒ ◒ ◔		MONTH DAY YEAR 20__

1. What is your sex?
   - Male
   - Female

2. What is your ethnic background?
   - Hispanic or Latino
   - Not Hispanic or Latino

CONFIDENTIAL

RACE_OTHER

3. What is your racial background? *(Choose all that apply)*
   - White or Caucasian
   - Black or African American
   - Native American/Alaskan Native
   - Asian
   - Native Hawaiian/Pacific Islander
   - Other:_____

4. Please indicate the HIGHEST level of education you have completed *(Pick only one answer)*
   - Some high school *(no GED or diploma)*
   - High school graduate *(GED or diploma)*
   - Some college courses
   - Associate degree *(two-year college)*
   - Bachelors degree *(four-year college)*
   - Graduate degree

5. Where do you live now? *(Pick only one answer)*
   - Barracks, B.O.Q., Dorm
   - On-base family housing
   - Off-base housing/campus
   - Amphibious Assault ship
   - Carrier Ship
   - Combat ship
   - Destroyer ship
   - Submarine
   - Temporary lodging

6. What is your marital status? *(Pick only one answer)*
   - Single, never married
   - Married
   - Not married *(Widowed/Divorced)*
   - Living with partner
   - Separated

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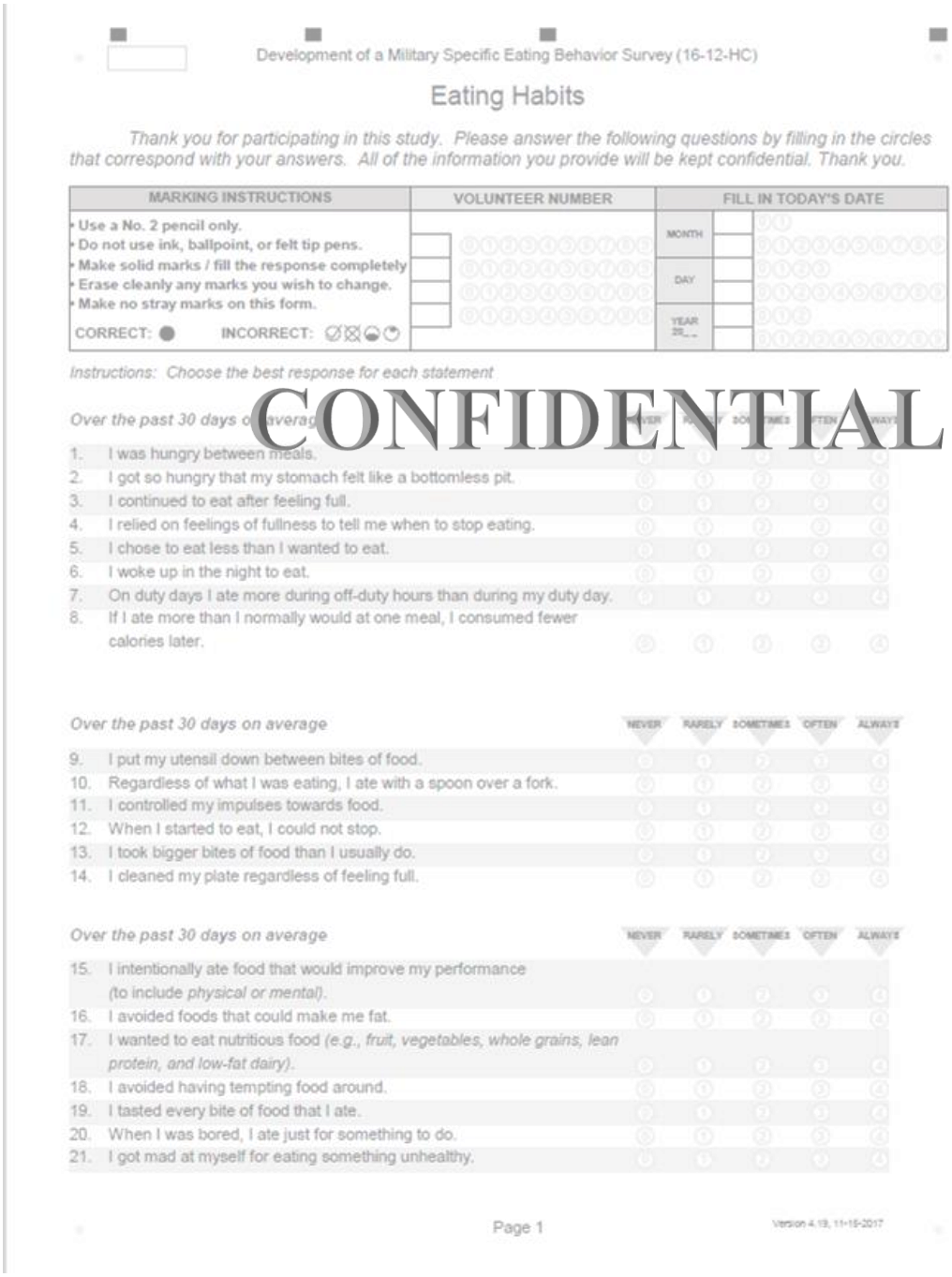
Version 7.10, 18 NOV 2017

APPENDIX F: USARIEM MILITARY SPECIFIC EATING HABITS QUESTIONNAIRE

(Cole, 2016)

*Military Specific Eating Habits Survey. Currently under development by the US Army Research Institute of Environmental Medicine (USARIEM). Survey permission granted as part of Cooperative Research and Development Agreement.



Development of a Military Specific Eating Behavior Survey (16-12-HC)

Eating Habits

Thank you for participating in this study. Please answer the following questions by filling in the circles that correspond with your answers. All of the information you provide will be kept confidential. Thank you.

MARKING INSTRUCTIONS	VOLUNTEER NUMBER	FILL IN TODAY'S DATE
• Use a No. 2 pencil only. • Do not use ink, ballpoint, or felt tip pens. • Make solid marks / fill the response completely • Erase cleanly any marks you wish to change. • Make no stray marks on this form. CORRECT: ● INCORRECT: ⊘⊠◒◔		MONTH DAY YEAR 20__

Instructions: Choose the best response for each statement

CONFIDENTIAL

Over the past 30 days on average	NEVER	RARELY	SOMETIMES	OFTEN	ALWAYS
1. I was hungry between meals.	0	1	2	3	4
2. I got so hungry that my stomach felt like a bottomless pit.	0	1	2	3	4
3. I continued to eat after feeling full.	0	1	2	3	4
4. I relied on feelings of fullness to tell me when to stop eating.	0	1	2	3	4
5. I chose to eat less than I wanted to eat.	0	1	2	3	4
6. I woke up in the night to eat.	0	1	2	3	4
7. On duty days I ate more during off-duty hours than during my duty day.	0	1	2	3	4
8. If I ate more than I normally would at one meal, I consumed fewer calories later.	0	1	2	3	4

Over the past 30 days on average	NEVER	RARELY	SOMETIMES	OFTEN	ALWAYS
9. I put my utensil down between bites of food.	0	1	2	3	4
10. Regardless of what I was eating, I ate with a spoon over a fork.	0	1	2	3	4
11. I controlled my impulses towards food.	0	1	2	3	4
12. When I started to eat, I could not stop.	0	1	2	3	4
13. I took bigger bites of food than I usually do.	0	1	2	3	4
14. I cleaned my plate regardless of feeling full.	0	1	2	3	4

Over the past 30 days on average	NEVER	RARELY	SOMETIMES	OFTEN	ALWAYS
15. I intentionally ate food that would improve my performance (to include *physical or mental*).	0	1	2	3	4
16. I avoided foods that could make me fat.	0	1	2	3	4
17. I wanted to eat nutritious food *(e.g., fruit, vegetables, whole grains, lean protein, and low-fat dairy).*	0	1	2	3	4
18. I avoided having tempting food around.	0	1	2	3	4
19. I tasted every bite of food that I ate.	0	1	2	3	4
20. When I was bored, I ate just for something to do.	0	1	2	3	4
21. I got mad at myself for eating something unhealthy.	0	1	2	3	4

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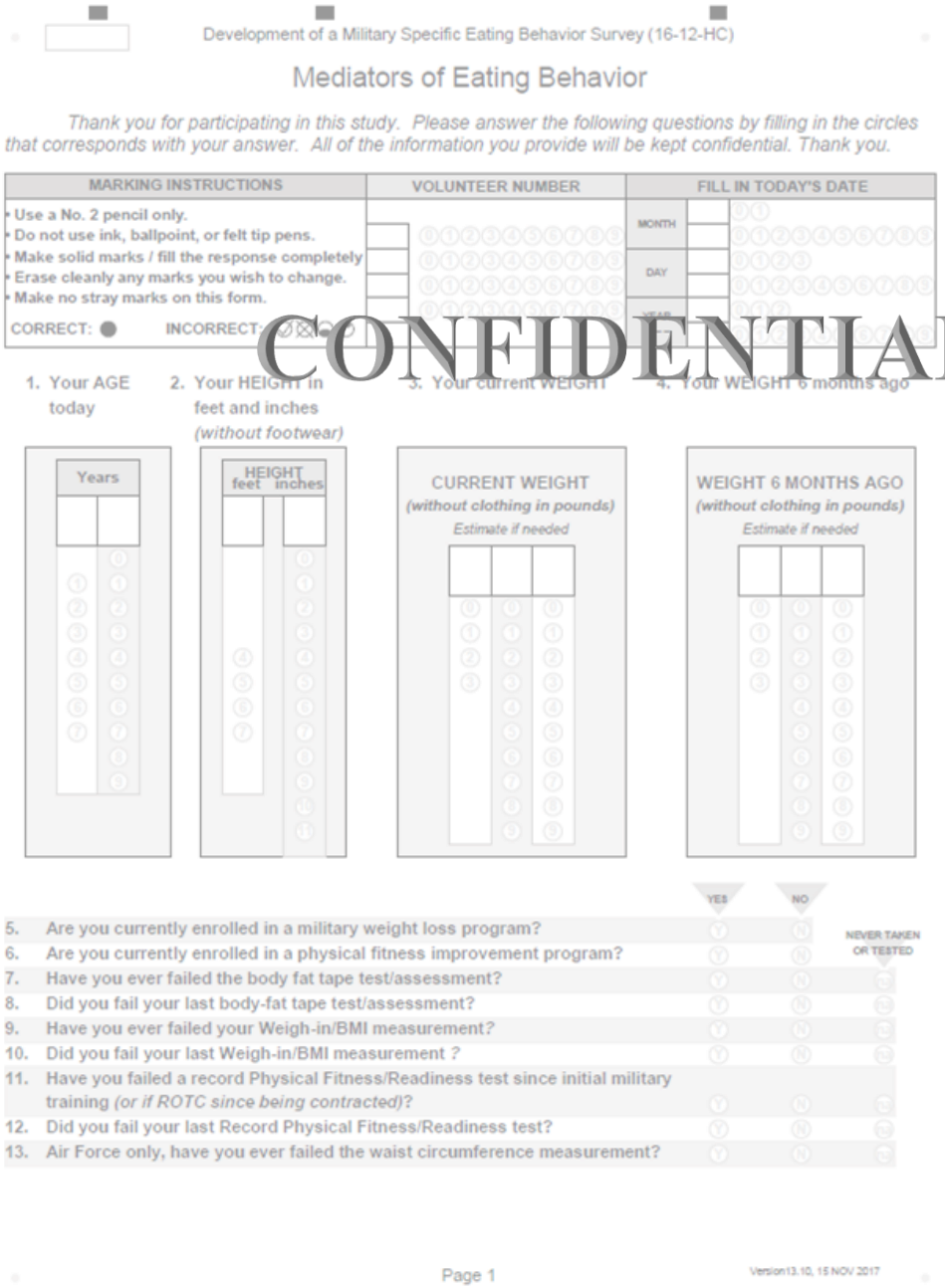
Version 4.19, 11-15-2017

APPENDIX G: USARIEM MILITARY SPECIFIC MEDIATORS OF EATING

BEHAVIOR QUESTIONNAIRE(Cole, 2016)

*Military Specific Mediators of Eating Behaviors Survey. Currently under development by the US Army Research Institute of Environmental Medicine (USARIEM). Survey permission granted as part of Cooperative Research and Development Agreement.



Development of a Military Specific Eating Behavior Survey (16-12-HC)

Mediators of Eating Behavior

Thank you for participating in this study. Please answer the following questions by filling in the circles that corresponds with your answer. All of the information you provide will be kept confidential. Thank you.

MARKING INSTRUCTIONS	VOLUNTEER NUMBER	FILL IN TODAY'S DATE
• Use a No. 2 pencil only. • Do not use ink, ballpoint, or felt tip pens. • Make solid marks / fill the response completely • Erase cleanly any marks you wish to change. • Make no stray marks on this form. CORRECT: ● INCORRECT: ⊘ ⊠ ◯		MONTH DAY YEAR

1. Your AGE today
2. Your HEIGHT in feet and inches *(without footwear)*
3. Your current WEIGHT
4. Your WEIGHT 6 months ago

Years | HEIGHT feet inches | CURRENT WEIGHT *(without clothing in pounds)* *Estimate if needed* | WEIGHT 6 MONTHS AGO *(without clothing in pounds)* *Estimate if needed*

		YES	NO	NEVER TAKEN OR TESTED
5.	Are you currently enrolled in a military weight loss program?	Y	N	
6.	Are you currently enrolled in a physical fitness improvement program?	Y	N	
7.	Have you ever failed the body fat tape test/assessment?	Y	N	N
8.	Did you fail your last body-fat tape test/assessment?	Y	N	N
9.	Have you ever failed your Weigh-in/BMI measurement?	Y	N	N
10.	Did you fail your last Weigh-in/BMI measurement ?	Y	N	N
11.	Have you failed a record Physical Fitness/Readiness test since initial military training *(or if ROTC since being contracted)*?	Y	N	N
12.	Did you fail your last Record Physical Fitness/Readiness test?	Y	N	N
13.	Air Force only, have you ever failed the waist circumference measurement?	Y	N	N

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Version13.10, 15 NOV 2017

APPENDIX H: EATING DISORDER DIAGNOSTIC SCALE (EDDS) (Stice et al., 2000)

Please carefully complete all questions and **circle** the response that applies to you.

Over the past 3 months…	**Not at all**		**Slightly**		**Moderately**	**Extremely**	
1. Have you felt fat?	0	1	2	3	4	5	6
2. Have you had a definite fear that you might gain weight or become fat?	0	1	2	3	4	5	6
3. Has your weight influenced how you think about (judge) yourself as a person?	0	1	2	3	4	5	6
4. Has your shape influenced how you think about (judge) yourself as a person?	0	1	2	3	4	5	6

5. During the past **6 months** have there been times when you felt you have eaten what other people would regard as an unusually large amount of food (e.g., a quart of ice cream) given the circumstances?.....Y N

6. During the times when you ate an unusually large amount of food, did you experience a loss of control (feel you couldn't stop eating or control what or how much you were eating)?.... Y N

7. How many **DAYS per week** on average over the **past 6 MONTHS** have you eaten an unusually large amount of food and experienced a loss of control?.....0 1 2 3 4 5 6 7

8. How many **TIMES per week** on average over the **past 3 MONTHS** have you eaten an unusually large amount of food and experienced a loss of control?.....0 1 2 3 4 5 6 7 8 9 10 11 12 13

During these episodes of overeating and loss of control did you…	**Yes**	**No**
9. Eat much more rapidly than normal?	1	2
10. Eat until you felt uncomfortably full?	1	2
11. Eat large amounts of food when you didn't feel physically hungry?	1	2
12. Eat alone because you were embarrassed by how much you were eating?	1	2
13. Feel disgusted with yourself, depressed, or very guilty after overeating?	1	2
14. Feel very upset about your uncontrollable overeating or resulting weight gain?	1	2

How many **times per week** on average over the **past 3 months** have you…	**Times Per Week**													
15. Made yourself vomit to prevent weight gain or counteract the effects of eating?	0	1	2	3	4	5	6	7	8	9	10	11	12	13
16. Used laxatives or diuretics to prevent weight gain or counteract the effects of eating?	0	1	2	3	4	5	6	7	8	9	10	11	12	13
17. Fasted (skipped at least 2 meals in a row) to prevent weight gain or counteract the effects of eating?	0	1	2	3	4	5	6	7	8	9	10	11	12	13
18. Engaged in excessive exercise specifically to counteract the effects of overeating episodes?	0	1	2	3	4	5	6	7	8	9	10	11	12	13

19. Over the past **3 months**, how many menstrual periods have you missed?.....0 1 2 3 N/A

20. Have you been taking birth control pills during the past **3 months**?.....Y N N/A

Questions about self-reported height and weight omitted, since they are included in the anthropometric data collection sheet and the USARIEM Military Specific Mediators of Eating Behaviors Survey.

APPENDIX I: BODY IMAGE-ACCEPTANCE AND ACTION QUESTIONNAIRE

(BI-AAQ) (Sandoz et al., 2013)

Below you will find a list of statements. Please rate the truth of each statement as it applies to you. Use the following rating scale to make your choices. For instance, if you believe a statement is 'Always True,' you would select a 7 for that statement. **Circle** the choice that applies to you.

	Never true	Very seldom true	Seldom true	Sometimes true	Frequently true	Almost always true	Always true
1. Worrying about my weight makes it difficult for me to live a life that I value.	1	2	3	4	5	6	7
2. I care too much about my weight and body shape.	1	2	3	4	5	6	7
3. I shut down when I feel bad about my body shape or weight.	1	2	3	4	5	6	7
4. My thoughts and feelings about my body weight and shape must change before I can take important steps in my life.	1	2	3	4	5	6	7
5. Worrying about my body takes up too much of my time.	1	2	3	4	5	6	7
6. If I start to feel fat, I try to think about something else.	1	2	3	4	5	6	7
7. Before I can make any serious plans, I have to feel better about my body.	1	2	3	4	5	6	7
8. I will have better control over my life if I can control my negative thoughts about my body.	1	2	3	4	5	6	7
9. To control my life, I need to control my weight.	1	2	3	4	5	6	7
10. Feeling fat causes problems in my life.	1	2	3	4	5	6	7
11. When I start thinking about the size and shape of my body, it's hard to do anything else.	1	2	3	4	5	6	7
12. My relationships would be better if my body weight and/or shape did not bother me.	1	2	3	4	5	6	7

APPENDIX J: INFLEXIBLE EATING QUESTIONNAIRE (IEQ)(Duarte et al., 2017)

Please rate the degree to which you agree with each statement using the following scale.

Fully disagree 1 | Somewhat disagree 2 | Neither disagree nor agree 3 | Somewhat agree 4 | Fully agree 5

	Totally disagree	**Disagree**	**Neutral**	**Agree**	**Totally agree**
1. When I cannot follow my eating plan I feel very anxious (or nervous).	1	2	3	4	5
2. When I do not follow one of my eating rules, then I make an effort to compensate it by following my rules even more strictly	1	2	3	4	5
3. For me, having a balanced eating pattern requires strictly following certain rules.	1	2	3	4	5
4. Having well defined eating rules makes me feel organized/in control.	1	2	3	4	5
5. I rather follow my eating rules than to eat without any guidance or according to my appetite or will.	1	2	3	4	5
6. If I notice any change in my weight (even a small one), following my diet becomes a priority for me.	1	2	3	4	5
7. I get worried when I do not follow my eating rules, even if it only happens occasionally.	1	2	3	4	5
8. Even if I feel satisfied with my weight, I do not allow myself to ease my eating rules.	1	2	3	4	5
9. I feel proud when I can rigidly follow certain eating rules.	1	2	3	4	5
10. Not following my eating rules makes me feel inferior.	1	2	3	4	5
11. To manage my eating through rules gives me a sense of control.	1	2	3	4	5

APPENDIX K: ANTHROPOMETRIC DATA COLLECTION FORM

(To be filled out by researchers)

Participant ID _____

Sex ____

Height _____ cm

Weight _____ kg

Neck 1 _____ cm

Abdomen 1 _____ cm

Hips 1 (females only) _____cm

Neck 2 _____ cm

Abdomen 2 _____ cm

Hips 2 (females only) _____cm

Neck 3 _____ cm

Abdomen 3 _____ cm

Hips 3 (females only) _____cm

Average neck _____ cm

Average neck _____ in

Average abdomen _____ cm

Average abdomen _____ in

Average hips (females only) _____ cm

Average hips (females only) _____ in

Percent body fat _____ %

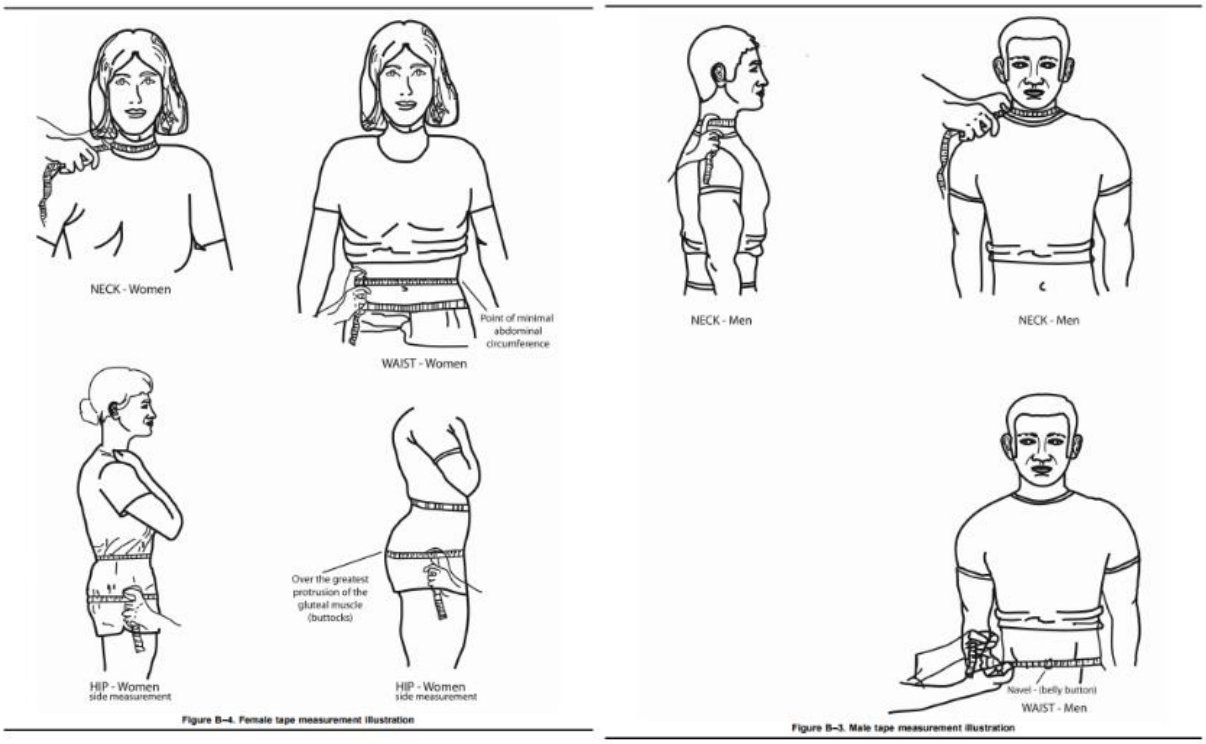
The equation for women is:

% body fat= [163.205 x Log10 (waist + hip – neck)] – [97.684 x Log10 (height)] – 78.387

The equation for men is:

% body fat= [86.010 x Log10 (waist – neck)] – [70.041 x Log10 (height)] + 36.76

APPENDIX L: ARMY REGULATION 600-9 ANTHROPOMETRIC MEASUREMENT PROCEDURE (SOURCE AR 600-9)(Department of the Army, 2013)



The Army Body Composition Program. Army Regulation 600-9. Department of the Army, Headquarters. Washington, D.C.: U.S. Department of Defense; 2013.

Table B–1
Weight for height table (screening table weight)

		Male weight in pounds, by age				Female weight in pounds, by age			
Height (inches)	**Minimum weight[1] (pounds)**	**17–20**	**21–27**	**28–39**	**40+**	**17–20**	**21–27**	**28–39**	**40+**
58	91	-	-	-	-	119	121	122	124
59	94	-	-	-	-	124	125	126	128
60	97	132	136	139	141	128	129	131	133
61	100	136	140	144	146	132	134	135	137
62	104	141	144	148	150	136	138	140	142
63	107	145	149	153	155	141	143	144	146
64	110	150	154	158	160	145	147	149	151
65	114	155	159	163	165	150	152	154	156
66	117	160	163	168	170	155	156	158	161
67	121	165	169	174	176	159	161	163	166
68	125	170	174	179	181	164	166	168	171
69	128	175	179	184	186	169	171	173	176
70	132	180	185	189	192	174	176	178	181
71	136	185	189	194	197	179	181	183	186
72	140	190	195	200	203	184	186	188	191
73	144	195	200	205	208	189	191	194	197
74	148	201	206	211	214	194	197	199	202
75	152	206	212	217	220	200	202	204	208
76	156	212	217	223	226	205	207	210	213
77	160	218	223	229	232	210	213	215	219
78	164	223	229	235	238	216	218	221	225
79	168	229	235	241	244	221	224	227	230
80[2]	173	234	240	247	250	227	230	233	236

Notes:
[1] Male and female Soldiers who fall below the minimum weights shown in table B–1 will be referred by the commander for immediate medical evaluation.
[2] Add 6 pounds per inch for males over 80 inches and 5 pounds per inch for females over 80 inches.

Table B–2
Maximum allowable percent body fat standards

Age group: 17–20
Male (% body fat): 20%
Female (% body fat): 30%

Age group: 21–27
Male (% body fat): 22%
Female (% body fat): 32%

Age group: 28–39
Male (% body fat): 24%
Female (% body fat): 34%

Age group: 40 and older
Male (% body fat): 26%
Female (% body fat): 36%

The Army Body Composition Program. Army Regulation 600-9. Department of the Army, Headquarters. Washington, D.C.: U.S. Department of Defense; 2013.

APPENDIX M: QUALITATIVE INTERVIEW GUIDE

1. Research Questions

   What are the eating behaviors of ROTC Cadets?

   1. What are the perceptions of ROTC Cadets in terms of their eating behaviors?
   2. What is the perspective of ROTC cadets on how and why they go about their eating behaviors?
   3. How do ROTC cadets describe the role of the ROTC context in shaping and influencing their eating behaviors?
   4. How do ROTC cadets describe their preparation to meet physical fitness and body composition standards in terms of their eating behaviors?
   5. What are the perceptions and experiences of ROTC cadets related to body image within the context of ROTC?

2. Interview Guide

   a. Introduction

      i. Purpose: Today I'm hoping to learn more about nutrition-related behaviors in Army ROTC Cadets.

      ii. The reason we are doing this interview is because we want to hear about your experiences that we just can't capture in a questionnaire, to make sure we really understand this from all perspectives.

      iii. Time: This should take about 60-75 minutes.

   b. Warm up

i. Tell me about your experience participating in our research study. What are some things you remember or really stood out to you about the survey?

c. Tell me about your eating behaviors.
    i. How would you describe them in your own words?
    ii. Probes:
        1. Can you walk me through what you eat and drink on a typical day?
        2. Can you walk me through your weekend in terms of what you eat and drink?
        3. How often do you dine out in a typical week or month?
        4. Where are some places you might get food from?
        5. What do you mean by healthy foods? What are some examples of healthy foods?
        6. What do you mean by unhealthy foods/junk foods? What are some examples?

d. Tell me about what you feel shapes and influences your eating behaviors.
    i. What are some things that drive you to eat a specific way, like you previously described?
    ii. Can you tell me more about how you decide what to eat?
    iii. What are your sources of knowledge?
    iv. Probes:
        1. Is there anything else that you use to help you decide what to eat?
        2. What kind of information do you use to help you decide what foods to eat?

3. Where do you feel you got that knowledge?
4. How easy or hard is it for you to eat this way?
5. Anything else you feel helps you decide what to eat?

e. Tell me about how being in Army ROTC has shaped and influenced your eating behaviors.
   i. What about Army ROTC do you feel causes you to eat a certain way?
   ii. Probes:
      1. What is your eating like now that you are in ROTC?
      2. What changes, if any, have you made to your eating because of ROTC?
      3. What are your thoughts and experiences related to appearance and body image in ROTC?
      4. How have these thoughts and experiences impacted your nutrition?

f. Tell me about how you prepare for your physical fitness test and height/weight evaluation when you know you have one.
   i. How does this compare to what you usually do?
   ii. Probes:
      1. How would you say you prepare for the assessments in terms of your nutrition?
      2. What are your goals when you are doing this?
      3. How helpful are the changes you make?
      4. Tell me about your stress related to the physical fitness and body composition assessments.

g. Tell me about what you think might help ROTC Cadets improve their eating behaviors to optimize health, readiness, and performance.
    i. What do you think is in place now that is helpful?
    ii. What do you think is in place now that is not helpful?
    iii. What is the role of the Cadre?
    iv. What is the role of other Cadets?
    v. What would you like to see in place that is not in place now?
    vi. Probe:
        1. What is the role of other cadets in helping with nutrition?
        2. What would you like to see in place to help you achieve your nutrition goals?
        3. Is there anything else we didn't cover that you think is important about nutrition and eating in ROTC?

3. Closing
    a. Thank you for your time. Your responses are very valuable in our search to learn more about the nutrition-related behaviors of ROTC Cadets, in order to provide better support and resources not only to Cadets, but to all service members.
    b. If you have any questions, please feel free to contact us.

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