EVALUATION OF THE THEORY OF PLANNED BEHAVIOR TO DETERMINE PHYSICAL ACTIVITY IN SAUDI FEMALE ADOLESCENTS

By

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ABSTRACT

Background and Significance: The significant increase in obesity rates among Saudi female adolescents is a major public health concern. The main factor linked to the high prevalence of obesity among Saudi female adolescents is that only 12.9% attain the World Health Organization (WHO) recommendation calling for 60 minutes/day of moderate to vigorous physical activity (MVPA). The low level of physical activity (PA) among Saudi female adolescents could be attributed to several psychosocial factors that stem from the culture and environment of Saudi Arabia. Understanding these factors is essential to effectively address the low PA problem and plan an intervention.

Framework: The conceptual framework for this study was the Theory of Planned Behavior (TPB).

Purpose: The primary purpose of the cross-sectional study was to examine the relationship between self-reported PA and TPB psychosocial factors, including attitude toward PA, subjective norms, perceived behavioral control (PBC), and PA intention among Saudi female adolescents in the Eastern Region, Saudi Arabia.

Sample: A convenience sample of 329 Saudi female adolescents' (aged 13–18 years) was recruited from intermediate and high schools in the Eastern Region, Saudi Arabia.

Methods: Adolescents from all-female public schools in the Eastern Region of Saudi Arabia were recruited. Administrators in each school sent a link to parents of the students to request parents' consent for their daughters to participate. Eligible adolescents were asked to complete an online TPB questionnaire and Physical Activity Questionnaire for Adolescents (PAQ-A) via Qualtrics. SPSS was used to calculate descriptive statistics. Mplus was used to conduct Structural Equation Modeling (SEM). **Results:** The mean age of participants in the study was 15.7 years. Among participants, 14.2% were overweight and 7.3% were obese. Mean PA score was 1.8 (SD = 0.74), indicating low PA level. The structural model exhibited an acceptable fit to the data [x2(217) = 412.28, p < 0.001, RMSEA = .05 with 90% CI [.04-.06], CFI = .93, TLI = 0.92 SRMR= .0.05]. The model explained (53%) and (21%) of the variance in PA intention and PA, respectively. The strongest predictor of adolescents' intention was attitude (β =0.43, *p*<.001) followed by PBC (β =0.36, *p*<.001). Moreover, the female adolescents' attitude (β =0.17, p<0.01), and PBC (β =0.14, p<0.01) had significant indirect effects on self-reported PA through intention. Additionally, intention (β =0.40, p<0.001) had a direct effect on PA. The model did not support the indirect relationship of SN. However, the study found that SN moderated the intention-PA. The interaction effect was statistically significant (β =0.47, *p*<.01, 95% *CI*=0.15-0.78). Moreover, only father education had a significant negative relationship with PBC (β =-0.13, *p*<.05).

Conclusions: The results suggest that attitude, PBC and PA intention are psychosocial factors that collectively tie with PA among Saudi female adolescents. The nuanced understanding derived from TPB-based modeling here can help in developing effective interventions to promote PA in these at-risk female adolescents.

Implications: The findings demonstrate the significant contributions of TPB's psychosocial factors in predicting PA intention and PA among Saudi female adolescents. These results provide needed information for nurses, health professionals, and researchers to develop and test a theory-based intervention to promote PA and reduce obesity-related diseases for Saudi female adolescents. Moreover, nurses can advocate for school policies targeted toward improving PA in order to prevent and decrease childhood obesity.

Copyright by MUNA ALI H ALALI 2023 This dissertation is dedicated to Mom and Dad, my dear husband, adorable kids, and lovely sisters and brothers whose love and support sustained me throughout

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Chapter 1: Background and Significance

Obesity has become one of the most challenging global public health problems. According to the World Health Organization (2021b), obesity has tripled since 1975. In particular, in 2016, overweight and obesity affected more than 340 million children and adolescents between the ages of 5–19 (WHO, 2021b). The WHO defines overweight and obesity as "abnormal or excessive fat accumulation that presents a risk to health" (WHO, 2021a). The Centers for Disease Control and Prevention ([CDC], 2021b) specifies the differences between overweight and obesity among children and adolescents, using age-and-sex specific percentiles for body mass index (BMI). BMI is estimated by using an individual's weight in kg divided by the square of height in meters. Accordingly, children and adolescents are considered overweight if their BMI falls between the 85th percentile and 95th percentile, whereas children and adolescents are considered obese if their BMI is at or greater than 95th percentile for age and sex (CDC, 2021b).

Childhood obesity has dramatically increased, and research consistently notes that this problem is prevalent in both developing and developed countries (De Onis, Blössner, & Borghi, 2010; Ng et al., 2014). Globally, from 1975 to 2016, obesity increased from 0.9% to 7.8% among girls, and from 0.7% to 5.6% among boys (NCD Risk Factor Collaboration, 2017). In the United States, nearly one-fifth of children and adolescents (ages 6–19) are obese (CDC, 2022a). Although public health professionals have long documented the increasing rate of obesity within high-income countries, they have also started to report the growing rate of obesity among Middle Eastern countries. For example, in the Middle East and Northern Africa (MENA), more than a fifth of all males and almost third of all females under the age of 20 are obese (Farrag, Cheskin,

& Farag, 2017; Ng et al., 2014), indicating that the problem in this area is more serious among young females than males.

Among countries in MENA, Saudi Arabia is one with the highest prevalence of obesity (Farrag, Cheskin, & Farag, 2017). According to several reports, more than 30% of Saudi children and adolescents are either overweight or obese (BMI>25kg/m²) with more Saudi children and adolescents, aged 6-16 years, being obese (18.2%) than overweight (13.4%) (Al-Hazzaa et al., 2022; Al-Hussaini et al., 2019). When Al-Hussaini and colleagues (2019) compared these findings with the WHO's obesity results reported in 2004, they found that the obesity rate among Saudi adolescents doubled over the last 10 years. Studies show that the prevalence of childhood obesity among adolescents is contributed to the low level of physical activity (PA) due to several environmental, culture and psychosocial factors (Ahmed et al., 2016; Al-Agha et al., 2016; Al-Hazzaa et al., 2012; Al-Nuaim et al., 2012; Alghadir & Gabr, 2015). Accordingly, physical inactivity in Saudi Arabia strongly represents a public health burden specifically among adolescents and children (Al-Hazzaa & AlMarzooqi, 2018). For this reason, due to lacking literature on the factors related to low level of PA among Saudi adolescents, the dissertation will focus on examining psychosocial constructs of the theory of planned Behavior (TPB) that contribute to PA intentions among Saudi female adolescents including attitude, subjective norms (SN), and perceived behavioral control (PBC).

The purpose of this dissertation chapter is to provide an overview of the problem and determinants of childhood obesity in Saudi Arabia. Additionally, the chapter will present the study purposes of the study, research questions, and the impact that PA has on society, healthcare, and the field of nursing. This chapter concludes with the significance of the study for addressing the gaps in knowledge.

Definitions of Children and Adolescents in Saudi Arabia

Numerous studies conducted in Saudi Arabia included school-aged children and adolescents with adolescents being defined as those in the age group of 6–21 years old. Some studies included only children, aged 5–11 years (Al-Agha et al., 2016; Al-Hussaini et al., 2019; Al-Muhaimeed et al., 2015; Fakeeh et al., 2019), while others included adolescents ranging in age from 13–19 years old (Abedelmalek et al., 2022; Al-Hazzaa, et al., 2014; Al-Hazzaa & Albawardi, 2019; Al-Hussaini et al., 2019; Al-Nuaim & Safi, 2022; Al-Qahtani et al., 2021; Al Dahi et al., 2016; Alqahtani et al., 2014).

Prevalence of Overweight and Obesity Among Saudi Youth

Regional Variations

Affecting nearly a third of all Saudi youth, the high prevalence of childhood obesity within the country is alarming and increasingly becoming a more pressing concern. Although a national issue, childhood obesity in Saudi Arabia, similar to most countries, varies by region. For instance, the eastern region of the country is the most affected, with 20.6 % of adolescents considered overweight and 19.4 % considered obese (Al-Qahtani et al., 2021). Conducting a systematic review of 23 studies, Hammad & Berry (2017) found that the eastern region of Saudi Arabia had the highest rate of childhood obesity ranging from 19%–35.6%, followed by the southeastern region (23.2%–29.4%), then the middle region (13.8%–20.5%), and lastly, the western region (10.8%). This indicates the need to address the problem in all regions of Saudi Arabia.

Age Differences

The problem of childhood obesity varies based on age. Evidence is clear that the prevalence of childhood obesity increases with age (Abedelmalek et al., 2022; Al Hammadi &

Reilly, 2019; Moradi-Lakeh et al., 2016). A cross-sectional study conducted in the capital city of Riyadh in Saudi Arabia on a sample of 7930 of children (6–11 years) and adolescents >11 years found the prevalence of overweight and obesity to be significantly higher among adolescents than in children (overweight: 14.6% vs 12%; obesity: 20.2% vs 15.7%, respectively) (Al-Hussaini et al., 2019). This information underscores the need to intervene with adolescents to prevent the problem from continuing and possibly becoming worse in adulthood because of evidence that the trend will continue into young adulthood if not successfully addressed through intervention.

Sex-Differences

Sex differences have been noted in the weight gain patterns between females and males. According to Al-Hussaini et al. (2019), Saudi females are more likely to be overweight or obese than males. Additionally, 27.4% of females under the age of 20 are overweight or obese compared to 23.5% of males (Ng et al., 2014). However, these sex differences in overweight and obesity rate also vary by region. For instance, in the eastern region, researchers have reported that females, in fact, have lower rates of overweight and obesity (11.8% and 19.2%) than males (19.3% and 35.6%); however, the prevalence of overweight and obesity is high for both groups (Al-Dossary et al., 2010; Hammad & Berry, 2017).

In contrast, in the southwestern region, Abedelmalek et al. (2022) found a higher prevalence of obesity in female (62.9%) than male (36.6%) adolescents aged 12–15 years. Similarly, Al-Hussaini et al. (2019) found that 450 female adolescents were obese, compared with 302 males in the central region of Saudi Arabia. Consistently, a national study by Al-Hazzaa et al. (2014) examined the prevalence of overweight and obesity in three major cities in Saudi Arabia—Al-Khobar, Jeddah, and Riyadh—located in the eastern, western and central

regions of Saudi Arabia, respectively. The authors found that the prevalence of obesity among female adolescents (20.8%) between 14–19 was slightly higher than for male adolescents (19.5%). In line with these findings, a large national study conducted across 13 regions in Saudi Arabia (n=2382) found that approximately 44% of female children and adolescents were overweight or obese in comparison to only 38% of male children and adolescents (Moradi-Lakeh et al., 2016). The findings show that more females compared to males are overweight or obese which indicates that designing interventions for adolescent females is a priority. Additionally, the varying patterns of overweight and obesity were noted across the regions which suggests there is an interaction between sex and culture, indicating that sex-specific interventions may be most effective.

Determinants of Children's and Adolescent's Obesity in Saudi Arabia

Several factors were found to be related to overweight and obesity among children and adolescents in Gulf Cooperation Council (GCC) countries (i.e., Kuwait, Qatar, Saudi Arabia, Bahrain and Oman; Al Yazeedi & Berry, 2019). For example, over the past 20 years, Saudi Arabia has experienced economic prosperity, which facilitated widespread social, cultural, and environmental changes that impacted the population's rates of overweight and obesity (Shaikh et al., 2016). Shifts toward increasing urbanization, motorization, trade liberalization and sedentary lifestyle along with inadequate health and dietary education contributed to an increasing prevalence of overweight and obesity in Saudi Arabia (Al Yazeedi & Berry, 2019; DeNicola et al., 2015). Moreover, the lack of physical activity (PA) is another major cause of obesity among Saudi children and adolescents (Shaikh et al., 2016). Two main factors that were modulated as social and behavioral determinants: socioeconomic status (SES) and PA, respectively.

Social Determinant

Researchers have proposed changes in SES may be responsible for the growing rate of overweight and obese children and adolescents in Saudi Arabia. The research on the relationship between overweight or obesity and SES is mixed. Al-Kutbe et al. (2017) found a significant negative correlation between family income and BMI of children in the western region of Saudi Arabia. This finding was not consistent with other studies conducting in Saudi Arabia. A study conducted in the central region in Riyadh that included 1,139 adolescents aged 14–19 years found that adolescents from low-income households (those earning less than \$1,333 a month) were more likely to have a normal weight (Algahtani et al., 2014). More recently, Al-Hussaini et al. (2019) found that adolescents from less educated families with monthly incomes less than \$1,500 who lived in apartments were less likely to be overweight or obese. In contrast, Mesawa et al., (2020) found that approximately 54% of children (6–16 years) of high SES with college educated mothers more likely to be overweight or obese than those from low SES backgrounds with less educated mothers. Moreover, adolescents from middle-or high-income families, specifically those earning more than \$2,500 a month, were more likely to be overweight or obese; and, moreover, the higher the income of a family, the more likely the child was above a healthy BMI for her/his sex and height (Al-Hussaini et al., 2019). Indeed, Ng et al. (2011) reported that the wealthiest Saudi families tended to maintain high caloric diets and engage in limited to no PA. However, diverging from findings of other researchers, Mesawa et al., (2020) found no significant relationship between childhood obesity and family income.

Behavioral Determinant

The high prevalence of overweight and obesity among adolescents in Saudi Arabia may be related to increasing westernization over the last few years which caused negative changes in

lifestyle and dietary habits. PA has been identified as one of the significant factors that affect adolescents' weight (Braithwaite et al., 2017). Caspersen, Powell, & Christenson (1985) defined PA as "any bodily movement produced by skeletal muscles that results in energy expenditure" (pp. 126). Taylor et al. (1978) further explained that the amount of muscles generating movement as well as the duration, intensity and frequency of muscular contraction determined PA. Montoye (1975) categorized daily PA on range from low to high that occurs in different ways in daily life while sleeping, at work, or at leisure time. Expanding upon this definition, Caspersen et al. (1985) classified leisure time PA into conditioning exercise, sports, household tasks, and others types of activities.

PA is well known for its role in promoting health and preventing serious disease. Conversely, physical inactivity is an important contributor to non-communicable diseases (NCDs), such as type 2 diabetes, cardiovascular disease, cancer, obesity and short of life expectancy (CDC, 2019; Lee et al., 2012). According to the WHO (2023), insufficient PA is one of the leading risk factors for death globally, specifically, accounting for approximately 3.2 million deaths each year. Accordingly, individuals should regularly engage in PA because it can decrease the occurrence of NCDs. Observational and epidemiological studies highlight the significance of PA as the most effective key to (a) improve health outcomes, and (b) manage chronic diseases (e.g., better glucose level control for people with diabetes) (Nunan et al., 2013). Moreover, practicing PA helps reduce the use of hospital services and costs due to decreased hospital admissions and lengths of hospitalization (Ku et al., 2017).

Although lifestyle transformations (e.g., increasing urbanization and automobile transportation) in Saudi Arabia have benefited the country in some ways, they have also introduced a sedentary lifestyle (Al-Agha, et al., 2020). Moreover, the shift has been associated

with an increased rate of obesity among adolescents. As a result of increased SES among Saudi's population, adolescents depend on cars for transportation to and from schools. According to Alqahtani et al. (2014), adolescents in households with drivers were at a significantly higher risk of obesity in both urban and rural areas. The reliance on motorized transportation, however, extends beyond just going to and from schools. Al-Hazzaa (2006) found that most Saudi adolescents depend on the motor vehicles even to go short distances instead of walking because they can reach their destination more quickly with the former mode. In short, the increased use of cars for transportation has also resulted in decreased PA, which has likely contributed to the increasing rates of obesity and overweight among Saudi adolescents.

Certain geographic area differences also contribute to Saudi adolescents' ability to lead a physically active lifestyle. For example, Al-Nuaim & Safi (2022) found that adolescents (15–19 years old) living in rural desert areas were less active compared with those living in rural farm areas or urban environments, which likely explained why adolescents in rural desert areas had higher rates of obesity than their peers in other rural areas. Al-Nuaim & Safi (2022) explained that several environmental factors contributed to the differences between these adolescents' activity levels. For instance, the harshness of desert climates and limited exercise facilities made engaging in PA difficult for adolescents. This information indicates a need to tailor interventions to address the unique environmental barriers to PA faced by Saudi adolescents living in certain areas of the country. For Saudi adolescent females in particular, one approach may be to provide public indoor sport clubs, similar to those available for their male counterparts.

However, Saudi literature supports a significant positive relationship between physical inactivity and overweight or obesity among adolescents (Al-Hazzaa et al., 2012; Alqahtani et al., 2014; Fakeeh et al., 2019; Shaikh et al., 2016). Shaikh et al. (2016) found that several factors

were linked to obesity, but physical inactivity was the main contributing factor. For this reason, an urgent need exists to identify and eliminate factors, some of which may be environmental or cultural, that decrease Saudi adolescents' PA and lead to overweight/obesity in this population.

Environmental and cultural factors. The main environmental factor is the lack of physical education (PE) availability in schools (Al-Hazzaa, 2018; Al-Nuaim & Safi, 2022). Saudi Arabia is a country where PE is available only in private schools 3 times a week for a total of 120 minutes of exercise. Recently, Saudi Arabia has been considerably modernizing its healthcare system. For this reason, the Ministry of Education (MOE) approved PE classes in females' public school; however, without the necessary equipment and PE teachers, many female public schools cannot implement effective PE courses. Saudi-based research studies have shown that female students in private schools are more physically active than those in public schools due to the availability of PE programs (Al-Hazzaa et al., 2014; Al-Sobayel et al., 2015). Moreover, a systematic review of Chaabane et al. (2021) reported that a lack of spaces, resources, and fitness centers that accept female adolescents are other barriers to their PA in Saudi. In addition, Saudi Arabia's hot climate as well as its increasing dependency on automobiles and housemaid domestic workers contribute to lower levels of PA (Chaabane et al., 2021).

Another factor that may contribute to the reduction in PA among Saudi female adolescents is their perceived social norms influenced by the country's conservative culture. Saudi Arabia's society shows a combination of modernism mixed with traditional values and conservative social norms (Al-Nuaim, A., & Safi, 2022; Samara et al., 2015) that can negatively influence both the intention to engage in PA and PA participation among Saudi female adolescents. Studies in Saudi Arabia have indicated a positive influence of family, peers and

culture on individual's PA. Al-Harbi & Al-Harbi (2017) found that 56% of females found that family acted as an important motivator to be physically active, whereas 52% found that peers had a key influence. Participants also mentioned that family and friends who provided social support to practice PA increased their PA (Al-Harbi & Al-Harbi, 2017).

Moreover, cultural factors encountered by Saudi females can prohibit their PA. The Saudi culture in some areas is a male-dominated one, with men, many times, controlling the ways their family practices PA. For this reason, females grow up in a conservative culture where PA is not traditionally encouraged or performed. In other words, this conservative culture may serve as a barrier to PA for Saudi females (Al-Nuaim, A., & Safi, 2022). In the major metropolitan cities, however, the conservativeness is less likely to pose as a restriction for females' PA mainly because of modernization and industrialization than other cities. And, Saudi males exert less control over urban women's decision regarding PA. Even more, with shifting cultural and social norms, PA for Saudi females has become more acceptable, especially in urban and suburban areas.

Furthermore, even with all of these positive changes in the country, some cities have several cultural restrictions for Saudi females make PA being less accepted. For example, some families discourage girls from engaging in PA because of their traditional belief that PA is only for boys (Al-Hazzaa et al., 2011). Additionally, wearing an abaya—an outer garment worn by women—restricts females from publicly practicing PA. In some rural areas, females have limitations on being alone outside their homes; therefore, they often cannot regularly visit fitness centers (Al-Eisa & Al-Sobayel, 2012). Furthermore, through their qualitative study, Al-Harbi and Al-Harbi (2017) found that cultural and traditional barriers limit female adolescents' intentions to

engage in PA. Al-Hazzaa (2018) highlighted the importance of decreasing the prevalence of physical inactivity among the Saudi population to reduce the increasing prevalence of NCDs.

Recommendation of PA. WHO (2019) recommends that all children and adolescents between the ages of 5–17, regardless of their gender, race, or family income, to practice at least 60 minutes of daily moderate to vigorous PA (MVPA) to improve their physical and mental health (WHO, 2019). In a recent systematic review, Al-Hazzaa (2018) found that the most Saudi children and adolescents were not physically active enough to meet the minimum requirement of MVPA that was recommended by the WHO.

Physical inactivity is much more prevalent among Saudi female than male adolescents. A study conducted across three major cities in Saudi Arabia—Jeddah, Riyadh, and Khobar—found that among adolescents between 15–19, females were far less active than males in these cities (Al-Hazzaa & Albawardi, 2019). Specifically, Moradi-Lakeh and colleagues (2016) found that 42.8% of female adolescents were physically inactive compared to 19.7% male adolescents. Meanwhile, another recent study found that of 464 total participants, only 4.1% of Saudi female adolescents reported a high level of PA, meaning they exercised, on average 60 minutes a day (Alharbi, 2019). Furthermore, nearly a quarter of female adolescents (15–24 years) reported having some limitation to practicing PA compared to only 12.5% of the male adolescents (Moradi-Lakeh et al., 2016). These findings support the need to increase the level of PA among Saudi female adolescents.

Significance

Significance of Physical Activity to Society

Engaging in at least moderate-intensity PA, such as doing sports, fast walking or cycling, provides short- and long-term health benefits to people of all ages (WHO, 2023). Attaining an

adequate amount of PA improves cardiorespiratory fitness and bone health and is essential for weight control (WHO, 2023). In contrast, low PA intention and PA significantly develop serious medical problems such as type 2 diabetes, hypertension, metabolic syndrome, certain cancer, and heart diseases and its related-risk factors such as obesity (CDC, 2022d; Yang, 2019). In contrast, accumulating evidence suggests that having a high level of PA intention and participation in PA benefit people's current and future mental health. Based on their systematic review and metaanalysis, Rodriguez-Ayllon et al. (2019) found that participants who met the recommended amount of daily PA significantly improved their mental health. They found a significant negative relationship between PA and psychological ill-being (unpleasant feeling or emotions), suggesting that those who engaged in more PA were less likely to be psychologically ill than their less active counterparts. Cross-sectional and longitudinal studies show that PA decreases depression, stress, and psychological distress and improves adolescents' self-image, satisfaction with life, and overall level of happiness (Rodriguez-Ayllon et al., 2019).

The majority of studies indicate a positive relationship between PA and cognitive functioning. However, regular PA among adolescents is associated with slightly improved in cognitive performance, achievement, and academic performance (Singh et al., 2019; Yang, 2019). Cumulatively, the literature upholds that PA may positively influence an adolescent's mental health and cognitive abilities. Based on this information, it is necessary to make the public aware of the benefits of PA and consequences of insufficient PA. Additionally, healthcare professionals, including nurse researchers, must engage their communities and government officials to adopt initiatives designed to increase PA, particularly among adolescents.

Significance of Physical Activity to Healthcare

Worldwide, healthcare professionals, public health officials, and researchers recognized that physical inactivity often results in a substantially expensive chronic disease burden. According to the Global Status Report on Physical Activity 2022 by WHO (2022), between 2020 and 2030, almost 500 million people could develop noncommunicable diseases (NCDs) that are directly attributable to physical inactivity, and they could cost up to US\$ 27 billion annually. The previous report by Ding et al. (2016) estimated the economic burden of physical inactivity worldwide. Ding et al. (2016) found that the direct and indirect costs of physical inactivity consequences is \$67.5 billion worldwide. These direct costs result from the diagnostic process, treatment, and transportation to and from healthcare facilities (Hamilton et al., 2018; Larg & Moss, 2011; Tremmel et al., 2017). However, according to Ding et al. (2016), the health-care costs of physical inactivity consequences were \$53.8 billion in 2013. Of this, \$37.6 billion were spent on type 2 diabetes and \$6.0 billion on stroke. The physical inactivity was responsible for more than \$2.4 billion of health-care costs in the Eastern Mediterranean region. Moreover, globally, physical inactivity deaths cost \$13.7 billion in productivity losses in 2013. Of those, \$0.7 billion in the Eastern Mediterranean region.

In Saudi Arabia, physical inactivity-related diseases comprise a large share of health budgets. For example, health-care expenditures for patients with diabetes are 10 times higher than those without diabetes (\$3,686 vs \$380) (Alhowaish, 2013). Consuming more of the country's overall budget, the direct and indirect costs associated with physical inactivity have a significant burden on Saudi Arabia's economy and healthcare system. For this reason, policymakers are encouraged to implement policies to reduce the economic burden resulting from physical inactivity-related diseases.

Significance of Physical Activity to Nursing Science and Discipline

Amid this childhood obesity crisis and to improve the level of PA, the American Nurses Association (2010) has called for multifaceted community partnerships to design school- and community-based interventions. Nurses are playing a vital role in different health-care settings, such as schools, public health, emergency room, and primary care areas. As PA decreases, nurses will encounter severe physical inactivity-related diseases, such as obesity and type 2 diabetes (Galuska et al., 2018; Pulgaron & Delamater, 2014). Therefore, nurses have a unique opportunity to improve health-promotion activities by working as educators and serving as role models for patients and community members. Additionally, nurses have the important role of recognizing and understanding the psychosocial, environmental, and cultural parameters or risk factors that impact PA. These factors must be identified to provide nurses with the knowledge needed to devise practical and evidence-based interventions.

In clinical practice, nurse practitioners (NPs) are on the front line providing health services and, particularly, preventive counseling for adolescents (Tenfelde & Garfield, 2020). With their knowledge of the contributing factors to and health effects of physical inactivity, nurses can assess and treat physical inactivity related diseases by, for example, offering obese patients individualized consultations on how to promote PA and modify eating habits. More specifically, school nurses play an important role in creating a healthy school environment. Yet, nurses need support with these endeavors and information on evidence-based interventions to both help improve adolescents' PA and reduce the prevalence of obesity among school-aged children and adolescents (Bejster et al., 2020)

In Saudi Arabia, identifying PA and understanding contributing factors will help school nurses integrate health education and exercise into the school curricula; increase awareness about

the lifestyle selections; and collaborate with parents and school personal to improve childrens' and adolescents' lifestyle habits, reduce or manage physical inactivity-related illnesses or problems, promote a healthy weight, and increase the quality of life (QOL). Moreover, nurses can advocate for school policies targeted toward improving PA in order to prevent and decrease childhood obesity.

The current problem is that many health professionals in Saudi Arabia lack sufficient knowledge about physical inactivity, particularly regarding effective behavioral management strategies to use with children and adolescents. Thus, based on the findings from this study, strategies can be implemented in future theory-based interventions to target adolescents' psychosocial factors to improve their level of PA.

Study Purpose

The primary purpose of this study is to examine the relationship between the psychosocial determinants of PA, particularly those defined by the theory of planned behavior (TPB; i.e., attitude toward PA, subjective norms, perceived behavioral control, and PA intention) and self-reported PA among female adolescents in Saudi Arabia.

Gaps in Knowledge

Despite recent government efforts to promote healthy lifestyles, obesity, and inadequate level of PA among adolescents remain major health problems in Saudi Arabia. The limited research on PA among Saudi female adolescents, particularly research based on health behavior theories, hinders the government's efforts in this area. Insufficient research limits the ability of healthcare professionals to plan and implement evidence-based PA interventions. Accordingly, to improve Saudi female adolescents' PA, theoretically-based interventions are needed, particularly given growing evidence that such interventions are more effective than non-

theoretical ones (Messing et al., 2019). For this reason, examining the factors that related to low level of PA among Saudi female adolescents is the first step before implementing the theory-based intervention.

The low level of PA among Saudi female adolescents could be attributed to psychosocial factors stemming from the culture and environment. Even though Saudis' Islamic religion encourages females to practice PA for health purposes, cultural boundaries greatly contribute to Saudi female adolescents' overall negative attitude toward PA (Mirsafian et al., 2014). The country's traditional Islamic culture is not monolithic, with some Saudi groups adopting more traditional values and others more progressive ones. For instance, in some places, it is generally culturally unacceptable for Saudi females to publicly practice PA other than walking in the presence of males. Moreover, most Saudi females lack knowledge about PA and its benefits, which may be, in part, resulted from the limited physical education (PE) classes available in female public schools and thus, these issues influence their attitude and PA intention and, in turn their participation in PA (Al-Hazzaa, 2018; Mabry et al., 2016). Studies show that an adolescent's positive attitude toward PA is associated with adolescents' intentions and higher engagement in PA compared to a negative attitude (Graham et al., 2011; Hartson et al., 2019). Therefore, it is important to examine the attitudes of Saudi females toward PA before developing interventions.

Another important psychosocial factor that may influence Saudi adolescent females' level of PA is their perceived social norms. Conservative Saudi norms for females may serve as a barrier to PA intentions among adolescent females. A systematic review reported that across different Arab countries, including Saudi Arabia, there was general lack of familial encouragement and acceptance of PA for adolescent females (Sharara et al., 2018). Researchers

found that the support of parents and friends helps adolescents develop positive SN and encourages them to be physically active (Bélanger et al., 2011; Lawler et al., 2020). Moreover, several studies have found that the SN of adolescents directly influence their PA intentions (see, e.g., Barkoukis & Hagger, 2009; Hartson et al., 2019). This information indicates that investigating SN is necessary to guide the future development of interventions targeting this population.

Researchers also identified several barriers particularly relevant to Saudi female adolescents that result in low perceived behavioral control (PBC) in PA (Al-Harbi & Al-Harbi, 2017; Al-Hazzaa & AlMarzooqi, 2018). These include the lack of PA spaces and facilities, climate conditions, traditional female roles and lack of self-confidence (Al-Hazzaa, 2018; Chaabane et al., 2020). Studies show that PBC has a direct (Hagger & Chatzisarantis, 2016) and indirect (through PA intentions) influence on adolescents' PA behavior (Hartson et al., 2019; Maddison et al., 2009). For this reason, exploring the barriers and facilitators of PA in Saudi female adolescents would contribute to a growing understanding of how PBC influences their decisions to engage in PA.

However, using a theoretical model is the appropriate way to understand the determinants of PA in adolescents (Atkin et al., 2016). Few studies used a theoretical model to examine the specific factors related to the PA among Saudi female adolescents (Al-Harbi & AlHarbi, 2017; Bajamal et al., 2017 as exceptions). In the western region, Bajamal et al. (2017) tested the HPM among Saudi female adolescents. Even though the HPM's variables explained 25.4% of the variance in PA among participants, these results are not generalizable to other regions due to cultural differences within Saudi Arabia. Moreover, in their study only three variables had strong effects on PA: self-efficacy, social support, and commitment. However, Bajamal and colleagues

indicated that other factors need to be identified because they may contribute to Saudi female adolescents' PA. Therefore, building on their work, this study will identify new psychosocial factors through examining psychosocial factors that may also influence Saudi female adolescents' intention and PA to build a more comprehensive and relevant model in the future.

In the central region of Saudi Arabia, Al-Harbi and Al-Harbi's (2017) conducted a qualitative study to identified behavioral, normative, and control beliefs in females, aged 18–20. However, the study did not qualify the influence of these three aspects of beliefs (e.g., TPB's psychosocial factors) on their PA intentions or actual PA behavior. The findings were also limited because they did not account for variations based on participants' age and SES. Despite the promising results of this qualitative study using the TPB, no quantitative study has applied the TPB to examine the relationship between psychosocial factors and PA among Saudi female adolescents.

Among behavioral theories, TPB is an appropriate framework for this study, as it can explain psychosocial factors that influence female adolescents' PA. TPB is a middle range theoretical framework that explains and predicts individual behavior (Ajzen, 1985). According to the TPB, individual's intention is determined by three factors: attitudes toward behavior, SN, and PBC, which predict the actual behavior (Ajzen, 1985). The theory is appropriate for this population because adolescence is a crucial development life stage where attitudes and beliefs are beginning to become established, but still can be changed (Nurmi, 2004). Additionally, the promising results from TPB-based studies conducted in Western and other Middle Eastern countries show a significant relationship between TPB's constructs and PA (see, e.g., Hartson et al., 2019; Santina et al., 2017). However, the findings do not necessarily apply to the Saudi context despite some of the similarities in culture among Arab countries. One of the main

reasons why these findings may poorly apply to Saudi context is that most of these countries provide PA opportunities for females both inside and outside of schools, whereas is not the case in Saudi Arabia. Moreover, these studies were conducted with both male and female adolescents.

Despite the significant results found across these studies, the relationship among TPB psychosocial factors and Saudi female adolescent's PA has not been established. In the absence of such research, the purpose of this study is to examine the applicability of TPB's psychosocial determinants—*attitude toward PA*, *SN*, and *PBC*— that influence adolescents' PA intentions and their actual PA. Given that the TPB explicitly accounts for social norms, it is an appropriate framework for this analysis. Understanding the key psychosocial factors that influence Saudi female adolescents' PA would increase the effectiveness of interventions to improve their level of PA.

Moreover, Saudi adolescent females' PA varies by demographic characteristics, including their BMI, age, family's household income and parents' educational level (Al-Agha et al., 2016; Alharbi, 2019). The literature provides evidence of a significant negative relationship between BMI and PA among Saudi adolescents (Al-Agha et al., 2016; Al-Nuaim et al., 2012). Additionally, it has been reported that PA declines with increasing age (Alharbi, 2019). However, relationships between parental education and income and PA are inconsistent among Saudi female adolescents (Alharbi, 2019; Khalaf et al., 2013). These findings suggest that these demographic characteristics may have an effect on the psychosocial factors and Saudi female adolescents' PA, indicating that continued examination of these relationships may be warranted so that PA interventions can be tailored to increase their effectiveness and meet the needs of this vulnerable population. Nurse researchers and healthcare professionals would benefit from

understanding the factors underlying adolescent's low levels of PA, as this information would enable them to design effective behavioral interventions.

Significance of the Study

The study identifies the importance of school nurses and other healthcare professionals in designing PA education and promotion programs to improve the level of PA among Saudi female adolescents in schools and communities. The study underscores the significance of PE classes and theoretically based intervention programs to combat the growing prevalence of physical inactivity among Saudi female adolescents. Furthermore, although school nurses are in a prime position to create a healthier school environment, their limited knowledge about PA and how to promote healthier lifestyle hinders their ability to do so. In response, this study provides insight on psychosocial determinants of PA, considering the Saudi context. As such, this research also offers more evidence about Saudi female adolescent's attitude, SN, PBC and intention about PA. In so doing, this work advances the science to inform nurses and health care professionals about ongoing barriers to these females' PA and suggests ways to, ultimately, promote PA among this population.

If this study shows support for the selected TPB psychosocial determinants, then designing a theory-based PA intervention targeting Saudi female adolescents from different demographic backgrounds should focus on improving the attitude toward PA, SN, PBC and PA intention. This study's structural equation modeling should reveal mediation effects of intention on the relationship between the TPB psychosocial PA determinants and PA. Using these results, nurses and health care professionals can develop PA programs and interventions to improve PA in adolescents. More specifically, if the results of the study's SEM model indicate that certain

psychosocial determinants based on TPB help explain Saudi female adolescents' PA, then interventions should focus on improving attitude toward PA, SN, PBC, and PA intention. This study will also provide additional insight to nurses and health care professionals about Saudi female adolescents' perceptions of PA, which, in turn, can inform these professionals' health promotion strategies and tactics.

Research Questions and Hypotheses

Research Question

RQ1: Does TPB constructs (attitude toward PA, SN, PBC, and PA intention) have direct and indirect effects on PA in a sample of Saudi female adolescents in Saudi Arabia?

Hypothesis 1. TPB constructs (attitude toward PA, SN, PBC) will have a direct effect on PA intention in a sample of Saudi female adolescents in Saudi Arabia.

Hypothesis **2.** TPB constructs (attitude toward PA, SN, PBC) will have a positive indirect effect on PA behavior through PA intention.

RQ2: Does socio-demographic factors (including age, household's family income, parental educational level, prevalence of overweight and obesity [estimated from BMI]) have effect in TPB psychosocial factors and PA among Saudi female adolescents in Saudi Arabia?

Hypothesis. the socio-demographic differences will have a positive direct effect on the TPB psychosocial factors and the level of PA.

Summary

Saudi female adolescents' strikingly high levels of physical inactivity, which have contributed to the high prevalence of obesity in this specific group, support the need to design an effective intervention to promote their PA. To design an effective intervention, however, health care professionals need to understand the psychosocial determinants of PA. TPB is a theory that identified three main psychosocial factors predictive of an individual's intention to engage in a behavior and actual participation in the behavior itself. As such, applying this theory to PA interventions may demonstrate effectiveness in increasing PA. However, to date, empirical research has not examined the applicability of this theory among Saudi female adolescents, specifically to explain these young females' PA. Therefore, the purpose of this study is to examine the relationship between TPB psychosocial variables (i.e., attitude toward PA, SN, PBC, and PA intention) and self-reported PA among Saudi female adolescents. Ultimately, the findings from this study may provide needed information for nurses, health professionals, and researchers to build a theory-based intervention to promote PA and control the growth of childhood obesity in Saudi Arabia.

This dissertation is organized into 5 remaining chapters. Chapter 2 describes the conceptual framework of the study and literature supporting its selection to guide the study. Chapter 3 includes a review and critique of the literature on psychosocial factors associated with adolescent females' PA, particularly those factors that are likely to be important for explaining PA behavior among Saudi females. Chapter 4 explains the design, methods, and analysis of data. Chapter 5 presents the results of the data. Chapter 6 interprets the findings and presents the conclusions, and implications of the study.

Chapter 2: Theoretical Approach

Understanding the determinants of PA in adolescents can be facilitated through the application of prominent behavioral theories (Atkin et al., 2016). These theories can be useful for identifying factors that need to be targeted in interventions to improve PA. Among various behavioral theories, the theory of planned behavior (TPB) is the most adequate theory to explain/understand psychosocial factors associated with Saudi adolescent females' PA. As an extension of the theory of reasoned action (TRA; Fishbein & Ajzen, 1977), the TPB takes into account the degree of control over the behavior. It has been used in nursing research and practice to predict and explain individuals' health-related behavior. Empirical research supports the use of the TPB as a theoretical framework to examine factors associated with PA (Lu et al., 2022). Understanding the key psychosocial factors that influence Saudi female adolescents' PA would increase the effectiveness of interventions to improve their level of PA. This chapter presents an overview of the TPB, including its description and limitations, along with the rationale for selecting it to guide the current study. This chapter concludes with a discussion of the analysis and evaluation of the TPB.

Additionally, the chapter includes an analysis of several other theories that are often used to explain PA, such as the health promotion model (HPM), self-determination theory (SDT), social cognitive theory (SCT), and social-ecological model (SEM). Specifically, the limitations and rationales for not selecting these theories to guide the current study are discussed.

Theories Used to Explain PA

A variety of theoretical models have been proposed to effectively predict and explain health-related behavior, particularly PA. The most tested models that have been used to delineate

the key determinants of PA among adolescents are the HPM by Pender (1982), SDT by Deci and Ryan (1985), SCT by Bandura (1986), and SEM by McLeroy et al. (1988).

Health Promotion Model (HPM)

The HPM, a middle range theory, includes three main concepts that directly and indirectly influence individuals' health-promoting behaviors (Wu & Pender, 2002). One concept involves individual characteristics that include prior related behavior and personal factors (i.e., age, sex, socioeconomic status, race or ethnicity, and pubertal status). Another concept is behavior-specific cognitions and affect, which includes perceived benefits of action, perceived barriers to action, perceived self-efficacy, activity-related affect, and interpersonal influences (i.e., social support) and situational influences (i.e., physical environment). Lastly, behavioral contingencies are expressed in the model as the commitment to a plan of action and competing demands and actions (Pender et al., 2011).

Several studies support the ability of the HPM concepts to predict PA among adolescents (Mohamadian & Ghannaee Arani, 2014; Voskuil et al., 2019). However, some limitations of the HPM are important to consider. For example, although it is a middle range theory, it is fairly complex because it includes a large number of constructs. It is difficult to have sufficient power to examine their relationships simultaneously in one study. Moreover, the HPM does not account for attitudes or beliefs that influence an individual's acceptance of a health behavior. This limitation is important to consider because the attitudes of Saudi females toward PA can be greatly influenced by their culture and religious beliefs. Additionally, Bajamal and colleagues (2017) tested cognitive and affective variables of the HPM with Saudi female adolescents (N=405) in the western region of Saudi Arabia and found this partial model explained 25.4% of the variance in PA. Among five examined variables, only three cognitive and affective variables

(self-efficacy, social support, and commitment) had significant effects on PA, whereas enjoyment and perceived barrier did not. Bajamal et al. remarked that the majority of the variance remained unexplained. It is possible that examining and identifying new psychosocial factors contributing to Saudi adolescent females' PA is essential. Also, there is limited studies conducted in all regions of Saudi to enhance our understanding about cultural influences on Saudi adolescent females' PA. Thus, building on the Bajamal et al. findings, including Saudi adolescents' attitudes and beliefs toward PA in future inquiry can gain a more comprehensive understanding about the influences of psychosocial factors on Saudi adolescent females' PA.

Self-Determination Theory (SDT)

SDT is a theory of individual motivation that mainly focuses on social contexts and environmental factors (Ryan & Deci, 2000). Individuals are described as being autonomously motivated (self-determined) when they engage in an activity for its own sake. The theory hypothesis that the individual performed behavior when behavior is controlled for external contingencies such as rewards (external regulation), underpinned and directed by intrapersonal sanctions such as guilt (introjected regulation), autonomously engaged within the person's value (identified regulation) or reflect a person's identity (integrated regulation). The theory proposes that autonomous motivation is achieved by meeting three individual basic psychological needs: competence (i.e., the need to feel effective and confident in one's activity), autonomy (i.e., the need to feel a sense of choice over task), and relatedness (i.e., the need to feel connected and accepted by important people) (Deci & Ryan, 1985).

Indeed, there are numerous studies supporting the use of SDT among adolescents (Nogg et al., 2020; Wang, 2017). The reason for not selecting this theory is because that Deci and Ryan (2000) states that people have to satisfy their psychological needs as they pursue their outcome.

Thus, the theory is more applicable to people with individualism belief who are already practicing the behavior but need motivation to meet the recommended level, as compared to those who are not usually engaging or with collective cultural beliefs. The theory does not focus on individuals whose PA are highly influenced by their cultural and collective beliefs, such as Saudi females. For these reasons, this theory is not as applicable to Saudi adolescent females, many of whose PA may not be explained by intrapersonal factors.

Social Cognitive Theory (SCT)

In SCT, Bandura (1986) proposes that individual behavior is the result of the dynamic interplay among personal (including cognitive), environmental, and behavioral influences. The theory's key concepts include: reciprocal determinism (i.e., the person, environment and behavior influence one another), outcome expectations (i.e., the anticipated outcomes of a behavioral choice), self-efficacy (i.e., the personal confidence to perform behavior), collective efficacy, self-regulation, facilitation/behavioral capability (i.e., the needed knowledge and skills to perform specific behavior), observational learning (i.e., learning to perform behavior by observing others), incentive motivation, and moral disengagement (Bandura, 1989; Glanz et al., 2008). Several studies used SCT to test the effect of its constructs on the level of PA among adolescents and achieved inconsistent results (e.g., Ardestani, 2015; Lee, 2018). Based on the systematic review and meta-analysis study by Young et al. (2014), the self-efficacy is consistently associated with PA, but not the outcome expectations.

The theory has several limitations. It assumes that environmental changes will automatically change individuals' behaviors or vice versa (reciprocal associations), and this assumption is not easily testable (Carillo, 2010). Additionally, the theory is complex and broad-

reaching and contains many concepts that make evaluating it more challenging to explicate directional associations among variables.

Social Ecological Model (SEM)

The SEM proposes that behavior is affected by the following levels of factors: (1) intrapersonal factors (e.g., beliefs and attitude), (2) interpersonal factors, including friends and family, (3) institutional factors, such as schools or health-care facilities, (4) community factors, including relationships among social networks, and (5) public policy, involving laws and policy (McLeroy et al., 1988). Many reviews in the literature have applied SEM to understand PA behavior among adolescents (Hu et al., 2021; Martínez-Andrés et al., 2020). Due to the model's multilevel approach, evaluating all components is difficult (Glanz et al., 2008). Another issue limiting model testing is that it does not clearly describe the relationships among variables (Glanz et al., 2008). These limitations precluded the model from being used to guide the current study.

The Theory of Planned Behavior (TPB)

The TPB is one of the most frequently used social psychological models to predict behavior. The TPB includes constructs of the TRA, including attitudes, SN and intention (Ajzen & Fishbein's, 1980), with the addition of PBC as an additional construct. The TRA posits that an individual's behavior is under volitional control, whereas the TPB contends that this assumption is not realistic. Ajzen (1991, 2006) purports that not all behaviors are under volitional control and individuals are expected to carry out their behavioral intentions when they have a degree of control over the behavior.

The TPB proposes that an adolescent's intention to engage in PA is the immediate or direct determinant of PA. The theory specifies three independent determinants of intention: 1)

attitude toward PA, 2) SN, and 3) PBC. Additionally, the theory indicates that intention is a mediator between attitude, SN, and PBC and a behavior (e.g., PA). The more favorable the attitude and SN are and the greater the PBC is, the stronger the individual's intention will be to perform the behavior. The stronger the intention is, the more likely the adolescent will enact the behavior (Ajzen, 2020). According to the theory, these determinants follow spontaneously and reasonably from the following three behavioral beliefs and the value attributed to the behavior: the behavior's likely consequences (behavioral beliefs), normative beliefs of important others, and factors that control the behavior (control beliefs) (Ajzen, 2011). Figure 1 presents TPB diagram.

Ajzen & Madden (1986) propose that PBC may also have a direct effect on behavior independently from an intention-mediated effect based on the level of actual (volitional) control. PBC can directly predict behavior when PBC is realistic and veridical (noted when an individual has enough information and resources).

Figure 1




Constructs of the TPB. The following are the main constructs of TPB:

Attitude. Attitude toward PA is the individual's own evaluation of a specific behavior. It is based on an individual's behavioral beliefs and the value perceived regarding the positive or negative consequences of performing PA (Ajzen, 2020).

Subjective Norms. It includes two types of normative beliefs: 1) injunctive beliefs, which are the expectations that significant social agents (e.g., friends and family) approve or disapprove of performing PA, and 2) descriptive beliefs, which are those concerning whether important people perform PA (Ajzen, 2020).

PBC. It is adolescents' judgment about whether they have the capability and resources to engage in PA. It is subdivided into internal (e.g., knowledge and abilities) and external factors (e.g., tangible obstacles or opportunities). Underlying PBC is control beliefs, which involve the presence of facilitator and barrier factors that influence PA participation (Ajzen, 2020).

Behavioral intention. It indicates an adolescent's readiness to perform PA (Ajzen, 1991; Ajzen, 2020).

Behavior. According to Fishbein and Ajzen (1977), behavior should be defined in terms of four elements: "the action performed, target at which action is directed, the context in which it is performed, and the time at which it is performed" (p. 899). Ajzen (1991) defined the elements as the TACT principle (the target, action, context, and time of behavior). These elements should be clearly described to strengthen the correlation among the TPB variables. Thus, PA is defined as engaging (action) in general types of PA (target) inside and outside of schools (context) over a week (time of occurrence).

Rational for selecting the TPB. The first reason for selecting this theory is that it has been used in nursing research and practice to predict and explain individuals' health-related

behavior such as PA (Hartson et al., 2019) and diabetes management (Lee et al., 2017). Moreover, a systematic review and meta-analysis of Plotnikoff et al. (2013) concludes that the TPB is the strongest theory for explaining PA in youth compared with other SCTs. Additionally, several meta-analytic reviews support using the TPB to predict PA in a wide variety of populations, including adolescents (McEachan et al., 2011; Schüz et al., 2017). Scholars have found a relationship between adolescent females' attitudes toward PA, SN, and PBC, intention and their actual PA levels (see, e.g., Hartson et al., 2019; Wang & Wang, 2015). Across studies, the TPB has predicted 28.7%– 60% of the variance in intention and 9%–43% of the variance in PA among adolescents from various countries and cultures (Hartson et al., 2019; Lu et al., 2022; Wang & Zhang, 2016). In contrast, Bajamal et al. (2017) found that the HPM predicted 25% of the variance in PA. Additionally, self-determination theory and social cognitive theory predicted 29% and 12% of the variance in PA, respectively (Gillison et al., 2006; Martin et al., 2011; Plotnikoff et al., 2013).

Another important reason for selecting this theory is because it includes SN— a construct other theoretical models do not include. Saudi literature suggested that social norms have a strong influence on female adolescents' PA (e.g., Al-Nuaim & Safi, 2022). Saudi adolescent females live in a society where PA is not traditionally encouraged, and this social norm affects their intentions to practice PA. Additionally, given Saudi Arabia's collectivist culture, family and friends are the main influencers in predicting adolescents' PA intentions (Al-Harbi & Al-Harbi, 2017). Thus, examining the influence of subjective norms on PA among this population is imperative.

Moreover, adolescence is typically a transition period where attitudes, beliefs and behavioral patterns develop and change (Mize, 2017). For this reason, understanding what

influences PA among adolescents is a necessary step to improving adolescents' PA because PA habits are established in adolescence and carried into adulthood. Traditional Islamic culture in Saudi Arabia influences adolescent females' beliefs and attitudes toward PA. Specifically, the traditional belief is that PA is only for boys and cultural restrictions about the freedom of movement and dressing result in Saudi adolescent females having a low PBC over their PA (Al-Nuaim & Safi, 2022). Their attendance at female-only schools, a requirement of traditional Islamic culture, also influences their attitude, SN, and PBC about PA. Therefore, examining these most likely influential psychosocial factors in this population is necessary.

Furthermore, existing reviews have shown the effectiveness of the TPB-based behavior change interventions in improving PA, particularly among adolescents (see, e.g., Darabi et al., 2017; Steinmetz et al., 2016). However, these interventions were not designed for Saudi adolescent females and their unique cultural context and needs. For this reason, the theory and its assumptions should be evaluated empirically first to determine the relevance of using the theory to inform the development of an intervention (Plotnikoff et al., 2012). If the theory is determined to be relevant, the findings of this quantitative study could support nurse researchers and practitioners tailoring future interventions designed for this specific population.

Limitation and descriptions of the TPB. The TPB has its limitations, although it has successfully explained and predicted PA in adolescents. The first limitation is the ambiguity surrounding the PBC construct. The conceptual and operational ambiguity of any construct can result in measurement issues. The PBC construct overlaps with Bandura's (1997) self-efficacy construct because both are concerned with control over behavior. According to Ajzen (2002), these concepts are quite similar conceptually because they both refer to individuals' beliefs that performance of a specific behavior is under their control.

Moreover, the TPB proposed directional associations among variables. For example, in PA, if individuals have a high level of PBC, they are more likely to have a stronger intention to perform the behavior and then are more likely to preform PA. In contrast, self-efficacy has a reciprocal relationship with the behavior (Voskuil & Robbins, 2015). Moreover, according to Bandura's (1997), four factors develop individual's self-efficacy beliefs and, in turn, the performance of the behavior. These factors are mastery experience (performance outcome), vicarious experience, social persuasion, and emotional states.

However, operationally, PBC and self-efficacy are assessed differently. PBC is usually measured directly by the ease or difficulty of performing behavior; therefore, it captures facilitator and inhibitor factors (Ajzen, 2020). In contrast, self-efficacy focuses on individuals' beliefs and confidence in their capability to perform a specific behavior under different circumstances (Bandura, 1986).

To overcome this limitation, a clear definition of PBC and other the TPB constructs is essential. Moreover, a reliable and valid the TPB instrument should be used to measure the constructs. Even though there is no official or standard the TPB questionnaire, Ajzen (2013) provides a sample questionnaire, as well as construction guidelines to develop a questionnaire that measure the TPB constructs. With regard to PBC, Ajzen (2002) indicated that to accurately measure this construct, the TPB instrument should contain items that assess two separate, but interrelated, concepts: self-efficacy and controllability (i.e., the extent to which an individual has the ability to perform a behavior). Additionally, the items in a PBC questionnaire should correspond to or be compatible with the predicted behavior (e.g., PA).

Therefore, the measurement instrument that has been selected for use in this study was designed to obtain measures of the TPB's constructs following Ajzen's (2013) guidelines. The

PBC items in this instrument measure the facilitators and hindering factors along with selfefficacy based on the elicitation study that was conducted in Saudi Arabia. Additionally, to gain the strongest relationship between model components, the instrument follows the principle of compatibility—constructs correspond to PA in terms of action, target, context, and timeframe (Ajzen, 2020).

Another limitation of the theory is that it does not take into account the effects of additional potential factors such as demographic variables, exposure to media, and past behavior. Addressing a weakness of the TPB, Ajzen (1991, 2020) suggested that incorporating additional variables to this model may indirectly influence an individual's behavioral intention and actual behavior through the TPB's psychosocial factors. Due to substantial heterogeneous findings about this relationship in Saudi's studies, a more extensive examination is needed. For this reason, several variables have been added to the model as covariates including (a) sociodemographic characteristics (e.g., age, family income and parental education), and (b) an anthropometric variable (e.g., BMI), as can be seen in Figure 2.

Figure 2

Conceptual Model: Application of The Theory of Planned Behavior (TPB) to Adolescent PA



Note. Reprinted from "The Theory of Planned Behavior", by Ajzen, I., 1991, *Organizational Behavior and Human Decision Processes*, 50(2), 179.

Analysis and Evaluation of the TPB

Theory analysis and evaluation are vital for developing nursing knowledge and determining if the conceptual model is appropriate to use in nursing research (Im, 2015). Fawcett (2005) developed a framework for theory analysis and evaluation for nursing theory that can be applied to the TPB.

Analysis of the TPB

The analysis includes an objective and nonjudgmental explanation of nursing theory through examining three areas: scope, context, and content (Fawcett, 2005).

Scope. The scope of the theory is based on the classification. The TPB is a middle-range theory, and it is predictive and explanatory (Ajzen, 1991). The model is used to predict and understand a variety of different behaviors, such as PA.

Context. The context of the theory refers to metaparadigm concepts of nursing (person, environment, nursing, and health) and the philosophical assumptions of the theory (Fawcett, 2005a). For a person, the individual's beliefs and the influence of family and friends were addressed within the TPB. The theory presents two factors that have relation with the environment: the culture norms and the perceived barriers and facilitators to enacting behavior (Cornally, 2014). However, the relationship of this theory to nursing is not obvious. Fawcett (2005) stated that metaparadigm can refer to an action taken by nurses. The scope of the TPB has been applied to understand the nursing process (assessment, planning, implementation and evaluation) of care action (Cornally, 2014). Moreover, in relation to health, TPB provides a framework for nurses to develop an intervention to change specific behavior. Based on this information, the TPB relates to all four nursing metaparadigm concepts.

The philosophical claim of the theory is that a person behaves in a certain way that is affected by certain factors: their relationship with others, environment, life experience and culture (Cornally, 2014). According to Fawcett (2005), worldview is the key in theory analysis. Worldview is defined as "philosophical claims about the nature of human beings, and the human-environment relationship" (Fawcett, 1993, p. 56). The TPB shows a reciprocal interaction worldview (Cornally, 2014). According to Fawcett (1993), the inherent beliefs involved in reciprocal worldview are "human beings are holistic and active; interactions between humans and their environment are reciprocal; change is a function of multiple antecedent factors" (p.58).

Content. The content of the theory includes the concepts of the TPB. Ajzen provides comprehensive guidance regarding the concepts of the theory. Numerous studies have described the relationships among the concepts of the TPB (Hartson et al., 2019; Lu et al., 2022; Plotnikoff et al., 2011). Additionally, several meta-analytic reviews showed strong empirical support for the

TPB, including one by Hagger et al. (2002) that contained 72 studies and another by McEachan et al. (2011) that included 207 studies.

Evaluation of the TPB

Theory evaluation includes judgements related to specific criteria (Fawcett, 2005b). These criteria are significance, internal consistency, parsimony, testability, empirical adequacy, and programmatic adequacy.

Significance. The significance of the theory focuses on the context of the theory and requires justifications for the importance of the theory to the nursing discipline (Fawcett, 2005). The significance can be achieved by assessing whether the philosophical claims, metaparadigm concepts, and conceptual model of the theory are explicit (Levine, 1988). The theory is based on three philosophical claims that one was absent in the TRA (Fishbein & Ajzen, 1977). A combination of attitudes, SN and PBC leads to an individual's behavioral intention. This concluded how the conceptual model of the TPB is explicit. Additionally, as mentioned above, the TPB is addressing the four aspects of nursing metaparadigm with a focus on person and environment.

Internal consistency. This criterion focuses on the context (philosophical claims and conceptual model) and content (concepts) of the theory. Both the context and concepts need to be congruent and reflect semantic clarity and consistency (Fawcett, 2005b). The concept and context of the TPB are congruent. The TPB provides a conceptual model that can be used with any individual's behavior, either positive or negative. Semantic clarity and consistency are met because the theoretical definitions of all concepts are explicit in Ajzen's (1991) work. Moreover, the same term and definitions are used for all concepts throughout Ajzen's papers. For internal

consistency, the linkages between the TPB concepts are clear and specified. The concepts are interrelated and linked to the outcome.

Parsimony. This criterion focuses on the contents of the theory and whether the theory is concise and comprehensive without oversimplifying the phenomena of interest (Fawcett, 2005b). Parsimony is obvious in the linear process of the conceptual model where one construct leads to others. Ajzen (1991) explained the five concepts (attitude, SN, PBC, intention, and behavior) that were grouped into three main beliefs (behavioral, normative and control). The TPB is parsimonious with clear operationalization of the variables and descriptions of the relationships between concepts.

Testability. This criterion focuses on the contents of the theory and relates to the capability of the model to empirical testing (Fawcett, 2005b). The TPB is a testable model, and the concepts of the model are measured using a four-point Likert scale. Comprehensive guidelines are published by Ajzen (2013) that help to develop the TPB instrument.

Empirical adequacy. This criterion relates to the assertation that the theory needs to be congruent with empirical data. Evaluation of this criterion is helpful to determine how to change, refine or delete one or more concepts of the theory (Fawcett, 2005b). Several studies have demonstrated the empirical adequacy of the TPB, which was determined through measuring its variables. For example, a meta analyses by Armitage and Conner (2001) shows strong empirical support for the TPB. Thereby, the theoretical assertations of the TPB are congruent with empirical evidence.

Programmatic adequacy. This criterion focuses on the utility of theory for specific practice (Fawcett, 2005b). The TPB meets this criterion through providing a framework to predict behavior. Even though the TPB is not directly applied to nursing practice, the theory is

easy to understand and helps to target a specific behavior to improve health and lifestyle. The TPB has been applied in the nursing discipline to examine different problems, such as poor hand hygiene, inadequate PA, alcohol consumption, and use of physical restraint (Hartson et al., 2019; Jeong & Kim, 2016; Phuphaibul et al., 2011; Wang et al., 2021).

Applications of the TPB

Several cross-sectional studies applied the TPB to examine the influence of its constructs on the level of PA among children and adolescents. Lu et al. (2022) applied the TPB to predict PA behavior and intentions of Taiwanese urban high school students. The study showed that attitude, SN and PBC explained 67% of PA intention. Moreover, the TPB constructs significantly predicted PA behavior and explained 32.5% of the variance in PA behavior, regardless of sex. Hartson et al. (2019) found that the model explained 60% and 43% of the variance in intention and PA, respectively, among Hispanic high school students in the United States. The study showed that adolescent females had a less positive attitude and lower level of PA, PBC and intention, compared to adolescent males (Hartson et al., 2019).

Among 9–13 year old Chinese students, Wang and Wang (2015) found that females expressed significantly lower intention to participate in PA than boys with no differences in attitude, SN, and PBC. Similar findings were found among adolescents in Hong Kong with Mok and Lee (2013) finding that adolescent females had significantly lower behavioral intentions than adolescent males. The TPB variables explained 53.1% of the variance in PA intention. Additionally, the study of Mok and Lee (2013) showed that SN and PBC were the most significant factors predicting intention. Similarity, Santina et al. (2017) found that PBC and intention were the main predictors of PA among Lebanese children aged 10–12 years and explained 36% of the variance in levels of PA. Furthermore, in a large sample of Canadian adolescents, Plotnikoff et al. (2011) found that attitude was the stronger correlate of intention, and PBC was the stronger correlate of PA behavior, regardless of sex. The TPB explained 59% and 43% of the variance for intention and PA, respectively.

Collectively, these studies show promising results for using TPB to predict PA among adolescents. These findings cannot apply to Saudi females because they are attending all-female schools, and are not exposed to PA. The Saudi adolescent females' perceptions about PA are expected to be different than female in other countries. Examining TPB in Saudi Arabia is necessary for understanding the factors contributing to adolescent females' low levels of PA to effectively intervene to mitigate the problem.

Summary

The chapter presented several theoretical models that have been used to improve adolescent females' PA. The TPB has been selected to guide this study. The theory focuses on the psychosocial factors (attitude, SN, PBC and intention) that may influence the level of PA among Saudi adolescent females. It is an appropriate framework for this study because it specifically includes subjective norms which are expected to have a strong influence on Saudi adolescent females' PA. The results of the study will contribute to expanding theoretical knowledge to help researchers acquire essential information needed to design effective theorybased interventions to promote PA among Saudi adolescent females.

Chapter 3: Literature Review

The limited level of PA among female adolescents in general may be resulting from different types of factors (Chaabane et al., 2021). Even though literature indicates that different environmental or cultural factors influence Saudi adolescent females' PA (e.g., PA spaces and facilities, and cultural restrictions above the freedom of movement and dressing) (see, e.g., Al-Nuaim & Safi, 2022), there is a lack of understanding regarding the psychosocial factors related to their PA. This information is important because several studies have indicated that certain psychosocial factors, such as female adolescents' PA intentions, are directly related to their PA and that PA intentions are influenced by other psychosocial factors, such as attitudes, SN and PBC (Hartson et al., 2019; Lu et al., 2022).

To address this gap in knowledge and enhance understanding in this area, the proposed study will examine the associations between PA and the TPB's psychosocial constructs—attitude toward PA, SN, PBC, and PA intention— in a sample of Saudi female adolescents. The reason for selecting females only is because prior studies conducted in Saudi Arabia have shown that females are far less active than males (see, e.g., Al-Hazzaa & Albawardi, 2019). The chapter includes a review and critique of the theoretical and empirical literature on PA and selected sociodemographic and psychosocial variables related to PA that reflect the theoretical model, as discussed in Chapter 2. Specifically, the sex differences in PA are introduced to justify the significance of focusing on females in this study. This information is followed by other demographic variables of interest, such as age, income status, parental education, and BMI; and the psychosocial variables, including PA intention, attitude toward PA, SN, and PBC.

Physical Activity (PA) and PA Measurement

PA is defined as "any bodily movement produced by skeletal muscles that results in energy expenditure" (Caspersen et al., 1985, pp.126). Researchers use subjective or objective measurements to evaluate PA among children and adolescents. PA is a complex and multidimensional behavior, so it is challenging to select the most accurate and suitable measure for specific populations. Selecting the measurement approach depends on several factors such as affordability, participants' age, sample size, type of PA data required, and measurement time frame (Hills et al., 2014). Both subjective and objective measurements have inherent strengths and limitations that need to be considered. Subjective measurements of PA include selfadministered and interviewed-administered recalls by using surveys, interviews, diaries and/or logs (Sallis et al., 2000). The greatest limitations with these types of measurements is that they rely on adolescents' or children's ability to recall PA behavior information—an approach susceptible to recall bias and social desirability (Jago et al., 2007; Sirard & Pate, 2001). Despite known limitations, the low cost and feasibility of testing a large number of individuals has led health-promotion researchers to rely on self-reported PA (Sallis et al., 2000).

Studies have used valid and reliable self-reported measurements among children and adolescents. Examples of these instruments are Youth Physical Activity Questionnaire (YPAQ) (Corder et al., 2009; McCrorie et al., 2017), International Physical Activity Questionnaire-Short Form (IPAQ-SF) (Al-Nuaim & Safi, 2022; Craig et al., 2017), moderate and vigorous physical activity items of the Youth Risk Behavior Survey (YRBS) (CDC, 2022e; Hawkins et al., 2022), and 3-day Physical Activity Recall (3DPARecall) instrument (Koh et al., 2019; McMurray et al., 2004; Pate et al., 2003). In the country of interest, which is Saudi Arabia, the most frequently used questionnaires in the literature are the Physical Activity Questionnaire for adolescents and

children (PAQ-A and PAQ-C, respectively) (see, e.g., Alharbi, 2019; Bajamal et al., 2017; Janz et al., 2008; Kowalski et al., 2004) and Arab Teens Lifestyle (ATLS) Questionnaire (Al-Hazzaa et al., 2022; Al-Nuaim & Safi, 2022).

Lately, different devices have become popular as measurement tools for PA, such as accelerometers and pedometers. Accelerometers are motion sensors that detect accelerations and body movements; and assess the frequency, duration, and intensity of PA (Hills et al., 2014; Ridgers & Fairclough, 2011). Most widely used are pedometers; these motion sensors count the number of steps taken during different activities (e.g., running or walking) (Hills et al., 2014). Pedometers also function as motivational tools to encourage more PA. Accelerometers and pedometers have been used widely among children and adolescents (Isensee et al., 2018; Suchert et al., 2015; Vanhelst et al., 2019). The strength of these objective measurements is that they are able to: (a) reduce the subjectively inherent in survey methods, and (b) provide valid and reliable measurement of PA among adolescents and children. However, these tools have limitations. For instance, accelerometers and pedometers may: (a) underestimate some PA-related activities, such as swimming, cycling, and conducting household chores (Hidding et al., 2018), (b) not readily provide information about the type and context of the behavior conducted, and (c) be labor-intensive and costly particularly among large populations (Welk et al., 2000).

Because the sample size of the current study is large, a convenient and feasible measure is required for administration. Therefore, to estimate the prevalence of PA among Saudi female adolescents, this study will measure PA levels on a scale from high to low using a self-reported assessment of PA, specifically the PAQ-A.

PA Interventions

A large number of studies have been conducted to identify the effectiveness of PA interventions among adolescents. For example, in their systematic review, Barbosa Filho et al. (2016) found that school-based, community-based, and multi-component interventions have positive effects on promoting PA among adolescents. A meta-analysis study by Pearson et al. (2015) concluded that school-based PA interventions are the most likely approach to influence adolescents, particularly females. School-based interventions have several advantages in promoting PA. For example, these interventions are open-access to all adolescents within the school despite their socioeconomic status, and benefit from qualified PE teachers and PA-related resources, including equipment and facilities (Pearson et al., 2015). Moreover, Messing et al. (2019) systematic review stated that numerous studies have employed different PA promotion strategies and reported positive influences, such as from parents' and families' involvement.

In addition, a systematic review found that PA interventions are more likely to be successful if they are theory-based (Messing et al., 2019). Pearson et al. (2015) found large effects for theory-based interventions in a school setting. A systematic review and meta-analysis study concluded that studies based on the theories of behavior change were significantly improved the level of PA among adolescents with no sex differences (Mears & Jago, 2016). Examples of these theories include Bandura's (1986) social cognitive theory, Deci, & Ryan's (1985) self-determination theory, Pender's et al. (2011) health-promotion model, and Ajzen's (1985) TPB. TPB is selected because it has been used widely to study health behavior including PA in female adolescents (Darabi et al., 2017; Hartson et al., 2019). Moreover, theoretical grounding is important, as it provides health professionals with a framework for: (a) understanding the problem, (b) examining the relationships between variables, and (c) predicting

potential outcomes (Bartholomew et al., 2011; Conner & Norman, 2005; Glanz & Rimer, 2005). According to Raingruber (2014), a theoretical model provides clarity on the factors associated with health-promoting behaviors that need to be taken into consideration when designing, implementing, and evaluating an intervention to increase the chance of positive outcomes.

In Arabic countries, few intervention studies were conducted among children and adolescents with most focusing on weight reduction (Benajiba et al., 2020; Maatoug et al., 2015). For example, a school-based PA and nutritional behavior intervention was conducted to reduce weight among adolescents aged 11–16 years in Tunisia (Maatoug et al., 2015). The study found that a school-based intervention improved healthy dietary habits and reduced the risk of obesity among boys more than girls. Moreover, only one study was found that tested a theory-based intervention to promote PA (Habib-Mourad et al., 2014). Habib-Mourad and colleagues (2014) evaluated the effectiveness of a multicomponent intervention that was based on social cognitive theory and designed to promote PA and healthy eating among Lebanese school children, aged 9–11 years. The researchers found that a theory-based intervention using a school-approach was feasible and effective in promoting the children's healthy eating and PA with no significant differences between sexes. This information indicates that a theory-based intervention may be promising for improving the level of PA among female adolescents.

In the country of interest, which is Saudi Arabia, one PA intervention study with adolescents, aged 12–15 years, was found in the literature. Elfaki et al. (2020) implemented a qusai-experimental study among 713 adolescents in Jazan city, Saudi Arabia. A school-based intervention over 6 months includes: weekly physical education classes, sport and play activities and counseling sessions with goal to improve PA. The researchers found that there is a significant improvement in PA among intervention group. The non-theory-based intervention

underscore the need to investigate factors that influence adolescent's PA to easily design theorybased interventions to promote their PA.

Sociodemographic Factors Associated with PA among Female Adolescents

Sex Differences in PA

Accumulating empirical evidence supports that sex-differences in adolescents' level of PA. Worldwide, male adolescents are reported to be more physically active than females (Bann et al., 2019; Boraita et al., 2020; Darfour-Oduro et al., 2018; Darling et al., 2020; Fernández et al., 2017; Moradi-Lakeh et al., 2016; Rosselli et al., 2020). For example, across 52 countries, including both low- and high-income, male adolescents were found to be more active inside and outside schools than their female peers (Bann et al., 2019). For instance, in Australia, 23.9% of male adolescents reported engaging in moderate physical activity (MPA) 7 days a week, compared to only 13.2% of female adolescents (Bann et al., 2019). Similarly, Rosselli et al. (2020) noted that only 21% of Italian female adolescents met the recommended 60 minutes of daily PA, as compared to almost 50% of the male adolescents. Moreover, Fernández et al. (2017) found that less than 3.1% of Spanish female adolescents practiced PA more than 6 times a week, compared to 12.3% of their male counterparts. This information underscores the urgency to understand factors that contribute to the low levels of PA participation among female adolescents in different countries.

In the Middle East, Darfour-Oduro et al. (2018) found female adolescents were less active than their male counterparts. For instance, in Lebanon, 30.5% of male adolescents met the recommendation of daily PA, compared with only 16.6% of female adolescents. In the country of interest—Saudi Arabia—a systematic review showed that female adolescents participated in less PA than male adolescents, and around 78% of females did not meet the recommended level

of PA (i.e., 60 min 5 day/week, 3 times/week, or 30 mins/day) (Al-Hazzaa, 2018). Al-Nuaim & Safi (2022) reported that among adolescents in Alahsa (eastern region of Saudi Arabia), 72.06% of females were physically inactive, compared with 31.82% of males. Similar findings indicating inadequate levels of PA among Saudi female adolescents were found in the literature regardless of whether subjective measures (Al-Hazzaa et al., 2022; Al-Nuaim & Safi, 2022; Alghadir & Gabr, 2015) or objective measures were used (Al-Nuaim & Safi, 2022). These findings indicate the severity of the problem among Saudi female adolescents.

Age

Extensive research, spanning across different countries and cultures, has demonstrated a decline in PA with increasing age (see e.g., Alharbi, 2019; Dalene et al., 2018; Lagestad et al., 2018; Pate et al., 2019; Sharara et al., 2018). For example, in Norway, results showed that around 24% of female adolescents reported being active at the age of 14, while only17% of female adolescents reported the same at age 19 (Lagestad et al., 2018). Similar findings have been found in the systematic review by Hu et al. (2021).

Indeed, a significantly lower number of female than male adolescents meet the guidelines at every age, regardless of whether PA is assessed subjectively or objectively (Dalene et al., 2018; Lagestad et al., 2018). This decline in PA in females exacerbates the differences in PA between sexes. The greatest decline in PA in females occurs during the prime years of puberty, specifically between the ages of 12–15 (Sherar et al., 2007). A National Heart, Lung, and Blood Institute Growth and Health Study showed a steep decline in PA among female adolescents from age 10 to 19 years old (Kimm et al., 2002). Finne et al. (2011) stated that female adolescents became almost 1.5 times less active each year. However, a systematic review of empirical studies conducted in Saudi Arabia showed a negative relationship between PA and age among

adolescents with no sex differences (Al-Hazzaa, 2018). Specifically, the level of PA among Saudi female children, aged 10–12 years of age, was significantly higher than it was for 13–15 year-old female adolescents in Riyadh—the capital (Alharbi, 2019). In summary, the evidence across different countries and cultures supports a negative relationship between PA and age, particularly for female adolescents.

Parental Education Level

Although parental education has been reported to influence adolescent PA, findings from studies examining the association between parental education and PA among adolescents are inconsistent. Unexpectedly, some studies reported a significantly negative association between parental education and PA, indicating that the more educated the parent, the less active the child (Cheung, 2017; De Rezende et al., 2014; Sherar et al., 2016). For instance, a study in China found that children and adolescents with more formally educated parents engaged in significantly less PA after school than their peers with less formally educated parents with no interaction effect between sexes and parental education level (Cheung, 2017). Likewise, objectively measured PA data pooled from 10 studies from Brazil, Australia, Europe and the United States showed that adolescents of university-educated mothers spent more time being sedentary and less time engaging in light and MVPA, compared with adolescents of high-school-educated mothers with no significant differences between sexes (Sherar et al., 2016).

In contrast, many studies showed a positive association between parental education and PA among adolescents. A systematic review of nine reviews using objective and subjective PA measurements demonstrated that parental education was positively associated with adolescent PA (Sterdt et al., 2014). For example, Muñoz-Galiano et al. (2020), using a subjective measure of PA, found that secondary school Spanish students with higher-educated parents engaged in

more PAs than those with less educated parents with no sex differences being discussed. In Saudi Arabia, Alharbi (2019) found no relationship between parental education level and PA among Saudi female adolescents. Conversely, Khalaf et al. (2013) stated that female students with mothers having higher levels of education were more physically active than their counterparts whose mothers had lower educational levels. Moreover, a study of children aged 6–12 years noted a positive significant association between parental education level and PA with no sex differences (Alotaibi et al., 2020). Other researchers reported that college-educated parents spent more time than non-college-educated parents regulating their female children's behavior, particularly their children's amount of screen time, and so the former group of parents imposed PA schedules, encouraged PAs that are age-appropriate, supported their female children's interest and had a greater knowledge of the health-related benefits of PA (Davis-Kean, 2005; Erkelenz et al., 2014; Gray et al., 2015; Padilla et al., 2015). The inconsistencies in the relationship between parental education and adolescents' PA among previous studies may stem from differences in the measurements of PA (subjective vs objective) and the type of PA assessed (e.g., leisure-time PA), indicating a need for continued research in this area.

Family Income

Several studies have investigated the role that family household income plays in influencing the level of PA among adolescents; however, the results from these studies are inconsistent. For example, in the United States, household family income was positively associated with the level of PA among adolescents with several studies showing limited PA among adolescents from low-income families (de Lima & Silva, 2018; Jin & Jones-Smith, 2015; Martins et al., 2015). For example, de Lima and Silva (2018) found a low level of PA among adolescents from low-income families with no differences between sexes. Moreover, studies

show that living in poverty negatively impacts adolescents' lifestyle behavior and health outcomes, making them more likely to be less physically active than their peers whose families have higher incomes; this finding was similar for males and females (e.g., Cottrell et al., 2015). Chang and Kim (2017) stated that low-income male and female adolescents complained of limited access to resources to practice PA, which led them to be less physically active than their high-income peers. One possible explanation for these findings is that high-income families have the financial resources necessary to pay for their children to purchase fitness equipment, attend a fitness center, and participate in extracurricular activities (Ferreira et al., 2007). Moreover, built environments, including sidewalks, bike trails and safe outdoor spaces, are available more in neighborhoods where high-income families live (Gordon-Larsen et al., 2006). These results indicate that the PA of both males and females is influenced by family income level.

In contrast, in Saudi Arabia, family income negatively influences the level of PA among female adolescents (Al-Hazzaa, 2018; Alharbi, 2019). For example, female adolescents from families with a high monthly income between \$4,000–\$5,333 tended to be less physically active, compared to adolescents from low-income families (those earning less than \$2,666 per month) (Alharbi, 2019). A possible explanation is that female adolescents with a high family income may have an increased ability to buy electronic devices and use motorized transportation, leading to a decrease in their level of PA, but an increase in their screen time. Given the interesting negative association between family income and female adolescents' PA level in Saudi Arabia, future research is needed to explore the factors contributing to this relationship, such as their perceptions of PA.

Extensive empirical evidence supports that limited PA or overall physical inactivity is a major risk factor for high BMI among adolescents (Braithwaite et al., 2017; Hamer & Stamatakis, 2018; Janssen et al., 2005; Kimm et al., 2002). Janssen and colleagues' (2005) study of youth across 34 countries found that lower levels of PA were associated with higher BMI for both sexes. Moreover, a longitudinal study, which surveyed youth over 7 years, found that male and female adolescents with higher vigorous physical activity (VPA) were at a lower risk of overweight and obesity (Hamer & Stamatakis, 2018).

Similarly, in Saudi Arabia, several researchers have found a large and significant negative relationship between PA and BMI (Abedelmalek et al., 2022; Ahmed et al., 2016; Al-Agha et al., 2016; Said, M. A., & Shaab Alibrahim, 2022). Indeed, studies have indicated that PA was lower among obese adolescents than their healthy weight counterparts with no differences based on sex (Elmanssury, 2020). Additionally, a study by Al-Hazzaa et al. (2012) found that obese female Saudi adolescents were significantly less physically active, particularly in terms of vigorous PA, compared with healthy weight female adolescents. Moreover, Al-Agha et al. (2016) found that severely obese female adolescents practiced PA less than 30 minutes per day. The current findings on the association between a low level of PA and overweight/obesity highlight that PA may play a major role in preventing adolescent female obesity.

Summary of Sociodemographic Factors related to PA

Empirical research, particularly studies based in Saudi Arabia, found sex differences in the level of PA among adolescents, such that females tend to be less physically active than males (Al-Sobayel et al., 2015; Alghadir & Gabr, 2015). The literature indicates that as adolescents' age increases, they tend to become less physically inactive (Alharbi, 2019; Dalene et al., 2018;

50

BMI

Lagestad et al., 2018). Moreover, family income and parental education are two proxies of socioeconomic status, and both negatively impact female adolescents' level of PA in Saudi (Al-Hazzaa, 2018; Alharbi, 2019). Observational studies have found a significant negative relationship between BMI and PA among adolescents (Al-Agha et al., 2016; Hamer & Stamatakis, 2018). The possibility exists that these demographic factors may influence Saudi female adolescents' perceptions, ultimately resulting in their low levels of PA. Therefore, this study examines these demographic factors and some key psychosocial factors among female adolescents in Saudi Arabia to determine whether the psychosocial factors are related to their levels of PA after adjusting for these demographic covariates.

Psychosocial Factors Associated with PA Intentions and PA Among Female Adolescents

Certain psychosocial factors have been shown to impact the level of PA among female adolescents. Key factors include PA intention, attitude toward PA, SN, and PBC.

PA intention

The PA literature defines intention in two conceptually and empirically distinct ways. One is decisional intention—the self-instruction of a goal-directed decision to perform PA (Bagozzi, 1992); the other is intention intensity/strength, which refers to an individual's commitment to enact the behavior (Ajzen, 1991; Cane et al., 2012; Fishbein & Ajzen, 2010). Meanwhile, some literature defines intention as a combination of both of these definitions (Conner & Norman, 2015; Rhodes & Rebar, 2017). This construct is considered the proximal influence on PA in correlational tests of the TPB (Symons Downs & Hausenblas, 2005). In the TPB, intention is measured by the intensity of determination, which is considered to be the best predictor of PA and a robust mediator between psychosocial factors and PA (Bélanger-Gravel et

al., 2013; Rhodes & Rebar, 2017; Schwarzer, 2008). In the proposed study, intention is defined as a female adolescent's motivation, commitment, and effort to engage in PA.

Even though most of studies show that intention is a significant predictor of PA (Hartson et al., 2019; Wang & Wang, 2015), findings are inconsistent about the relationship between PA intention and actual PA behavior. A meta-analysis by Rhodes & Dickau (2012) have reported that PA intention have a small effect on PA behavior (d=0.15; 95% CI = 0.06-0.23). Additionally, in their systematic review and meta-analysis study, Rhodes and De Bruijn (2013) found that only 54% of participants translated their positive PA intentions into actual PA. In another study, Chinese female adolescents had a significantly low level of PA intentions compared with male Chinese adolescents (Mok & Lee, 2013). However, other empirical studies have demonstrated a medium to strong relationship between PA intention and participation. For example, meta-analysis studies using TRA and TPB show a statistically significant relationship between PA intention and PA participation with a medium effect size (see e.g., Hagger et al., 2002; McEachan et al., 2011). Indeed, Chatzisarantis et al. (2019) analyzed data from 13 studies and found that favorable PA intention are more likely to predict PA participation than unfavorable intention among youth aged 13–24 years old with no sex differences. A previous study reported that individuals with unfavorable intentions toward PA participation (nonintenders) were more likely to participate in PA if their intentions had changed to at least a moderate level. For this reason, healthcare professionals need to focus on the non-intenders to promote PA.

Not surprisingly, this disconnect has been coined as the intention-PA gap. Some researchers explained that this gap is a potential mechanism moderating the relationship between PA intention and actual PA behavior (Baron & Kenny, 1986; Sniehotta, 2009). Lately, health

behavior researchers have called for continued research to investigate other factors related to PA and explore ways to extend the TPB to reduce the intention-PA gap to, in turn, improve the explanatory power of the theory (Hankins, M., French, D., & Horne, 2000; Rhodes & Dickau, 2012). In response, numerous researchers have started to add additional factors to improve the relationship between intention and PA, such as moral norms, peer norms, habits, mindfulness, and self-efficacy (see, e.g., Gardner et al., 2011; Hartson et al., 2019; Lippke et al., 2009; Rebar et al., 2014; Rhodes & Dickau, 2012). The addition of these factors has increased the variance of PA intention in some studies. For example, in a sample of British adolescents, aged 13-16 years, Chatzisarantis et al. (2009) found that, regardless of sex, peer norms, peer identity, and perceived autonomy support increased the variance of PA intention from 42% to 50%. In contrast, Hartson et al. (2019) reported that mindfulness did not significantly moderate the relationship between intention and MVPA among Hispanic male and female adolescents. Given the inconsistencies across studies in the relationship among additional external factors to improve the relationship between intention and PA, the current study only measures the factors originally included within the TPB (i.e., attitude toward PA, SN, PBC, PA intentions, and PA). Moreover, no study was found that examined the effect of PA intention on the PA among Saudi female adolescents. This lack of information underscores the need to study this relationship in this population.

Attitude Toward PA

Attitude is defined as individual evaluation to approve or disapprove a particular entity (Eagly & Chaiken, 1998). Attitudes are expressed through cognitions (beliefs), affective responses (emotions) and overt behaviors toward a particular object (Eagly & Chaiken, 1998). Attitude toward PA was found to be positively associated with PA (Van Der Horst et al., 2007). Having a positive attitude toward PA is associated with decreased body weight and greater

involvement in PA, compared with negative attitude toward PA (Graham et al., 2011; Marques et al., 2011).

Several empirical studies explored the impact of attitude on PA intention, according to Ajzen's theory of planned behavior (1985). Hartson et al. (2019) found that attitude toward PA in both Hispanic male and female adolescents was a stronger predictor of PA intention than other TPB's constructs. Similar findings have been noted for Black and White 8th grade girls in the United States, and 12–16 years old Chinese male and female adolescents (Saunders et al., 2004; Wang & Zhang, 2016). A systematic review and meta-analysis study showed that attitude was a stronger construct than SN and PBC to explain PA intention in male and female youth (Plotnikoff et al., 2013). Plotnikoff et al. (2011) found that attitude toward PA explained 56% of variance in PA-intention among Canadian female adolescents.

Saudi Arabia is a country where religious beliefs and culture structure people's life. Islam is fundamental to most Saudi Arabians' identity. Although Islam encourages both male and female to practice PA for joy and health purposes, social and cultural boundaries limit females' PA and shape their attitude toward PA (Mirsafian et al., 2014). For example, per the traditional culture, Muslim females should not publicly practice PA in the presence of men, except for walking. Furthermore, given this context, most females have limited knowledge about PA and its benefits, especially because most female schools do not offer physical education (PE) classes. A systematic review by Martins et al. (2015) reported that inactive female adolescents had a negative attitude toward PA, including perceiving PA as non-significant or viewing it as something they disliked. Al-Harbi & Al-Harbi (2017) found that some Saudi female adolescents reported no benefits of practicing PA; however, the authors surmised that this understanding stemmed from the female adolescents' limited information about PA and its relation to health

outcomes. In contrast, in the United States, Loprinzi et al. (2018) found that male and female adolescents between the ages of 12–15 had a positive attitude toward PA and understood the amount of PA needed for their age. The inconsistencies across studies likely stem from participants' different education about PA in their respective schools; indeed, regardless of sex, Graham et al. (2011) explained that having the PE in school had a great impact on PA attitude among adolescents. In conclusion, Saudi Arabia's traditional culture and, thus, minimal PE classes and health education curriculum in schools, shape female adolescents' attitudes toward PA.

Indeed, physically active female adolescents tend to hold positive and favorable attitudes toward PA, associating PA with overall well-being, health and social benefits, and positive selfbody image (Martins et al., 2015). However, in Saudi Arabia due to economic modernization, major cities (e.g., Riyadh, Jeddah, and Al-Khobar) are undergoing cultural and social changes. These changes influence female adolescents who are starting to develop a positive attitude toward PA. Al-Harbi and Al-Harbi (2017) investigated the attitude toward PA of female Saudi adolescents in Riyadh and found that they hold a positive attitude toward engagement and participation in PA. Approximately, 56% of participants identified PA as a way to reduce the risk of disease and improve people's overall health; 32% reported that PA engendered positive feelings; and 44% stated that PA helped people control their weight (Al-Harbi & Al-Harbi, 2017). Additionally, in Jeddah, nearly a third of Saudi female adolescents (n=1,519) reported that they believed that PA is important for their health (Aljaaly, 2017). Indeed, active Saudi male and female adolescents in three major cities—Riyadh, Jeddah and Al-Khobar—reported the reasons for being physically active were to lose weight and for recreation (Al-Hazzaa et al., 2014).

Even though Saudi Arabia's government allows females to do PA in public fields and Saudi female adolescents are somewhat aware of the benefits of PA, their engagement in PA is still low because of social restrictions and cultural norms. The main problems are the maledominated society, compulsory wearing of abaya and hijab–dress code, and the view that PA is a masculine activity. All of these restrictions have greatly contributed to Saudi female adolescents' overall negative attitude toward PA. Aside from positive attitude, Saudi female adolescents believe that PA consumes too much time and makes them feel tired and exhausted; these beliefs influence their PA intention and actual PA (Al-Harbi & Al-Harbi, 2017). In Iran, which has a somewhat similar culture as Saudi Arabia, Mirsafian et al. (2014) found that Muslim's females who never participated in PA indicated PA was hard and not a source of enjoyment, whereas those who exercised two or more times a week showed a positive attitude toward PA with perceptions that PA improved health and relieved stress. A negative attitude toward PA is one of the major risk factors for obesity and prolonged diseases due to physical inactivity (Nelson et al., 2010; Zaman et al., 2018) and, therefore, needs to be targeted.

Moreover, a positive experience with PA is associated with a positive attitude toward PA that then links to regular PA (Sollerhed et al., 2005). Graham et al. (2011) investigated adolescents' attitude toward PA and conducted two follow-up studies, one 5 years later and the other 10 years later. Graham and his colleagues found that adolescents with a positive attitude toward PA engaged in 30%–40% more MVPA each week at 5 and 10 years later than those with a less favorable attitude; no sex differences were noted. Belton et al. (2014) found that inactive female adolescents demonstrated significantly more negative attitudes toward PA and had less knowledge of the benefits of PA, compared to active female adolescents.

Additional reasons that could influence female adolescents' attitudes toward PA include: parents' attitudes toward PA and their past experiences with PA (Corr et al., 2019; Zaman et al., 2018). Saudi Arabia's culture is family-centered, where family has a strong impact on female adolescents' PA attitudes and decision making. Indeed, parents can help female adolescents to develop a positive attitude toward PA through modeling a favorable attitude toward it (Corr et al., 2019; Graham et al., 2011). Moreover, negative past experiences of PA lead to unfavorable attitudes toward PA (Tinker, 1991). From a motivational perspective, people's attitudes toward PA are key and need to be considered during the development of health promotion and obesity interventions (Belton et al., 2014; Kopczynski et al., 2014; Plotnikoff et al., 2013). The current findings on the relationship between attitude and PA intention and actual PA highlight that examining attitude in Saudi female adolescents is important to improve their PA.

Subjective Norms

SN are defined as perceptions of social pressure from parents, family, and friends toward PA (Ajzen, 1991). The literature addressed the impact of social environments on adolescents' involvement and participation in PA (Bélanger et al., 2011). Studies discussed the effect of SN on PA intention among adolescents. Although some studies represented a weak/small effect of the SN-intention relationship, other empirical studies found a strong relationship. For example, a meta-analysis of 72 studies by Hagger et al. (2002) found that SN is a weak predictor of PA intention among adolescents regardless of sex. Similar findings have been found among 8th and 9th grade female adolescents (Ellis et al., 2013). In contrast, SN presented a moderate effect on PA intention among Hispanic male and female adolescents (Foley et al., 2019), and a strong predictor of PA intention among New Zealander adolescents (Foley et al., 2008). These inconsistent results warrant investigation of SN among female adolescents.

Saudi Arabia is a collectivist community; therefore, female adolescents are usually influenced and surrounded by people in the community. The strength of these communities is the ability to create sociocultural environments that motivate people to incorporate healthy behaviors (e.g., PA). Several studies reported that parents and family support influence female adolescents to practice PA (Alsubaie & Omer, 2015; Ramezankhani et al., 2019). A qualitative study reported that parental support contributed to the development of positive SN and encouraged adolescents to be physically active (Bélanger et al., 2011).

Across several Arab countries, Sharara et al., (2018) found limited parental support of PA; instead, the parents tended to favor educational activities. A review of 34 studies found that female adolescents generally received less parental support and facilitation to exercise than male adolescents (Gustafson & Rhodes, 2006). However, Saudi female adolescents reported that family members, mainly their mothers and sisters, were the major influencers of their PA decisions (Al-Harbi & Al-Harbi, 2017). Al-Harbi and Al-Harbi (2017) argued that Saudi Arabia's traditional culture likely explains this finding because females generally socialize and communicate mostly with female family members. In a study with a large sample of Saudi adolescents (n=2866), researchers found that females exercised mostly with their families (Al-Hazzaa et al., 2014). These findings are consistent with studies on PA patterns within the Hispanic culture. Like the Hispanic culture, the Saudi culture is also collectivist in nature, meaning family and friends are the main subjective norms that play a major role in predicting PA intention (Triandis et al., 1998). Again, SN can positively affect the level of PA among female adolescents.

Additionally, parental support consists of explicit modeling. Parents play an important role in modeling behavior that encourages PA in their adolescents (Griffith et al., 2007). Madsen

et al. (2009) conducted a longitudinal study to investigate the impact of parental models on African American and Caucasian female adolescents. The study found that females who perceived that their parents practiced PA three or more times a week were 50% more active than their counterparts with sedentary parents. A qualitative study conducted in Canada with female adolescents (*N*=515), aged 15–18 years, who participated in focus group discussions, found that parents and family members worked as role models and influenced female adolescents' desire to be physically active (Bélanger et al., 2011).

According to Gustafson and Rhodes (2006) parenting modeling plays an important role in creating PA social norms in preadolescents regardless of sex. However, during adolescence, teenagers are more likely to view friends and peers as role models rather than their family members (Yao & Rhodes, 2015). Friends' modeling of PA is significantly correlated with teenagers' PA (Graham et al., 2014; Laird et al., 2016) and PA intention (Azzarito & Hill, 2013; Bélanger et al., 2011; Craike, Symons, & Zimmermann, 2009; Yungblut et al., 2012).

Adolescents, more so than other age groups, like to "fit in"; given their strong need for peer acceptance, adolescents generally endorse their friends' behaviors (Coleman, 1980). According to Baker et al. (2003), peer norms impact adolescents' PA beliefs and intentions and reinforce PA by providing encouragement and support. The findings are inconsistent with the notion of peers' modelling. Some studies found that females received more positive norms from their parents and less from their friends (Ling et al., 2014). Lawler et al. (2020) found that parent's modeling of PA sustained female adolescents' PA over 12 months in Ireland. In contrast, other studies showed that female adolescents practice high levels of PA because of their active friends, even though their parents, particularly their mothers, played a major role in shaping their healthy lifestyles (Corr et al., 2019; Ling et al., 2014; Voorhees et al., 2005).

Additionally, a cross-cultural study, with data from seven Arab countries, found that male and female adolescents reported that friends' support was somewhat important to be physically active (Musaiger et al., 2013).

Furthermore, Coleman et al. (2008) found that female adolescents who are active and engage in different types of PA are more likely to have an active friend, whereas less active teenagers are more likely to have more sedentary peers. Al-Harbi and Al-Harbi (2017) reported that 52% of Saudi female participants in their study stated that their friends encouraged and motivated them to practice PA. Furthermore, Lawler et al. (2020) found that female adolescents who held positive perceptions of their friends' PA and support were more likely to initiate PA and have a decreased risk of PA drop-off over the following year. Cross-cultural literature and systematic reviews reported that female adolescents attributed their physical inactivity to their lack of physically active friends and peer support (see, e.g., Chaabane el al., 2020; Graham et al., 2014; Laird et al., 2016; Ramezankhani et al., 2019; Sharara et al., 2018). In conclusion, female adolescents are influenced by the social pressure to engage in PA. For this reason, investigation the effect of SN on PA intention and actual PA among Saudi female adolescents is important to improve their level of PA because they are more likely to be physically active if both their parents and friends accept and encourage the behavior.

PBC

Studies have found that PBC correlates with female adolescents' PA intentions and PA (Hartson et al., 2019; Maddison et al., 2009). PBC and self-efficacy are conceptually similar constructs that reflect individuals' beliefs that their behavior is within their own control; however, the two are operationally different (Ajzen, 2020). Given their conceptual similarities, PBC and self-efficacy sometimes overlap in the literature (Hagger et al., 2002). Nevertheless,

Ajzen (2020) stated that PBC was assessed operationally by facilitators and barriers—the ease or difficulty of the behavior— that influenced the performance of behaviors (e.g., "I find it difficult to exercise three times a week"). PBC involves perception of the needed skills, abilities, and opportunities, and support from other people to engage in a behavior (Ajzen, 2020). Self-efficacy is mainly focused on the individual's belief and confidence in his/her ability to do a behavior (e.g., "I am confident that I can practice exercise three times a week when I am on vacation (Bandura, 1986; Wallston, 2001).

Several studies have shown that different influencing facilitators and barriers are associated with PA among female adolescents. Studies suggest that these findings belong to different levels of an ecological model including: individual (attitude toward PA; motivation and fun; and perception of competence, body image and femininity), social (tangible and intangible social support from parents, friends, and PE teachers), and environmental (climate conditions, cost, time, and access to opportunity) (Abdelghaffar et al., 2019; Al-Harbi & Al-Harbi, 2017; Al-Hazzaa et al., 2014; Aljaaly, 2017; Martins et al., 2015; Ramezankhani et al., 2019; Sterdt et al., 2014). A systematic review of qualitative studies by Martins et al. (2015) identified UK and non-UK adolescent's perceptions —mainly female—of PA facilitators and barriers. Martins and colleagues found that active female adolescents had a high perception of competence. Moreover, they indicated having a friend's support and parents' social and financial support increased their PA level. Indeed, these physically active young females seemed to challenge societal norms and stated femininity is unrelated to PA.

In contrast, a systematic review by Ramezankhani et al. (2019) identified several barriers to female adolescents' PA, including lack of time due to homework and household chores, lack of support and equipment, and lack of appropriate space for PA. Additionally, a qualitative study

identified two themes related to PBC: perceived competence and access (Bélanger et al., 2011). Female adolescents who declined to do PA stated that feelings of incompetence acted as a barrier to participate in PA. They compared their skills with their friends and devaluated their own skills, thereby discouraging them from participating in PA even though they enjoyed the activity. Additionally, the participants reported that the cost of registration for sport facilities and PA equipment were also barriers to participate in PA (Bélanger et al., 2011; Chaabane et al., 2021; Corr et al., 2019).

Similarly, researchers identified several barriers to PA specifically among Saudi female adolescents. Some of these barriers include wearing an abaya (traditional cover), hot weather (with temperature reaching 120°F), limited PA facilities (e.g., sport grounds, outdoor parks, and fitness centers), lack of social support, the traditional female roles, lack of self-confidence, and lack of time because of housework and studying (Al-Hazzaa, 2018; Al-Hazzaa et al., 2014; Aljaaly, 2017; Chaabane et al., 2021). Additionally, a qualitative study including 56 adolescents in Morocco identified cultural norms as a barrier to PA participation among female adolescents. Abdelghaffar et al. (2019) stated that because of conservative cultural and religious norms, families prohibited females from practicing PA outdoors or from wearing athletic clothingprohibitions which consequently reduced their motivation to engage in PA. Moreover, in collectivist cultures, such as the one in Saudi Arabia, the main priority for females is to care for the families and the households. Researchers have found that this orientation is associated with females' low levels of internal control and confidence regarding PA (Abdelghaffar et al., 2019; Al-Eisa & Al-Sobayel, 2012). For this reason, understanding the barriers and facilitators among Saudi female adolescents is essential for explaining how PBC influences their intention to engage in PA.

Summary of Psychological Factors Associated with PA

This review of the literature indicates that several psychosocial factors based on the TPB have potential to influence Saudi adolescent females' PA and warrant examination. The TPB-based psychosocial factors include attitude toward PA, SN, PBC, and intention. Understanding the effect of these factors on Saudi adolescent females' PA is important for tailoring PA interventions to address the specific needs of this population. This knowledge can then be used to target and improve the key psychosocial factors identified as being associated with PA to increase participation in the behavior among Saudi female adolescents.

Chapter 4: Methods

The purpose of the study is to examine the relationship between TPB psychosocial factors (attitude toward PA, SN, PBC, and PA intention) and PA among Saudi female adolescents. This chapter will describe the: (1) study design, setting, and sample of participants, (2) recruitment procedure, screening, and enrollment, (3) data collection methods, and (4) data analysis.

Study Design

A cross-sectional study design was utilized to examine the relationship between psychosocial factors and PA among Saudi female adolescents aged 13–18 years old. This design is considered adequate because it can test the associations among independent, mediating, and dependent variables (Setia, 2016). A key advantage of a cross-sectional design is to investigate multiple variables at a single point in time. Cross-sectional studies are relatively easier to conduct, less time-intensive, and more cost-effective than other types of designs (Pandis, 2014). This design is suitable for generating hypotheses (Wang & Cheng, 2020).

Using reliable and valid self-report measurements, this cross-sectional study was employed to assess the associations between the TPB's psychosocial factors and PA (primary outcome) among Saudi adolescent females. In addition, the study determined whether sociodemographic differences, including age, household family income, parental educational level, and weight status (underweight, healthy weight, overweight, and obesity) estimated from BMI, had relationship with TPB psychosocial factors and PA among female adolescents in Saudi Arabia.

Setting and Participants

According to the Ministry of Education (MOE, 2022), 262 female public intermediate
schools and 175 female public high schools are located in rural and urban areas in the Eastern Region of Saudi Arabia. The intermediate schools include 7th–9th grades, and the high schools include 10th–12th grades. A convenience sample was used to recruit female adolescents from all-female public schools in the Eastern Region, Saudi Arabia. The sample included students from Qatif, Dammam, Alkhobar and other small cities in the Eastern Region.

Inclusion and Exclusion Criteria

Saudi female students, ages 13–18 years, meeting the following criteria were included in the study: (a) enrolled in public intermediate or high schools in Saudi Arabia, (b) had a signed individual assent and parental consent, and (c) were able to read and understand Arabic. Participants were excluded if they had health conditions preventing their participation in PA.

Power Analysis and Sample Size

Research suggests different approaches to determine sample size for SEM with 3 latent variables (attitude, subjective norms, and intention). The sample to-parameters ratio (10:1 or 20:1) approach was used to estimate the sample size for this study (Klein, 1998). The number of parameters in the model includes number of path coefficients for any arrows, number of exogenous variables, number of covariance among exogenous variables, and disturbance terms. As noted in Figure 2, the model under consideration has altogether 19 parameters: 13 paths, 4 exogenous variables, zero covariance, two disturbance terms (two endogenous variables). The sample size was 190 (based on 10:1 ratio).

Following the rule of thumb, a large sample size is needed for reliable results to be obtained from SEM analysis (Thompson, 2004: p. 24). According to Molwus et al., 2013, sample sizes in the extant literature between 100 and 400 were large enough to produce plausible results. Therefore, the sample size of 329 is considered sufficient.

Recruitment Procedure, Screening, Enrollment, and Data Collection

Before conducting the research, the study purpose, and procedures for protecting participants were reviewed and approved by the institutional review board of the Michigan State University (STUDY00006023), and MOE in Saudi Arabia (4300653365). After receiving the approval, an employee from the MOE (Planning and Development Department) sent a letter requesting permission to conduct the study to the principal of each middle and high schools in the Eastern Region, Saudi Arabia. The letter included the barcode and a link to the study information.

In the letter, principals were asked to send the study link to the parents of all students in the school via email or WhatsApp (free messaging application that provides instant messaging) to obtain parental consent prior to students' assent. Clicking on the link redirected parents to study information hosted on Qualtrics XM— a computer software program that facilitates and automates the process of conducting surveys, polls, intercepts, and reports (Michigan State University, n.d.-b). The study information provided to the parent of each student included the study aims, scope, procedures (including data protection), inclusion and exclusion criteria and time commitment. The parents were asked to sign the consent form if they were interested in having their adolescent participate in the study.

The parents who signed the consent form were then asked to provide an e-mail address of their daughters so that the survey could be automatically sent to them. If their daughter did not have an e-mail address, parents were asked if they would like their daughter to continue proceeding to the survey from the same link. Students were directed to the assent form that included the study scope, procedures (including data protection), inclusion and exclusion criteria, time commitment, and the need to sign the assent form if they were interested in participating.

The following definition of PA was provided as follows: "practicing any type of PA that makes adolescents move, breath hard, and increase their heart rate." Before interested students could proceed to the screener page, they were asked to agree to participate in the study through an online information page and select "I agree to participate" at the bottom of the page. Non-interested students received a message thanking them for their time.

Interested students were able to independently complete the Qualtrics survey at home at a convenient time. The survey did not ask the students to list a name or contact information. Students were screened by asking them to identify their age and academic grade in school; and whether they were able to read and understand Arabic and had any health conditions preventing them from participating in PA. A Qualtrics system feature excluded students who did not meet the eligibility criteria. Students who did not meet eligibility criteria received a message thanking them for their time. Eligible students were directed to the main survey which consisted of 46 items.

Participation was voluntary for all survey items. All students, as volunteer participants, were able at any time to stop participating in the study and quit completing the survey by closing the survey window. Moreover, they had the right to refuse to answer any questions at any time. Students needed approximately 10 minutes to complete the survey. Upon successful survey completion, the following message was shown: "We thank you for the time you spent taking this survey. Your response has been recorded."

Data Collection Methods

Students' data were collected using an online questionnaire in Arabic. Previously tested reliable and valid surveys were used to measure the psychosocial factors and PA.

Sociodemographic Characteristics

Items were developed by the primary researcher to assess sociodemographic characteristics (See Appendix B) including age, height, weight, family income, and parents' education level.

Age. Students' age is considered a continuous variable. Students were asked to answer an open-ended question by typing their birthdate (day, month, year) in Georgian or Hijri date (Arabic).

Body Mass Index (BMI). Self-reported height and weight were used to determine the BMI. The reason for calculating BMI was to examine the influence of BMI on the psychosocial factors and PA. BMI is calculated by dividing weight in kg by height in m². The International Obesity Task Force (IOTF) age- and sex- specific BMI cut-offs to assess the prevalence of thinness, normal weight, overweight, obesity was used to identify any overweight and obese Saudi female adolescents aged 13 to 18 years (see Appendix C). Four categories were used: 1) thinness, BMI < 18.5 kg/; 2) normal weight, BMI between 18.5–24.9 kg/m²; 3) overweight, BMI \geq 25 kg/m²; and 4) obesity, BMI \geq 30 kg/m² (Cole et al., 2000; Cole & Lobstein, 2012; Ramirez-Marrero et al., 2005).

Household Family Income. Household monthly family income is considered a categorical variable. Students were asked to select one of three response choices: a) low-income (earnings less than 5,000 SR or USD\$1,333 monthly), b) medium-income (earnings between SR5,000 – SR15,000 SR or USD\$1,333–\$4,000 monthly), d) high income (earnings more than 15,000 SR or USD\$4,000 monthly) (Khan et al., 2020). One United States dollar (USD) is equal to 3.75 Saudi Riyals (SR).

Parents' Education Level. Mothers' and fathers' educational level is considered a categorical variable. Students were asked to select one of the following three response choices for each parent to assess the parent's educational level: a) intermediate school or lower, b) high school or diploma, c) undergraduate or graduate degree (diploma, bachelors, masters, PhD).

Physical Activity (PA)

The 8-item Physical Activity Questionnaire for Adolescents (PAQ-A) was used to assess students' participation in various types of PA in the past 7 days at different times—in the morning, at lunch, and during the weekend (Kowalski et al., 2004). Each item is scored on a 5point scale, with '1' indicating low and '5' indicating a high level of PA. The final result is calculated based on the average value of the points obtained; a higher mean score indicates a higher level of PA and vice versa (Kowalski et al., 2004). The PAQ-A is a modified version of Physical Activity Questionnaire for Children (PAQ-C). However, the former questionnaire does not include a question regarding practicing PA during recess (Kowalski et al., 1997).

The English version of the PAQ-A was translated to Arabic by Bajamal et al. (2017) and tested with Saudi female adolescents in school settings (see Appendix B). The Arabic version has good internal consistency (Cronbach's alpha = .81), inter-rater reliability (.87), and test-retest reliability (.84). After submitting IRB application to conduct this study in Saudi Arabia, dancing activity was deleted from PA questionnaire as requested by MOE. It was deleted from the following questions: 1, 3, 4, 5, and 7 (see Appendix B).

The PAQ-A has been shown to be a reliable and valid method for assessing and classifying adolescents into different activity levels. Researchers have demonstrated acceptable-to-good levels of internal consistency (Cronbach's α =.71–.88) (Aggio et al., 2016; Guedes & Guedes, 2015; Janz et al., 2008; Koh et al., 2020). A study by Wyszyńska et al. (2019) to

evaluate the PAQ-A with Polish adolescents showed high internal consistency (Cronbach's α =.93). Moreover, concurrent validity was assessed in several studies where scores were correlated with accelerometer readings. For example, a study by Aggio et al. (2016) showed moderate correlations of .39 and .42, and a study by Janz et al. (2008) reported strong correlations of 0.56 and 0.63. These results support using the PAQ-A with adolescents.

Theory of Planned Behavior (TPB) Psychosocial Factors

The TPB scale measures attitude toward PA, SN, PBC, and intention. PA is described as practicing any type of PA that makes adolescents move, breath hard, and increase their heart rate (Bélanger-Gravel & Godin, 2010). The scale has moderate-to-good internal consistency when used with adolescents (Cronbach's α =0.66-0.75). Moreover, it has a good temporal stability over two-week reliability testing (test-retest results between 0.48 and 0.71) (Bélanger-Gravel & Godin, 2010). The scale has been used in studies with children (mean age=11.6 years) (Escriva-Boulley & Boiché, 2020; Gourlan et al., 2018).

The English version of the scale was translated to Arabic by Santina et al. (2017) following Ajzen's (2004) guidelines and tested on fifth and sixth grade Lebanese children in school settings. The scale consists of 36 items. Subscales include attitude and behavioral beliefs (12 items), subjective norms and normative beliefs (8 items), PBC (facilitators, barriers, and selfefficacy; 11 items), and intention (4 items). The variables were assessed based on the means of these four-point Likert scales: (1) not at all, (2) not really, (3) yes maybe, and (4) yes for sure. The Arabic-version scale, which has very good internal consistency (Cronbach's α =0.72–0.92; Santina et al., 2017), was used in the current study (see Table 1).

TPB Subscales	Cronbach's Alpha
Attitude	0.92
Subjective norms	0.90
PBC	0.72
Intention	0.76
Behavioral Beliefs	0.73
Normative Beliefs	0.76
Control Beliefs	0.77-0.66

Cronbach's Alpha for TPB Subscales Based on the Study of Santina et al. (2017) among Children Aged 10–12

Some minor modifications were made in some questions for two reasons: 1) the current translated survey by Santina et al. (2017) was tested on students who practiced PA in a school setting and not on those who are not able to do so (e.g., Saudi adolescent females), and 2) a qualitative elicitation study based on the TPB was conducted with Saudi females about PA (Al-Harbi & Al-Harbi, 2017). Based on the information provided in these studies, especially the elicitation study by Al-Harbi & Al-Harbi (2017), items were removed or replaced with the most appropriate items that are applicable to Saudi's culture. Changes made to each subscale are as follows (see Appendix B):

Attitude. Changes were made as follows to:

 Question 1 "For you, doing PA is...": the item "making you feel good" was changed to "something fun and stress-relieving". Additionally, another item (helpful to lose or control weight) was added. Moreover, changes were made for the two following questions:

- Question 2, "Do you think that performing a physical activity ...", the item "lead to falling on the ground or breaking your hand or leg" was changed to "lead to injury". Two items were also added (leave you feeling exhausted and consume time).
- 3. Question 3 "Do you think doing physical activity helps you to…", one item (feel warm during winter) was removed because students are not expected to practice PA in summer and winter, and the translated survey data were collected in the winter.

Subjective Norms. For the question "Do the following people encourage you to do physical activity?", the item focusing on class teacher was changed to sister, brother, and social media because there is no PA teacher at the schools.

PBC. Question 9 "Do you think you are able to engage in physical activity for at least 30 minutes during most school days even if...", four items (the school playground is unsafe, there are school rules that prevent you from playing sometimes (e.g., raining), you have an exam after recess, or the activity takes place after a difficult class lesson) were changed to 3 items (I do not have sport machines in the house, I do not have time, and there is a lack of gym and fitness center).

For question 10 "Do you think it is easier for you to engage in physical activity for at least 30 minutes during most school days if...", five items (you like the activity organized by the teacher, the PE or other class teacher organized games that involve movements, you like the person who organized the physical activity, you have an exam after the activity or after a difficult class lesson, school management provided you with the necessary sport equipment) were changed to three items (I have sport machine in the house, I am wearing comfortable/sport clothes outside, and I am able to go to gym and fitness center).

Procedure for Human Subject Protection and Data Management

To ensure the confidentiality of participants, several measures were undertaken. First, participants were not asked to identify themselves by name on the Qualtrics survey. Qualtrics uses unique identification numbers for each participant. The responses to the survey were saved directly into Qualtrics for review by the research team members only. Second, participants were informed about their right to refuse to answer any questions that they do not want to answer or to stop participating at any time. Third, only research team members approved by the IRB had access to the data. Fourth, after the completion of the study, the PI assumed responsibility for managing and retaining the research data.

According to MSU Guidelines for Research Data within a Qualtrics Survey Tool (Michigan State University, n.d.-a), all data were stored and processed in a single geographical region as specified on a service order. Furthermore, MSU is responsible for the routine backup of data and its eventual deletion. Additionally, the data are deemed to a part of MSU's confidential information and will not be utilized by Qualtrics for any purpose other than performing its obligations under its license agreement with MSU. Qualtrics is responsible for preventing unauthorized access, disclosure, alteration, and use of the data.

Before the study was closed by the IRB, the key matching participants to the ID number that was housed on the researcher's password-protected computer in a password-protected file were destroyed along with any personal identifiers noted in the data. The following measures was used to store the data for a minimum of three years: 1) encrypted external hard drive (deidentified data) and the secure MSU data repository (de-identified prior to IRB closure). MSU policy states that data will be stored for a minimum of three years from the end of the study. Participants' confidentiality will be protected to the maximum extent allowable by law.

Data Screening

Preparing data for analysis is necessary to ensure high-quality data which can yield meaningful results. Several procedures were applied for screening data prior to any substantive data analysis including: (1) cleaning the data, and (2) testing the reliability and validity of the instruments.

Data Cleaning

According to Qualtrics (2022), the following methods can be used to clean the data before exporting the dataset and analyzing the survey results: 1) turn the numeric data into graphics for issues such as the straight-lining respondents (e.g., selecting first response for all questions), and 2) review open-ended questions where participants may fill in with nonsense text.

After completing this process, a downloaded SPSS dataset from Qualtrics was checked by the investigator. This dataset includes all survey raw response data (covers answers and survey questions and metadata [duration and dates]). Specifically, it includes start and end dates of the survey, type of responses collected, IP address, duration, finished and progress status, recorded date, response ID, and respondent's location. A simple manual data validation protocol was established by the investigator that includes five tasks: (1) excluding the repeat participants and fraudulent, (2) eliminating the survey of response with identical IP with some exceptions, such as respondents answer survey from the same computer, (3) checking the consistency between the age of respondent and the grade, and (4) comparing the reported region in which survey was taken with the respondent's location.

Reliability and Validity of the Instruments

Cronbach's alpha coefficient (α ; Cronbach, 1951) was used to assess internal consistency reliability of the PAQ-A and the TBP among adolescents. Internal consistency reliability helps to determine whether all items in a questionnaire are consistent (correlated) among themselves and with the instrument as a whole (Revelle, 1979). Because the TPB instrument consists of subscales that measure different constructs, the internal consistency was assessed separately for each subscale (Henson, 2001). The higher the coefficient α (closer to 1.0), the greater the likelihood that all items measure the same construct (Nardi, 2018). However, according to Kane (2016), validity must be considered each time the instrument is used. For this reason, assessing the construct validity is required to determine the accuracy of the measure (Nardi, 2018). Confirmatory factor analysis (CFA) was used to investigate the construct validity of the TPB psychosocial instruments (Said et al., 2011).

Data Analysis Based on the Aims of the Study

First, the Statistical Package for Social Science computer software (SPSS, Version 28.0) was used to analyze the quantitative data. Descriptive statistics, including means, standard deviations, percentages, and frequencies, were used to describe behavioral, psychosocial, anthropometric, and sociodemographic data. Missing data pattern was evaluated prior to SEM testing. Moreover, data distribution was assessed prior to an aim testing. The statistical analysis that was used to examine each aim of the study is as follows:

Aim 1: Examine the relationship between TPB psychosocial factors (attitude toward PA, SN, PBC, and PA intention) and PA among Saudi female adolescents. SEM was performed using Mplus software to examine the direct and indirect effects among psychosocial factors and self-reported PA.

Aim 2: Examine whether adolescents' attitude, SN, PBC, intention and PA are associated with their sociodemographic factors (including age, family income, parental educational level, prevalence of overweight and obesity [estimated from BMI]). SEM was used to examine the association between sociodemographic factors, psychosocial factors, and PA.

Assumptions of Structure Equation Modeling (SEM)

SEM requires four underlying assumptions to be satisfied to ensure accurate inferences before implementing the analysis.

1. *Multivariate Normality*. Normality of variables is assessed with two methods: statistical and graphical. Skewness and kurtosis are the two components of normality. Skewness is related to symmetry of distribution that affects the mean of the tests (Kim, 2013). Kurtosis is related to peakedness of distribution that affects the variance and covariance of the tests (Kim, 2013). SPSS was used to determine the absolute value of skewness and kurtosis. West et al. (1995) proposed a reference of departure from normality as an absolute skewness value >2, and kurtosis value >7. All the variables' skewness and kurtosis absolute values were within the range in this study. The skewness (range from 0.134 to 0.138) and kurtosis (range from -0.14 to 1.19) were not severe because they did not exceed 2 and 7, respectively (Kim, 2013; Kline, 2015).

2. *Outliers.* All measured variables should be screened for any outliers to determine the extent and shape of nonnormality distribution data (Tabachnick & Fidell, 2018). An outlier is a set of values that are different from the remaining data with either an extreme value on one variable (univariate) or a strange combination of values on at least two variables (multivariate) (Han & Kamber, 2006; Tabachnick & Fidell, 2018). The univariate and multivariate outliers were examined using SPSS. Boxplot was used for continuous variables to detect which points are univariate outliers. Boxplot is a very simple visualization tool to detect the outlier by using

interquartile range (IQR) (Spitzer et al., 2014). IQR is defined as the difference between the upper quartile (Q3; the value under which 75th of data point) and lower quartiles (Q1; the value under 25th of data points). As a rule of thumb, an outlier means "the value lies at least 1.5 times the length of the IQR beyond either side of the edge" (Mowbray et al., 2019). Boxplot detected no outlier in the variables.

For multivariate outliers, the Mahalanobis distance was used (Leys et al., 2018). According to Kline (2015), multivariate outliers need to be detected before performing SEM because they can easily jeopardize fit indices. No multivariate outliers were identified in the data. **3.** *Linearity*. Bivariate scatterplot was used to assess the linear relationship among measured variables, specifically whether the independent variables have a linear relationship with the mediator and the outcome variable. If both variables are normally distributed and linearly related, the overall shape of scatterplot is oval or nearly oval (Tabachnick & Fidell, 2018). If nonlinear relationship between variable is apparent, data transformation will be used (e.g., computing square root, logarithm or inverse) (Mertler & Reinhart, 2016; Tabachnick & Fidell, 2018). In this study, all scatterplots showing the relationship between two variables (different sets of variables examined) were oval-shaped or very close to oval-shaped, indicating linear relationships between all two-variable combinations.

4. *Multicollinearity and Singularity*. Multicollinearity and singularity are two problems that occur when variables are too highly correlated (\geq .9) or redundant, respectively (Tabachnick & Fidell, 2018). The diagnosis of multicollinearity begins with the correlation matrix followed by an evaluation of statistical parameters such as tolerance and Variance Inflation Factor (VIF) (Schroeder et al., 1990; Tabachnick & Fidell, 2018). VIF was calculated for each independent variable to measure how multicollinear predictors may affect the linear regression analysis. The

higher value of VIF (>10), the greater is the degree of collinearity (Schroeder et al., 1990). VIF is the reciprocal of tolerance. Tolerance <0.25 represents multicollinearity (Midi, Sarkar, & Rana, 2010). If multicollinearity or singularity is detected, a simple method is to delete the problematic variable from the analysis if the information will be captured by the other variable and not be lost (Sprinthall, 2007). Table 2 shows that none of VIF values for the predictor variables in the study are greater than 5, which indicates that multicollinearity does not exist.

Table 2

Variable	Tolerance	VIF
Age	0.893	1.120
BMI	0.976	1.024
Family Income	0.708	1.413
Father Education	0.687	1.456
Mother Education	0.671	1.490
Attitude	0.641	1.559
SN	0.765	1.307
PBC	0.599	1.668
Intention	0.694	1.442

VIF-Multicollinearity Test Results

Note: N = 329. Dependent variable: physical activity. VIF= variance inflation factors. Source: author's results of multicollinearity from SPSS.

Steps of Structural Equation Modeling

Structural equation modeling (SEM) with multiple imputation and maximum likelihood estimation (ML) was employed using Mplus version 8.8 (Muthén and Muthén, 2017). Four steps of SEM were followed to analyze the data: 1) specify the model; 2) determine the model identification; 3) evaluate the model of fit, and 4) modify the model (Suhr, 2006). A range of recommended fit indices was used to evaluate a good fit of the model including chi-square index (X^2) with a nonsignificant value indicating better model fit (Barrett, 2007); root mean square error of approximation (RMSEA) which estimates the closeness of misfit; a score of less than 0.08 indicating acceptable misfit (MacCallum et al., 1996); comparative fit index (CFI) and Tucker-Lewis Index (TLI) >.9 which is considered acceptable (Hu & Bentler, 1999).

First, CFA was used to assess the proposed measurement model and to dictate the number of factors. The standardized factor loading should be greater than the recommended threshold of 0.60 to establish sufficient factor loading for all items (Kline, 2005). Items with factor loadings < 0.5 were considered for removal (Hair et al., 2009). The construct validity was determined by Computing Average Variance Extracted (AVE) and Composite Reliability (CR). The cut off value should be equal or greater than 0.5 for AVE and 0.6 for CR (Hair et al., 2006). If AVE is less than 0.5 and CR is higher than 0.6, the convergent validity of the construct is still adequate (Fornell & Larcker, 1981). Furthermore, discriminant validity was established by assessing the correlation coefficient between two factors, a result of less than 0.85 indicates adequate discriminant validity of the model (Brown, 2015).

Then, a full structural model was implemented to explain the direct relationships between latent and observed variables (standardizes coefficients). The model examined the relationship between TPB psychosocial factors including attitude, SN, PBC, and PA intention, and PA behavior. To examine indirect relationship between psychosocial factors and PA through intention, a mediation analysis was implemented in mplus by using IND function. It was tested for significance by using 95% bias-corrected bootstrap (5000) confidence interval (Hayes & Scharkow, 2013).

Finally, sociodemographic factors were added as covariates to test whether adolescents' attitude, SN, PBC, intention and PA were associated with their age, BMI, family income and parental education level. The bias-corrected bootstrapping method (5000 bootstrap samples) with

IND function was used. Furthermore, the model fit of model with sociodemographic factors was compared with previous model without covariates to determine the most parsimonious model.

Summary

The chapter presented an overview of the study design, setting and sample, recruitment procedure, data collection methods and data analysis. This cross-sectional study aims to examine the relationships of TPB psychosocial factors, including attitude toward PA, SN, PBC, and PA intention with self-reported PA in Saudi female adolescents. The data from the online questionnaires were analyzed using the SEM technique.

Chapter 5: Results

The chapter presents the research findings from this study. First, missing data, the psychometric properties of the scales and test of measurement model are evaluated. Then, the descriptions of the demographic characteristics, physical activity (PA) and psychosocial factors are presented. Discussion of the following models are presented: the hypothesized model, the moderation of SN model, and inclusion of covariates (sociodemographic) model. The chapter concludes with major findings related to the research aims followed by a summary of the key findings.

Missing Data

Before conducting any interferential analysis, data were examined for missingness. Determination of the number and patterns of missing values for all variables was assessed using Analyze Patterns and Missing Values Analysis in SPSS. When considering all variables, the missing rate was 2.8%. There were 40 cases with missing data. The PA questionnaire had the highest amount of missing data, but this finding is not surprising because the questions come at the end of the long survey, the completion of which may have eventually led to respondent fatigue. For the TPB constructs, there were few missing items. These items may have been perceived as long or intrusive. According to Tabachnick & Fidell (2018), missing data is less problematic if less than 5% of data points are missing in pattern from a large data set. Discarding occurred for single cases missing over 50% of the quantitative data.

Little's Missing Completely at Random (MCAR) was applied in SPSS to assess the missing data patterns to determine whether the data are MCAR. The results indicated that the data were not MCAR (χ^2 = 2174.37, df=1882, *p*<0.001). So, it's either Missing at Random (MAC) or Missing not at Random (MNAR). Through examining the pattern in the data, it does

not look MNAR because the pattern of missing data is predictable from other variables in the data set, and it's not related to the variable itself. Also, according to Tabachnick & Fidell (2018), it does not matter since the proportion of missing data is small (less than 5%), so any procedure for handling missing values yields similar results. Therefore, the missing data patterns appeared to be missing at random (Little, 1988). Accordingly, multiple imputations with 10 datasets were conducted using Mplus to enhance robustness (Woods et al., 2021).

Psychometric Properties of Scales

Reliability

To assess internal consistency of each scale, Cronbach's alpha was used. The acceptable value of alpha ranges from 0.70 to 0.95 (Tavakol & Dennick, 2011). As noted in Table 3, Cronbach's alpha coefficient was 0.81 for the 8-item PAQ-A, indicating excellent internal consistency reliability (George & Mallery, 2003). The item-total correlation coefficient for PAQ-A ranged from -0.02 to 0.70. This result demonstrates that item-total correlation among items were found to be acceptable except for question 2 (What did you do besides eating breakfast?), which was the only question with small item-total correlation coefficient (<.20) (Piedmont, 2014). This could be due to the fact that most students eat their breakfast at school which is followed by sitting in the class for hours until the end of the day. Students do not have PE classes and recess to walk or run. However, Cronbach's alpha improved to 0.85 after deleting this low-correlated item.

The Cronbach's alpha coefficient was 0.86 for the 36-item TPB questionnaire, indicating good internal consistency reliability, see Table 3. The Cronbach's alpha coefficient was 0.72 for the 14-item attitude subscale, 0.80 for the 8-item SN and 0.90 for the 4-item intention subscales. The Cronbach's alpha coefficient was 0.54 for the 10-item PBC subscale, maybe due to

misunderstanding questions. Therefore, item-total correlation was evaluated and items with poorly correlated with other items and with low total item-correlation become candidates for removal. After deleting 5 items. The Cronbach's alpha coefficient was improved to 0.71 for 5item PBC.

Table 3

Reliability of TPB, Psychosocial Factors, and PA Scales

Scales	Cronbach's α	
TPB	0.86	
Attitude	0.72	
SN	0.80	
PBC	0.71	
Intention	0.90	
PAQ-A	0.81	

Note: N = 329. SN= Subjective norms. PBC=Perceived behavioral control. TPB= total mean of attitude, SN, PBC and intention.

Validity

Factorial Structure of the PAQ-A. A confirmatory factor analysis (CFA) was conducted to test the factorial structure of the PAQ-A. The results of the one-factor structure of PAQ-A indicated that the model did fit the data well based on fit indices: $[x^2 (298) = 941.81, p < 0.001, \text{RMSEA} = .07 \text{ with } 90\% \text{ CI } [.06-.08], \text{ CFI} = .97, \text{ TLI} = 0.97 \text{ SRMR} = .03].$

Factorial Structure of the TPB Scale. CFA was conducted to test the factorial structure of the TPB in the Mplus. The results of the model indicated that the four-factor structure of TPB had an acceptable fit based on fit indices $[x^2 (558) = 1171.03, p < 0.001, RMSEA = .05 with 90\% CI [.05-.06], CFI = .85, TLI = .83, SRMR= .06]. CFA was also conducted to test the factorial structure of attitude, SN, PBC, and intention, see Table 4. All models but attitude had an acceptable fit based on the fit indices.$

Variable	Fit Indices
Four-factor of TPB	<i>x</i> ² (558) = 1171.03, <i>p</i> < 0.001, RMSEA = .05 with 90% CI [.0506], CFI = .85, TLI = .83, SRMR= .06
Three-factor of Attitude	<i>x</i> ² (74) = 289, <i>p</i> < 0.001, RMSEA = .09 with 90% CI [.0810], CFI = .83, TLI = 0.80, SRMR= 0.07
Two-factor of SN	<i>x</i> ² (19) = 56.22, <i>p</i> < 0.001, RMSEA = .07 with 90% CI [.0510], CFI = .95, TLI = 0.93, SRMR= 0.04
Three-factor of PBC	<i>x</i> ² (23) = 88.5, <i>p</i> < 0.001, RMSEA = .07 with 90% CI [.0509], CFI = 0.90, TLI = 0.80 SRMR= 0.05
One-factor of Intention	<i>x</i> ² (2) = 2.5, <i>p</i> = 0.2, RMSEA = .02 with 90% CI [.0010], CFI = .99, TLI = 0.99, SRMR= 0.01

Estimates of CFA Models: Model Fit Indies for Variables

Note: SN= Subjective norms. PBC=Perceived behavioral control. TPB includes attitude, SN, PBC and intention.

Demographic Characteristics

A total of 624 Saudi female students were contacted for eligibility screening from all 262 intermediate and 175 high female public schools in Eastern Region, Saudi Arabia. Of the 624 potential students, 329 were included, and 295 were excluded for different reasons: a) 24 students had an illness or disease preventing them to practice PA; b) 53 students were less than 13 years of age or greater than 18 years; c) 30 mothers refused to have their daughters participate; d) 25 students declined to participate; e) 153 students made the decision by not completing the questionnaire after signing the assent form; f) 10 students had more than 50% of missing data (Tabachnick & Fidell, 2018). Table 5 includes the demographic characteristics of the study sample.

Age

Participant's age ranged from 13 to 18 years with a mean of 15.7 (SD = 1.5). As shown in Table 5, 22.8% of female participants were 17 years old.

Academic Grade

As shown in Table 5, the larger sample of participants came from high schools (n=219, 66.6%), compared with intermediate schools (n=110, 33.4%). The percentage of 12^{th} grade participants was the highest, as compared to those in other academic grades (n=82, 24.9%).

BMI

The mean weight of sample was 53.17kg (SD= 11.7). The mean height of sample was 157.02 cm (SD = 6.7). The mean BMI of the sample was 21.5 (SD=4.4). As shown in Table 5, more than half of the participants (n =190, 57.8%) had a normal weight, whereas 16.1% (n=53) were thin, 14.3% (n=47) were overweight and 7.3% (n=24) were obese.

Family Income

As shown in the Table 5, the largest percentage of participants had a monthly family medium-income earnings between 1,333 - 4,000 (SR5,000 - SR15,000, n= 173, 52.6%), followed by high-income monthly family earnings greater than 4,000 (SR15,000, n= 78, 23.7%), and low-income monthly family earnings less than < 1,333 USD (SR5,000, n=77, 23.4%).

Parent Education Level

As shown in Table 5, the largest percentage of participants reported their father's highest education level as being undergraduate or higher education (n=137, 41.6%), followed by high school or diploma (n=127, 38.6%). For their mother's highest educational level, the largest percentage of participants reported high school or diploma (n=155, 47.1%), followed by undergraduate or higher education (n=118, 35.9%).

Demographic variable	п	%	
Age			
13	52	15.8	
14	48	14.6	
15	69	21.0	
16	62	18.8	
17	75	22.8	
18	23	7.0	
City			
Khobar	68	20.7	
Dammam	50	15.2	
Qatif	185	56.2	
Öther	26	7.9	
Academic grade			
Intermediate	110	33.4	
High	219	66.6	
Grade			
7th	28	8.5	
8th	43	13.1	
9th	39	11.9	
10th	77	23.4	
11th	60	18.2	
12th	82	24.9	
BMI category			
Thin	53	16.1	
Normal weight	190	57.8	
Overweight	47	14.3	
Obese	24	7.3	
Monthly Family income			
< \$1.333 USD (SR5.000)	77	23.4	
(1,333 - \$4.000 (SR5.000 - SR15.000))	173	52.6	
> \$4,000 (SR15,000)	78	23.7	
Father's education level			
Intermediate school or lower.	65	19.8	
High school or diploma	127	38.6	
Undergraduate or higher	137	41.6	

Demographic Characteristics of Participants (N=329)

Table 5 (cont'd)

Demographic variable	п	%
Mother's education level		
Intermediate school or lower.	56	17.0
High school or diploma.	155	47.1
Undergraduate or higher	118	35.9
Note: Missing data $(n-15, 4.60)$ for DMI/IOTE $(n-0, 2.70)$	for weight $(n-11, 2, 20\%)$ for heigh	ht (n-1, 0, 20/) for

Note: Missing data (n=15, 4.6%) for BMI/IOTF, (n=9, 2.7%) for weight, (n=11, 3.3%) for height, (n=1, 0.3%) for family monthly income. 3.75 SR= USD

Table 6

Means and Standard Deviations for Continuous Demographic Variables (N=329)

Continuous Demographic Variables	М	SD
Age (years)	15.7	1.5
Weight (kg)	53.17	11.7
Height (cm)	157.02	6.7
BMI	21.5	4.4

Note: Missing data (n=15, 4.6%) for BMI, (n=9, 2.7%) for weight, (n=11, 3.3%) for height.

Descriptive Statistics for PA and TPB Variables

PA

The PA questionnaire scores ranged from 1 to 4.35, with an average score of 1.8 (SD =

0.66), which indicates a low level of PA according to Kowalski et al (2004). Walking, doing indoor chores and using stairs were the highest activities reported by participants, as compared to other activities. Over half of the participants reported walking (n=214, 73.2%) and doing indoor chores (n=216, 65.6%). According to the results, 248 participants (75.3%) reported using stairs.

Participants had reported other types of PA that not mentioned in the scale, such as eastern dancing (n=7), yoga (n=5), riding horses (n=4), table tennis (n=4), jumping rope (n=4), gymnastic (n=3), handball (n=3), weight lifting (n=3), bicycling (n=3), volleyball (n=3), resistance training (n=2), cardio exercise (n=2), skating (n=1), boxing (n=1), quad stretch (n=1),

scootering (n=1), diving (n=1), badminton (n=1), warming exercise (n=1), skate boarding (n=1), and stretching exercise (n=1).

Eighty-seven (26.4%, n=87) participants reported sickness or something else that prevented them to do PA, such as lack of equipment and enough space to do PA, schoolwork, menstrual period, flu, fasting, foot pain after running, fatigue, and lack of sleep.

TPB Variables

As shown in Table 7, the scores of TPB ranged from 1.63 to 3.9, with a mean of 2.8 (*SD* = 0.42). Specifically, the scores of attitude toward PA ranged from 1.67 to 4, with mean of 2.8 (*SD* = 0.40). The scores of SN ranged from 1 to 4, with mean 3.2 (*SD* = 0.56). The scores of PBC ranged from 1.47 to 3.72, with mean 2.6 (*SD* = 0.43). The scores of intention ranged from 1 to 4, with mean 2.7 (*SD* = 0.82).

Table 7

	Descriptive Statistics for T	PB, TPB Psychosocia	l Factors, and PA	Scales ($N=329$)
--	------------------------------	---------------------	-------------------	--------------------

Scales	М	SD	Min	Max
TPB	2.8	0.42	1.63	3.9
Attitude	2.8	0.40	1.67	4
SN	3.2	0.56	1	4
PBC	2.6	0.43	1.47	3.72
Intention	2.7	0.82	1	4
PA	1.8	0.66	1	4.35

Note: M = Mean; SD = Standard deviation; Min = Minimum; Max = Maximum.

Table 8 shows the number and percentage of the highest participants selecting "Yes, for sure" for some of TPB Questionnaire items. A large number of participants reported that doing PA is good for improving health (n=244, 74.2%) and losing or controlling weight (n=232, 70.5%). Closer to 40% of participants reported that doing PA consumes too much time (n=126, 38.3%).

Moreover, participants reported that important people around them support the idea of PA (n=157, 47.7%), advise them to do PA (n=162, 49.2%), and agree to do PA (n=220, 66.9%). Participants identified the person that encourages them to do PA. Almost, half of participants reported mother and (n=165, 50.2%), sister/brother (n =130, 39.6%), friends (n=131, 39.8%), and some participants reported people on social media (n= 124, 37.7%).

Furthermore, participants reported doing PA for at least 60 minutes during school is difficult (n= 153, 46.5%), easy (n=109, 33.1%), very difficult (n=42, 12.8%), very easy (n= 25, 7.6%). Perceived barriers to PA were identified based on the percentage of participants selecting "Yes, maybe" and "Yes, for sure". More than half of the participants indicated that lack of sport machine at home (58.7%), lack of a fitness center (55.9%), lack of time (51%), and hot weather (35.6%) were reasons for not doing PA. Finally, only 84 students (25.5%) intended or planned to do PA.

Table 8

Item	n	%
Attitude		
PA is energizing	108	32.8
PA is fun	102	31.0
PA is stress relieving	134	40.7
PA is improving health	244	74.2
PA helps to lose weight	232	70.5
PA consumes too much	126	39.0
time		
Gain body Strength	206	62.6
Subjective norms		
Support the idea of PA	157	47.7
Agree to do PA	162	49.2
Encourage to do PA	220	66.9
Individual support person		
Mother	165	50.2
Father	165	50.7
Sister/brother	130	39.5

Number and Percent of Participants Selecting "Yes, for sure"/"Yes, maybe" for TPB Questionnaire Items (N=329)

Table 8 (cont'd)

Item	n	%
Friends	131	39.8
Social media	124	37.7
PBC-Doing PA is		
Very difficult	42	12.8
Difficult	153	46.5
Easy	109	33.1
Very easy	25	7.60
PBC-Barriers		
Lack of sport machines	193	58.7
Lack of fitness center	184	55.9
Lak of time	169	51.0
Hot weather	117	35.6
PBC-Facilitators		
Having sport machine	261	79.3
Wearing sport clothes	253	76.9
Going fitness center	224	68.1

Note: Missing data (n=1, 0.3%) for the following items: energizing, improving health, they agree to do PA, father, sister/brother, friends, people on social media, lack of fitness center, (n=2, 0.6%) for having fun and going to fitness center, (n=3, 3.9%) for have sport machine in the house, wearing comfortable clothes, , (n=1, 0.3%) for family monthly income.

Psychosocial Factors Related to Female Adolescent's PA Intention and PA

Measurement Model

As previously mentioned, CFA of TPB demonstrated an acceptable fit of the

measurement model to the data. To measure the discriminant validity of TPB scale, the inter-

factor correlations coefficients were examined. Table 9 shows that all inter-factor correlation was

below the cutoff of 0.85, indicating adequate discriminant validity at the measurement level

(Brown, 2015).

Although the majority of indicators had factor loadings greater than the recommended threshold of 0.60 (Kline, 2005), some items had low factor loadings, see Table 10. Average Variance Extracted (AVE) and Composite Reliability (CR) were examined to confirm that each item is loaded appropriately into the theoretically assigned construct. AVE is an important aspect to establish the convergent validity of a scale. AVE should be higher than 0.5 (Hair et al., 2006). If AVE is less than 0.5 and CR is higher than 0.6, the convergent validity of the construct is still adequate (Fornell & Larcker, 1981).

Table 10 shows that the CR for the constructs ranged above the cutoff value of 0.6, except for some items for attitude and PBC subscales. Items with following reasons were deleted to improve the construct: (1) factor loadings less than 0.5, (2) low AVE (<0.5) when CR <0.6. As shown in Table 11, the Cronbach's alpha was improved after deleting 4 items of attitude (α =.74), 1 item in SN (α =.81), and 5 items in the PBC (α =.71). Moreover, the fit indices of all variables were improved as shown in table 12.

Table 9

Variables	1	2	3	4	5	6	7	8
1 ATT1	-							
2 ATT2	0.31***	-						
3 ATT3	0.78***	0.25***	-					
4 SN1	0.40***	0.02	0.45***	-				
5 SN2	0.32***	0.07	0.36***	0.55***	-			
6 PBC1	0.65***	0.34***	0.51***	0.25***	0.24***	-		
7 PBC2	0.61***	0.04	0.45***	0.30*	0.35**	0.56***	-	
8 PBC3	0.45***	0.01	0.48***	0.41***	0.33***	0.41***	0.27*	-
9 INT	0.63***	0.30***	0.53***	0.30***	0.33***	0.77***	0.55***	0.37***

Correlation among Measured Variables

Note: The values are the estimated correlation reported from TECH4 command in Mplus. * = p < .05, ** = p < .01, *** = p < .001. ATT1 = attitude-1; ATT1 = attitude-2; ATT3 = attitude-3; SN1 = subjective norm-1; SN2 = subjective norm-2; PBC1= perceived behavioral control-1; PBC2= perceived behavioral control-2; IN = intention.

Table 10

Estimates o	f Measurement M	lodel j	for Psych	ıosocial	Factor	Variables
	/					

Psychosocial Factor	Items	Factor	SE	AVE	CR	Cronbach's
Variables		loading				alpha
Attitude toward PA	ATD1-1	0.70	0.04	0.3	0.7	.72
	ATD1-2	0.53	0.05			
	ATD1-3	0.70	0.04			
	ATD1-4	0.66	0.04			

Psychosocial Factor Variables	Items	Factor loading	SE	AVE	CR	Cronbach's
v unuoios	ATD1-5	0.45	0.05			uipilu
	ATD1-6	0.40	0.05			
	ATD2-1	0.53	0.06	0.3	0.6	
	ATD2-2	-0.34	0.06			
	ATD2-3	-0.45	0.05			
	ATD2-4	-0.81	0.07			
	ATD3-1	0.60	0.04	0.5	0.8	
	ATD3-2	0.80	0.03			
	ATD3-3	0.80	0.03			
	ATD3-4	0.65	0.04			
SN	SN1-1	0.72	0.04	0.5	0.8	.8
	SN1-2	0.75	0.04			
	SN1-3	0.70	0.04			
	SN2-1	0.80	0.03	0.5	0.8	
	SN2-2	0.80	0.03			
	SN2-3	0.70	0.04			
	SN2-4	0.60	0.05			
	SN2-5	0.30	0.06			
PBC	PBC1-1	0.83	0.04	0.5	0.6	.54
	PBC1-2	0.87	0.04			
	PBC1-3	-0.31	0.05			
	PBC2-1	0.55	0.09	0.1	0.3	
	PBC2-2	0.32	0.09			
	PBC2-3	0.10NS	0.08			
	PBC2-4	0.25	0.09			
	PBC3-1	0.72	0.05	0.4	0.7	
	PBC3-2	0.63	0.05			
	PBC3-3	0.60	0.05			
Intention	INT1	0.86	0.02	0.7	0.9	.9
	INT2	0.83	0.02			
	INT3	0.80	0.03			
	INT4	0.81	0.02			

Table 10 (cont'd)

Note: All standardized factor loadings (λ) are significant at *p* <.001 except PBC2-3. SE = standard error; AVE = average variance; CR = composite reliability. Bolded cells are deleted. NS=non-statistically significant.

Psychosocial Factor	Items	Factor	SE	AVE	CR	Cronbach's
Variables		loading				alpha
Attitude toward PA	ATD1-1	0.75	0.04	0.4	0.7	.74
	ATD1-2	0.53	0.05			
	ATD1-3	0.73	0.03			
	ATD1-4	0.63	0.04			
	ATD2 1	0.54	0.10	0.5	0.6	
	ATD2-1 ATD2-4	0.34	0.10	0.5	0.0	
	A1D2-4	-0.82	0.07			
	ATD3-1	0.60	0.04	0.5	0.8	
	ATD3-2	0.80	0.03			
	ATD3-3	0.80	0.03			
	ATD3-4	0.65	0.04			
SN	SN1-1	0.72	0.04	0.5	0.8	.81
	SN1-2	0.76	0.04			
	SN1-3	0.70	0.04			
	SN2-1	0.80	0.03	0.5	0.8	
	SN2-2	0.80	0.03			
	SN2-3	0.70	0.04			
	SN2-4	0.53	0.05			
PBC	PBC1-1	0.80	0.06	0.7	0.8	.71
	PBC1-2	0.88	0.06			
	PBC3-1	0.72	0.05	0.4	0.7	
	PBC3-2	0.63	0.06			
	PBC3-3	0.58	0.05			

Estimates of Measurement Model for Psychosocial Factor Variables after Modifications

Note: All standardized factor loadings (λ) are significant at *p* <.001. SE = standard error; AVE = average variance; CR = composite reliability.

Table 12

Variable	Fit Indices
TPB	<i>x</i> ² (271) = 494.1, <i>p</i> < 0.001, RMSEA = .05 with 90% CI [.0405], CFI = .93, TLI = .92, SRMR= .04
Attitude	<i>x</i> ² (32) = 87.1, <i>p</i> < 0.001, RMSEA = .07 with 90% CI [.0509], CFI = .94, TLI = 0.92, SRMR= 0.04

CFA Models after Modifications

Variable	Fit Indices
SN	$x^{2}(13) = 24.10, p = 0.02, \text{RMSEA} = .05 \text{ with } 90\% \text{ CI } [.0208], \text{CFI} = .98,$
РВС	TLI = 0.97, SRMR= 0.02 $x^{2}(4) = 4.4, p=0.35, RMSEA = .02$ with 90% CI [.0008], CFI = 0.99, TLI =
	0.99, SRMR= 0.02

Table 12 (cont'd)

Theoretical Model

To understand the relationship between TPB psychosocial factors and PA intention and PA, a structural equation modeling was conducted. This technique helps to evaluate whether the data fit the model, and if the direct and indirect relationships reach the level of statistical significance (standardized coefficient).

Before imputation, SEM was conducted to explain relationships between exogenous and endogenous variables using bias-corrected bootstrapping method (5000 bootstrap samples). The structural model had an acceptable model fit with the data with three latent variables (attitude, SN, and intention): $[x^2(217) = 424.45, p < 0.001, RMSEA = .05 \text{ with } 90\% \text{ CI } [.04-.06], CFI$ = .93, TLI = 0.91 SRMR= 0.05]. The model explained (52%) and (19%) of the variance in PAintention and PA, respectively. The strongest predictor of adolescents' intention was attitude $(<math>\beta$ =0.43, p<.001) followed by PBC (β =0.36, p<.001). There was no relationship between intention and SN (β =0.01, p=0.90). Intention had a direct effect on PA (β =0.37, p<0.001). See Table 13, for the mediation effects.

Effects	Direct Effects	Indirect Effects	95% CI	
F→INT→PA	F to PA	F via INT to PA	Lower	Upper
ATT→INT→PA	0.136ns	0.162*	0.055	0.269
SN→INT→PA	-0.043ns	0.004ns	-0.068	0.067
PRC→INT→PA	-0.017NS	0 133*	0.050	0.217

Mediation Effects of Psychosocial Factors on Female Adolescents' Intention and PA

Note: N= 329, Standardized indirect effects obtained from Mplus IND function with bootstrap 5000. The indirect effect is indicated significant when 95% bias-corrected confidence intervals (CIs) for the estimate do not contain zero. *p < .01. F= Factor, NS = non-statistically significant (p<0.05).

After imputation, SEM was conducted using the imputed file (10 datasets) and the biascorrected bootstrapping method (5000 bootstrap samples). Due to small missing data, there is a little improvement in the model and results. The structural model (A) had an acceptable model fit with the data with three latent variables (attitude, SN, and intention): $[x^2(217) = 421.28, p < 0.001, RMSEA = .05$ with 90% CI [.04-.06], CFI = .93, TLI = 0.92 SRMR= 0.05].

As shown in Table 14, the correlation was high between attitude and PBC (r=0.63, p<.001) and between attitude and SN (r=0.55 p<.001). The correlation was moderate between and SN and PBC (r=0.42, p<.001). The aforementioned results were interpreted based on Cohen's guidelines (1988): weak (0.1–0.29), moderate (0.30–0.49) and strong (0.50–1).

The model explained (53%) and (21%) of the variance in PA intention and PA, respectively. The strongest predictor of adolescents' intention was attitude (β =0.43, p<.001) followed by PBC (β =0.36, p<.001). There was no relationship between intention and SN (β =0.01, p=0.91). Intention had a direct effect on PA (β =0.40, p<0.001), see Figure 3.

Variables	1	2	3	4	5
Attitude SN PBC Intention PA	.55** .63** .67** .35**	.42** .40** .17*	.64** .28**	.44**	

Model (A): Correlation Matrix Between Psychosocial Factor and PA Variables

Note: N = 329, Correlations of the measurement model was estimated using the TECH4 command in Mplus. SN = Subjective norms; PBC = Perceived behavioral control; PA = Physical activity; *p < .05, **p<0.001.

Figure 3

Model (A): The Structural Model: The Influences of Psychosocial Factors on Adolescents' PA Intention and PA



Note: N=329. Path weights are standardized beta weight (β). Solid lines indicate statistically significant paths. Dotted lines indicate a non-statistically significant path. * p-value <.001

Mediation Analysis

Female adolescents' intention significantly and fully mediated the relationship of attitude and PBC with PA. The female adolescents' attitude (β =0.17, p<.01) and PBC (β =0.14, p<0.1) had significant indirect effects on self-reported PA through intention (see Table 15).

Effects	Direct Effects	Indirect Effects	95% CI	
F→INT→PA	F to PA	F via INT to PA	Lower	Upper
ATT→INT→PA	0.142ns	0.171*	0.061	0.282
SN→INT→PA	-0.047ns	0.004ns	-0.072	0.081
PRC→INT→PA	-0.036NS	0 142*	0.053	0.231

Model (A): Mediation Effects of Psychosocial Factors on Female Adolescents' Intention and PA

Note: N= 329, Standardized indirect effects obtained from Mplus IND function with bootstrap 5000. The indirect effect is indicated significant when 95% bias-corrected confidence intervals (CIs) for the estimate do not contain zero. *p < .01. F= Factor, NS = non-statistically significant (p<0.05).

Model Modification: Moderation of Subjective Norms

As shown, intention was not a significant mediator between SN and PA, so the results did not support the original hypothesis. Given the recognized importance of SN in Saudi's culture, and inconsistencies across studies in the relationship among factors to improve the relationship between intention and PA, decision made to explore whether SN may serve as a latent moderator variable on the relationship between PA intention and PA behavior (see, e.g., Hartson et al., 2019; Rebar et al., 2014).

To examine whether SN acts as a moderator of the intention-PA relationship, a moderation analysis was implemented by using interaction term between the moderator and the variable being moderated (XWITH option) (Asparouhov & Muthén, 2020). Analyses conducted with The XWITH option utilized the random with integration algorithm to define latent variable (SN) interactions between intention and PA. XWITH was paired with the symbol "|" to define the interaction variables (SNINT). Typical fit indices were not available when testing interaction model. Indicator variable was standardized to provide standardized coefficient estimator for the model (Maslowsky et al., 2015). The interaction effect was statistically significant (β =0.47,

p<.01, 95% *CI*=0.15-0.78). This revealed that the relation between intention and PA becomes more positive as SN increased, see Figure 4.

Figure 4

SEM Moderation Model





Sociodemographic Factors related to TPB Psychosocial Factor Variables and PA

Sociodemographic factors were included in the SEM-Model (A) as covariates to (1) rigorously examine the characteristics of participants, and (2) examine whether the covariates improve the model and significantly affect the final results. Therefore, Age, BMI, family income, father and mother education were added to the Model (A), see Figure 5.

Using the imputed file (10 datasets) and the bias-corrected bootstrapping method (5000 bootstrap samples), SEM-Model (B) had an acceptable fit with following fit indices [x^2 (307) = 525.88, p < 0.001, RMSEA = .0.05 with 90% CI [.04-.05], CFI = .92, TLI = .91, SRMR= .05]. As shown in Figure 5, none of sociodemographic factors but father education were significant covariates of psychosocial factors and PA, see Table 16 and 17. Father education has a

significant negative relationship with PBC (β =-0.13, p<.05). This indicates that one standard deviation increases in father education resulted in .13 decrease in PBC on average. According to Cohen's guidelines (1988), the effect size is considered to be small.

Figure 5





Note: N=329. Path weights are standardized beta weight (β). Solid lines indicate statistically significant paths. Dotted lines indicate a non-statistically significant path. * p-value <.001, **<.05,

Table 16

Model (B): Mediation Effects of Psychosocial Factors on Female Adolescents' Intention and PA

Effects	Direct Effects	Indirect Effects	95% CI	
F→INT→PA	F to PA	F via INT to PA	Lower	Upper
ATT→INT→PA	0.176ns	0.154*	0.053	0.240
SN→INT→PA	-0.060ns	0.003ns	-0.070	0.064
PBC→INT→PA	-0.031NS	0.128*	0.042	0.120

Note: N= 329, Standardized indirect effects obtained from Mplus IND function with bootstrap 5000. The indirect effect is indicated significant when 95% bias-corrected confidence intervals (CIs) for the estimate do not contain zero. *p < .01. F= Factor, NS = non-statistically significant (p>0.05).

Variable Covariate	Attitude (β)	SN (β)	PBC (β)	Intention (β)	ΡΑ (β)
Age	0.089	0.005	-0.023	-0.063	-0.106
BMI	0.028	0.082	-0.044	-0.003	-0.022
Family Income	-0.037	0.094	-0.086	0.014	-0.035
Father Education	-0.109	0.007	-0.133*	0.053	0.090
Mother Education	0.081	-0.005	-0.001	-0.090	-0.119

Model (B): The Results of the Relationships between Sociodemographic Factors and Psychosocial Factors and PA

Note: N= 329, Standardized direct effects obtained from Mplus. *p < .05.

After removing all covariates from the model and remaining only the father education, the SEM Model (C) had an acceptable fit with following fit indices $[x^2(238) = 447.48, p < 0.001,$ RMSEA = .0.05 with 90% CI [.04-.06], CFI = .93, TLI = .92, SRMR= .05], see Figure 6. The model explained (53%) and (21%) of the variance in PA intention and PA, respectively, see Table 18.

Figure 6

Model (C): Father Education as Covariate



Note: N=329. Path weights are standardized beta weight (β). Solid lines indicate statistically significant paths. Dotted lines indicate a non-statistically significant path. * p-value <.001, **<0.05
Father Education

ANOVA and Tukey's HSD (Honestly Significant Difference) post-hoc tests were conducted using SPSS to examine the father education differences in PBC. As shown in Table 18, there was significant differences among the groups in PBC, F(3, 328) = 3.8, p=.022. The participants with a father who had intermediate school or lower had significantly higher PBC for PA (M=3.02, *SD*=.65) than participants with a father with high school or diploma (M=2.9, *SD* =.61) or undergraduate degree or higher (M=2.7, *SD*=.68), see table 18.

A post hoc Tukey test showed that the intermediate school or lower and undergraduate degree or higher differed significantly at p < .05; high school or diploma group was not significantly different from the other two groups, see table 19.

Table 18

Means and Standards Deviations for PBC by Father's Education

Scales by mother's education	Ν	М	SD	F	df	Р
Intermediate school or lower	65	3.02	.65	3.8	(2,328)	.022
High school or diploma	127	2.90	.61			
Undergraduate or graduate	137	2.75	.68			

Note: *N*=329

Table 19

Post-hoc Comparisons of Mean Scores on Father Education by Group

Group Comparisons	Mean differences	St. Error	Sig.	95% CI	
				Lower Bound	Upper Bound
Intermediate school or lower					
high school or diploma	.1195	.0994	.452	1145	.3537
undergraduate degree or higher	.2620*	.0981	.022	.3038	.4932
High school or diploma					
intermediate school or lower	1195	.0994	.452	3537	.1145

Table 19 (cont'd)

Group Comparisons	Mean	St. Error	Sig.	95% CI		
	differences			Lower Bound	Upper Bour	
undergraduate degree or higher	.1424	.0803	.180	0467	.3315	
Undergraduate degree or higher	2.00*	0001	000	1022	0200	
intermediate school or lower	2620*	.0981	.022	4932	0308	
high school or diploma	1424	.0803	.180	3315	0.467	

*The mean difference is significant at the 0.05 level

Comparing Models

The Chi-square differences between two models is calculated by using likelihood ratio (LR) test. LR test is suitable to compare models with imputed data with ML estimator (Asparouhov & Muthén, 2010; Cheung & Rensvold, 2002; Raykov & Marcoulides, 2008). The LRT statistics is 505.8 - 421.28 = 20, which is chi-square distributed with $\Delta DF = 84$. Using the chi-square critical value table, the cut-off of the pertinent chi-square distribution with 84 degrees of freedom is 106.4 (at significance level .05), this difference is not significant (Turney, 2022). As a result, model (A) fits the data better than Model (B). Additionally, fit indices also show Model (A) fits data better than Model (B), see table 20.

Comparing model (A) and (C). The LR test statistics is 58.3, which is chi-square distributed with $\Delta DF = 15$. Because the cut-off of the pertinent chi-square distribution with 15 degrees of freedom is 24.9 (at significance level .05), this difference is significant (Turney, 2022). Thus, model (C) fits the data better than Model (A). Therefore, Model (C) with father education is most parsimonious model.

Table 20

Model	χ2	df	RMSEA	90%CI	CFI	TLI	SRMR
Model A (no covariates)	421.28	217	.053	0.04-0.06(p=.22)	0.93	0.92	0.05
Model B (with covariates)	525.88	307	.048	0.04-0.05(p=.70)	0.92	0.91	0.05
Model C (with father education)	447.48	238	.052	0.04-0.06 (p=.34)	0.93	0.92	0.05

Fit Indices Comparisons between Models

Summary

To answer the research questions, the direct and indirect effects of the TPB's variables, including attitude, SN, PBC and intention, on the PA among Saudi female adolescents were examined. This chapter supported all two hypotheses of the study. Regarding the first aim, a direct relationship was noted only between intention and PA, and indirect relationships of attitude and PBC with PA occurred through intention. Additionally, the model supported SN as a moderator of the intention-PA relationship. For the second aim, only father education had a significant relationship with PBC.

Chapter 6: Discussion, Limitations, and Implications

The purpose of the study was to examine the relationship between self-reported PA and TPB psychosocial factors, including attitude toward PA, SN, PBC, and PA intention among Saudi female adolescents in the Eastern Region, Saudi Arabia. A total of 329 female adolescents were recruited from public schools in the Eastern Region. Validated and reliable measures were used. The chapter includes discussion of: (1) the demographic characteristics of participants and their level of PA, (2) the direct and indirect relationship between TPB psychosocial factors and PA, (3) the moderation of SN on the intention-PA relationship, and (4) sociodemographic differences in TPB psychosocial factors and PA. The chapter also includes the study limitations, implications for nursing research and practice, implications for policy and society, contribution to science and future research. The chapter concludes with a summary.

Demographic Characteristics

The mean age of participants in the study was 15.7, somewhat similar to the average age in recent studies that examined lifestyle factors among Saudi male and female adolescents (Al-Hazzaa et al., 2022; Al-Nuaim & Safi, 2022; Bajamal et al., 2017). Moreover, participants of the study had varied levels of parental income and education. The majority of participants had a medium monthly family income (earnings between USD\$1,333–\$4,000), which is similar to the income reported by both male and female adolescents from different cities in Saudi Arabia (Ahmad Bahathig et al., 2021; Al-Hazzaa et al., 2022). Furthermore, similar to recent studies, fathers had a higher education (undergraduate and higher) compared to mothers as reported by Saudi male and female adolescents (Alasqah et al., 2021; Alsubaie, 2021). In contrast, in previous studies in Saudi Arabia, the proportion of both fathers and mothers with a high education was similar (Ahmad Bahathig et al., 2021; Al-Hazzaa et al., 2021; Al-Hazzaa et al., 2022; Alharbi, 2019;

Bajamal et al., 2017). For example, in a study that was conducted among both male and female adolescents, aged 14 to 19, from Riyadh, Al-Hazzaa et al. (2022) found that around 40% of mothers and fathers had university degrees.

The sample mean of BMI was 21.5 in the study, which is somewhat similar to the previous studies that were conducted with Saudi female adolescents (Al-Hussaini et al., 2019; Ahmad Bahathig et al., 2021). A study by Al-Hussaini et al. (2019) reported that the prevalence of overweight among 6- to 16-year-old adolescent females from center of Saudi Arabia was 14.2%, and Bajamal et al. (2017) reported the prevalence of obesity among 12- to 18-year-old adolescent females from western region of Saudi Arabia was 7.3%, which are somewhat congruent with the current findings. Other recent studies also reported a high prevalence rate of obesity and overweight among both male and female adolescents (Abedelmalek et al., 2022; Ahmad Bahathig et al., 2021; Aliss et al., 2020). For example, a study by Abedelmalek et al. (2022) found that 26.25% of Saudi female adolescents, aged 12 to 15, from the northwestern of Saudi Arabia were considered overweight, and 62.9% were considered obese. These discrepancies may be related to differences in the age of participants and the geographical regions.

Physical Activity

The finding of low levels of PA among Saudi female adolescents in the study was similar to previous studies conducted in Saudi Arabia. A study by Bajamal et al. (2017) using the same PAQ-A questionnaire found that the mean score for PA among Saudi female adolescents was 2.1, which is considered to be low. Similarly, Alharbi (2019) found that the mean score for PA among Saudi female adolescents using the PAQ-C questionnaire was 2.6, which is also considered to be low. Moreover, a study by Ahmad Bahathig et al. (2021) found that 92.7% of

399 Saudi female adolescents were not meeting PA recommendations of moderate to vigorous PA calling for at least 60 min daily. Additionally, a recent study showed that more than 48.5% of 598 female adolescents, aged 14–19 years, were considered inactive (Al-Hazzaa et al., 2022). The consistency among Saudi studies relative to PA indicated that Saudi female adolescents are at high risk for physical inactivity.

Relationship between Psychosocial Factors and Intention

The findings of the study indicated that attitude and PBC predict intention among this population. TPB constructs (e.g., attitude and PBC) explained 53% of the variance in PA intention; the variance in this study was higher than the findings reported in studies by Wang & Zhang (28.7%, 2016), Wang & Wang (33%, 2015), Gourlan et al. (40%, 2018) and a meta-analysis by McEachan et al. (44.3%, 2011). This discrepancy may be related to that; these studies were conducted among both male and female adolescents from different countries and cultures.

Consistent with TPB literature, attitude was the strongest predictor of intention (Hartson et al., 2019; McEachan et al., 2011), followed by PBC (Hartson et al., 2019; Lu et al., 2022; McEachan et al., 2011; Santina et al., 2017; Wang & Zhang, 2016). Collectively, the studies suggest that increasing adolescents' favorable attitudes and perceptions of control over their PA may lead to increased PA intention (see, e.g., Chatzisarantis et al., 2015; Steinmetz et al., 2016). Numerous researchers have been targeted the TPB constructs to improve the level of PA among adolescents. For instance, an Iranian intervention study that was conducted in a similar culture like Saudi Arabia, found that an educational intervention program based on TPB improved attitude and PBC among the female adolescents (Darabi et al., 2017). The study used several strategies to improve underlying salient behavioral and control beliefs, included: (1) information

through lecture and class discussion, and (2) persuasive message via media, reading and lecture. Analyses indicated that the application of these change behavior methods resulted in improvement in attitude and PBC among female adolescents.

Contrary to our prediction, SN did not predict PA intention in Saudi female adolescents. The majority of existing literature has consistently demonstrated that SN is an insignificant or weak predictor of PA intention among both male and female adolescents in studies conducted in Western countries (Armitage, 2005; Hagger & Chatzisarantis, 2016; Kim et al., 2019; Lu et al., 2022; McEachan et al., 2011). In contrast, however, few studies did find a significant relationship between SN and PA intention among both male and female adolescents, particularly in a collectivistic culture such as Saudi Arabia (Barkoukis & Hagger, 2009; Hartson et al., 2019). There are potential explanations for the insignificant relationship between SN and intention in Saudi female adolescents. According to La Barbera & Ajzen (2021), even though SN is a better predictor of intention in collectivistic than in individualistic cultures, SN declines when PBC increases. As shown in the study, PBC had a significant medium effect on intention which may decrease the effect of SN on intention among females who are living in a collectivistic culture.

Furthermore, the Saudi government is starting to empower women by granting them more rights. Saudi Arabia recently endorsed new reforms toward advancing women's perception and gender equality (Rizvi & Hussain, 2022). The reforms of women's rights include eliminating discriminatory limitations on women by incorporating dismissal of permission from a male guardian (i.e., to acquire a job, enroll in university, or go through any surgical procedure; The Embassy of the Kingdom of Saudi Arabia, 2019). The reform supports, encourages, and secures Saudi women's future by reinforcing their capabilities and strengths. This appreciable collective change in the country had an immense impact on Saudi women. Today, with newfound

independence, Saudi women feel more competent, independent, and self-reliant (Rizvi & Hussain, 2022).

The newfound changes can be clearly seen in the current study in which all participants are adolescents who are going through the individuation and separation process and establishing abilities of self-determination and decision-making (Hui & Tsang, 2012). Under the recent changes in Saudi Arabia, adolescents are starting to have a sense of empowerment and develop thoughts independently from others (e.g., parents and friends) (Cox & Ullrich-French, 2010). Therefore, social support from family and friends may not influence adolescent's PA intention if adolescents do not intend to do PA.

The other possible explanation for the insignificant relationship between SN and intention may be related to the operationalization of the construct. As mentioned by Kim et al. (2019), the weak association between these two constructs in the literature may be due to methodological shortcomings including the measurement of SN. Indeed, SN only measured injunctive norms among Saudi female adolescents. Rhodes & Nigg (2011) found that injunctive norm is the weak predictor of PA intention. A meta-analysis by Rivis and Sheeran (2004) reported that descriptive norms predicted additional variance in PA intention. Even though the SN construct was originally conceptualized as injunctive within the TPB, the two components of normative beliefs (injunctive and descriptive) should be encompassed in the standard measure to assess the SN (Ajzen, 1991).

Moreover, the measure of SN did not capture gender norms, which may have influenced the results. It is important to consider gender norms because cultural and religious expectations regarding gender roles are deeply rooted in Saudi's society. Therefore, it is necessary to understand the impact of gender norms on adolescents' intentions and PA.

Relationship between Psychosocial Factors and PA

The study found that the TPB constructs explained 21% of the variance in PA, somewhat similar to a meta-analysis by McEachan et al. (2011). In contrast, recent studies found that the core constructs of TPB explained 32.5% (Lu et al., 2022), and 43% of the variance in PA (Hartson et al., 2019) in both male and female adolscents aged 15–18 years, suggesting that the finding of the current study is slightly lower than some previous studies. Even though the variance is low, it is still higher than other previous studies that conducted among both male and female adolscents aged 9–14 years, which found TPB accounted for 3.7% and 9% of the PA variance, respectively (Duncan et al., 2012; Wang & Wang, 2015).

These discrepancies in the results may be due to differences in participants' background and cultural values, which can influence the effects of TPB constructs on PA (Hagger et al., 2007). Furthermore, a self-reported PA measure is not sensitive for capturing the range of PAs undertaken by adolescents (Duncan et al., 2012). Therefore, the remaining 79% of the variance in PA could not be explained, indicating that other factors should be investigated.

Regarding the TPB, intention had a direct effect on PA, somewhat similar to findings of previous studies among both male and female adolscents (Hartson et al., 2019; McEachan et al., 2011; Santina et al., 2017). Consistent with the TPB literature, the mediating role of intention in the relationship between some of TPB constructs and PA was supported in this study with Saudi female adolescents. Interestingly, the analysis showed that the associations between attitude and PA, and PBC and PA were fully mediated by PA intention. Similarly, a meta-analysis by Hagger & Chatzisarantis (2016) found a significant indirect effect of attitude ($\beta = .11$, p < .001) and PBC ($\beta = .10$, p < .001) on PA mediated by intention, and a non-significant indirect effect of SN ($\beta = .02$, p = .209), regardless of sex. This result infers that enhancing attitude and PBC toward

PA are important to form an intention to engage in PA among Saudi female adolescents (Hagger et al., 2002).

Moderation of SN

SN was examined as a moderator of the intention-PA relationship because SN may operate in a more complicated manner than the TPB had proposed in determining behavioral intention (Wan, Shen & Choi, 2018). Additionally, this interaction effect was important to investigate because of the noted gap between intention and behavior which is caused mainly by individuals who express a positive intention to do PA but do not act. However, the moderator is a variable that facilitates or inhibits the intention-PA relationship, and so understanding its effect is important to successfully increase intention to engage in PA (Rhodes & Dickau, 2013). Most attention has been directed to the moderating effect of PBC on the relationship between intention and PA, while relatively no study has explored the moderating effect of SN among adolescents. Surprisingly, SN does moderate the relationship between intention and PA among Saudi female adolescents (β =0.47, *p*<.01).

The moderating effect of SN unveils new insight into the existing literature by increasing understanding of the underlying mechanism of social process. With increased social support and encouragement that adolescents experience from individuals, PA intention is positively associated with PA behavior. This finding indicates that a high SN would presumably improve the translation of PA intention into PA, as compared with a low level of SN. The strength of SN may be reflective of the cultural value of collectivism even though Saudi culture is subject to variation depending on the individual's age, social status, and region of Saudi Arabia (Evason, 2019). The finding supports other empirical evidence showing that social norms (e.g., family) have an influence on adolescents, and can positively translate their PA intention to PA (Aljehani

et al., 2022). Therefore, researchers should consider SN in their intervention studies because high support is needed if the plan is to translate PA intention to PA behavior in this population.

Sociodemographic Factors related to TPB Psychosocial Factors and PA

The literature is sparse on the relationship between sociodemographic factors and psychosocial factors based on the TPB in adolescents. Most literature has focused on the sociodemographic differences in PA only. Therefore, the current study may be the first to focus on this area. Interestingly, the current study found that female adolescents with highly educated fathers had less PBC. There is a substantial amount of evidence on the influence of parents' education level on adolescents' PA; but according to Muñoz-Galiano et al. (2020), the relationship is complex and should be predicted from psychosocial factors. Noting that PBC is a psychosocial factor and includes both resources and efficacy related to PA, it is expected that parents with higher levels of education (Muñoz-Galiano et al., 2020). Highly educated parents may limit their children's PA resources or access to any after-school activities, which may influence their children's ability and confidence related to PA.

However, the findings of the sociodemographic factor relationship with PA correspond with those of Al-Hazzaa et al. (2022) who found no significant differences in PA among both Saudi male and female adolescents based on age. In contrast, a study by Alasqah et al. (2021) showed that increasing age was positively associated with lower or insufficient PA among adolescents, regardless of sex. Similar results were reported in other studies conducted in Saudi Arabia among both male and female adolescents in western and central region of Saudi Arabia (Aliss et al., 2020; Alsubaie & Omer, 2015).

Moreover, the current study showed no significant differences in adolescents' BMI relative to PA. This finding corresponds with the results of previous studies conducted among female adolescents aged 13–16 years in central and south region of Saudi Arabia (Ahmad Bahathig, 2021; Al-Hazzaa, 2022). In contrast, a number of studies have shown an inverse association between PA and weight status among female adolescents aged 10–15 years in south and eastern region of Saudi Arabia (Abedelmalek et al., 2022; Said & Shaab Alibrahim, 2022). For example, a study by Abedelmalek et al. (2022) found that 62% of 977 Saudi adolescents who reported not practicing PA were obese, and 59% of 942 who did not engage in moderate PA were also obese, regardless of sex.

Furthermore, findings similar to the current study were found in the Saudi literature that showed no significant differences in Saudi females' PA based on family income and level of parental education (Al-Hazzaa et al., 2022; Alasqah et al., 2021). In contrast, a study by Alharbi (2019) found that family income was a significant factor that influenced the level of PA among Saudi female adolescents in Riyadh, the capital city of Saudi Arabia. The conflicting findings indicate that more work may be needed in this area of research.

Study Limitations

To the researcher's knowledge, this quantitative study was the first that examined psychosocial factors related to PA and based on the TPB among Saudi female adolescents. The first limitation was that the study had a cross-sectional design and involved data being collected at one time point, so no causal relationship was drawn (Wang & Cheng, 2020). For this reason, an experimental or longitudinal study is needed to test the causal relations in which the attitude, SN and PBC are manipulated and the effect of manipulation on the intention-PA relationship is observed.

The second limitation was the use of a convenience sample, which could be susceptible to selection bias. Participants were predominantly from Qatif (56.2%), high schools (66.2%) and medium-income families (52.6%). The results of the study did not provide information about a population that is underrepresented in the research (Etikan et al., 2016). It is expected that not all principals of schools sent the survey to students, which resulted in some schools not having the opportunity to be included in the study. Moreover, the study was conducted in the Eastern region of Saudi Arabia, so the results may not be generalizable to other regions of the country. Furthermore, the findings of the study may have limited generalizability to other countries due to cultural differences and the delay in introducing PE classes for females in Saudi Arabia. For this reason, future research should endeavor to recruit participants using a random sampling method to ensure randomness in the selection of the sample.

The third limitation was using self-reported height, weight, and PA, which was susceptible to recall bias. Even though the study used an established and validated measure of PA, the adolescents may overestimate their response due to social desirability. Future studies need to use an objective measure for height, weight and PA. Additionally, objective measure of PA (i.e., accelerometer) helps to accurately measure the duration and intensity of PA (McNeill et al., 2007). Moreover, using online surveys resulted in a low-response rate. A low response rate was not expected because the survey was to be sent to all schools in the eastern region of Saudi Arabia (Evans & Mathur, 2005).

The last limitation was the length of the survey questionnaire. Even though the average survey was short, the amount of missing data tended to increase as the participants went further into the survey. The withdrawal from participation in the study can be interpreted as boredom or fatigue (Evans & Mathur, 2005). In conclusion, despite these limitations, this dissertation sheds

valuable new insight on PA-related psychosocial factors in Saudi female adolescents that can be useful in future research.

Implications

Implication for Nursing Research

The findings of this study can positively impact nursing research by providing insight into adolescents' cognitive processes (i.e., reasons underlying attitude and PBC associated with PA) so that the antecedents of any of these factors can be targeted (Ajzen, 2006). Clarifying mechanisms underlying PA intention and actual behavior enables nurse researchers to exclude components of the TPB unrelated to increasing adolescents' PA levels and, instead, focus on those contributing to behavior change. For example, nurse researchers can design a TPB-based intervention that targets PBC by increasing adolescents' skills to perform PA and enhance their confidence in engaging in PA. Indeed, Saudi female adolescents with a positive attitude and increased perceived behavioral control are more likely to translate their intention to PA. Therefore, the future educational intervention program targeting TPB factors through using various behavioral change techniques (BCTs) can contribute to the improvement of PA among Saudi female adolescents. The following strategies could be used in the intervention with Saudi adolescents: (1) increase positive attitude by providing information about PA and basic types of PA; correct misconception about PA and imped the negative one, (2) identify perceived and actual barriers to undertake PA, and PA facilitators in the society; provide a trained instructor to improve adolescents' PA skills and strategies to incorporate PA into their daily life, and (3) encourage adolescents to set goals for their PA behavior.

Implication for Nursing Practice

The findings provide information for school nurses and other healthcare professionals on specific psychosocial factors that need to be targeted when developing PA programs to improve PA levels among this population. Nurses have a pivotal role in teaching adolescents how to have a healthy lifestyle (Nichol et al., 2002). The findings suggest that school nurses and health promoters need to continuously improve students' attitude toward PA and at the same time encourage adolescents to attain and maintain regular PA. Moreover, school nurses need to provide adolescents with information on alternative PA activities to keep them physically active when there is no PE in schools, or when the weather is not ideal in the country.

In addition, nurses should take into consideration that the needs of the Saudi community differ from those in other countries. The strong effect of SN on the relationship between intention and PA suggests that community and family are significant tools for health promotion in adolescents. Therefore, incorporating family into an PA educational program is needed to translate adolescents' intention to behavior.

Implication for Policy and Society

The study highlights the need for Saudi policymakers to improve PA among Saudi female adolescents. The results of this dissertation support that female adolescents are not practicing enough PA. Even though, in 2017, Saudi Arabia granted females access to PE in public schools, it has not been offered in most public schools until recently. Two possible reasons behind the delay in introducing the PE include a lack of Saudi female PE teachers and sports facilities at the schools.

These findings reinforce the necessity of collaborative partnerships between health and education sectors to guide the development of health and PE classes in public schools.

Consideration must also be given to the individual, social, and environmental factors that are likely to influence females' PA intention to do PA. These sectors could apply methods of implementation science to assist schools to adopt evidence-based school health programs (Kolbe, 2019). Moreover, policymakers should work to create an identifiable plan for addressing females' barriers toward practicing PA in the community. Females need to have equitable access to sports opportunities, and this endeavor starts with building safe neighborhoods and providing more accessible facilities within the community (i.e., free sport community centers for females that are similar to those available for boys).

Contribution to Science and Future Study

This study goes beyond filling a gap in Saudi literature concerning the significance of Saudi female adolescents' psychosocial factors related to PA; it contributes to expanding theoretical knowledge to help researchers acquire essential information needed to design effective theory-based interventions to promote PA among Saudi female adolescents. More specifically, this study is poised to offer important empirical evidence that school nurses and administrators can use to develop and implement PE classes and other PA programs in their respective schools to increase PA among this population. Moreover, the study helped to determine the effects of psychosocial factors on PA intention and behavior among Saudi female adolescents. Indeed, the current findings together with previous findings from the same population (i.e., Bajamal et al., 2017) can contribute greatly to the design of program interventions or policies that promote an active lifestyle among female adolescents.

The current study captures only 53% and 21% of the variance of intention and PA, respectively. These percentages indicate that a substantial proportion of the variance is not explained. For this reason, future studies need to investigate additional important determinants of

PA that may contribute to explaining PA behavior among Saudi female adolescents. These factors may include parents' awareness about and commitment to PA, gender norms, and school environmental factors (e.g., teachers, PE curriculum, and school facilities).

Future studies need to investigate potential moderators because this study found that SN moderates the intention-PA relationship. Furthermore, to broadly understand this SN factor, researchers can explore the nuances of the relationship between injunctive and descriptive norms in predicting PA intention among Saudi female adolescents. Finally, researchers may use mixed methods, qualitative, or elicitation studies to add more insight into the relevant beliefs underlying the TPB constructs.

Summary

The findings demonstrate the relative contribution of the TPB's psychosocial factors in predicting PA intention among Saudi female adolescents. This study based on the TPB contributed toward filling a gap in the literature by investigating the moderating role of SN. Despite some limitations, the study can help researchers to better understand the factors influencing intention to do PA among Saudi female adolescents. Thus, improving attitude and PBC is necessary to favor the formation of positive intention and regular PA.

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APPENDIX A: ENGLISH AND ARABIC VERSIONS OF CONSENT/ASSENT FORM

Consent Form

Dear Parent,

Researchers at Michigan State University are inviting your daughter to take part in a survey (takes ONLY about 10 minutes to complete)

Study Title: Evaluation of the theory of planned behavior to predict physical activity in Saudi female adolescentsResearcher and Title: Muna Alali, BSN, MSN, PhD studentDepartment and Institution: College of Nursing, Michigan State University

Contact Information: Eastern region, Saudi Arabia, +966562889951

Purpose Of Research

We are asking for your permission to allow your daughter to participate in a research study to assess psychosocial factors that influence physical activity among Saudi female adolescents in Eastern Region, Saudi Arabia.

What Your Daughter Will Be Asked to Do

Your daughter will be asked to complete an online survey via Qualtrics (may take no more than 10 minutes to do).

Your daughter must be:

- Between 13 18 years old
- Able to speak, read, and understand Arabic to participate
- No health problems that stop her from doing physical activity

Potential Benefits

Your daughter may have the chance to share her thoughts about physical activity, but she may not directly benefit from her participation in the study. However, other adolescents may benefit because we will use the information from this study to improve and develop programs if needed to promote healthy behaviors.

Her participation is deeply appreciated because it will help a doctoral student from Saudi collect information for her dissertation.

Potential Risks

The risks to participating in this survey are minimal because you may provide yours or your daughter's email address at the end of the survey.

Your Daughter Rights to Participate, Say No, Or Withdraw

Participation is voluntary. Refusal to participate will involve no penalty or loss of benefits to which your daughter entitled at her school. Your daughter may discontinue participation at any time without penalty or loss of benefits to which she is entitled at her school. Your daughter has the right to say no. Your daughter may change her mind at any time and withdraw. Your daughter may choose not to answer specific questions or to stop participating at any time. Whether your daughter choose to participate or not will have no effect on her grade or evaluation.

Privacy and Confidentiality

Your daughter will NOT need to provide a name or any contact information on the survey. Any information your child provides will be kept confidential.

The data collected for this study will be protected and kept confidential in a secure and password protected location at Michigan State University, United State for a minimum 3 years after finishing the study. Only the appointed researchers and the MSU Human Research Protection Program (HRPP) will have the access to data. Confidentiality will be protected to the maximum extent allowable by law. The results of this study may be published or presented in group format at professional meetings, but the identities of all research participants will remain confidential.

Costs and Compensation for Being in the Study

There is no cost or compensation (money, gifts) to participate in the study.

Contact Information

Thank you so much in advance for your assistance with this important project. In the event of that your daughter suffer a research-related injury, or if you have questions about the study, please feel free to contact me. My contact information is given below.

Muna Alali Kingdom of Saudi Arabia Eastern Region Email: alalimun@msu.edu Tel:

Approved by a Michigan State University Institutional Review Board effective 4/11/2022. This version supersedes all previous versions. MSU Study ID STUDY00006023.

If you have questions or concerns about your daughter role and rights as a research participant, would like to obtain information or offer input, or would like to register a complaint about this

study, you may contact, anonymously if you wish, the Michigan State University's Human Research Protection Program at 517-355- 2180, Fax 517-432-4503, or e-mail irb@msu.edu or regular mail at 4000 Collins Rd, Suite 136, Lansing, MI 48910.

Documentation of Informed Consent

If you are interested in having your daughter complete the survey, please provide your permission by completing the following questions:

After you have reviewed the consent form, please select below:

o I give permission for my daughter to participate in the study. o I am not interested in her participation.

If you agree that your daughter participate in the study, please type your email address or your daughter e-mail address to send the survey:

Email address of parent Email address of student

If she does not have e-mail address, and she is with you and you would like her to start the survey, please select NEXT.

Approved by a Michigan State University Institutional Review Board effective 4/11/2022. This version supersedes all previous versions. MSU Study ID STUDY00006023.

Assent Form

Dear Student,

Researchers at Michigan State University are inviting you to take part in a survey (takes ONLY about 10 minutes to complete) to assess psychosocial factors that influence physical activity among Saudi female adolescents in Eastern Region, Saudi Arabia. The title of the research project is "Evaluation of the theory of planned behavior to predict physical activity in Saudi female adolescents."

Physical activity involves moving your body and "practicing any type of activity that makes you move, breath hard, and increase your heart rate". Some examples are walking, running, biking, and swimming.

If you agree to participate in this study, you will be directed to screening page. If you meet the inclusion criteria, you will be directed to the main survey.

You may have the chance to share your thoughts about physical activity, but you may not directly benefit from your participation in this study.

Your participation is deeply appreciated because it will help a doctoral student from Saudi collect information for her dissertation.

The risks to participating in this survey are minimal. Participation is voluntary. Refusal to participate will involve no penalty or loss of benefits to which you are entitled at your school. You may discontinue participation at any time without penalty or loss of benefits to which you are entitled at your school.

The data collected for this study will be protected and kept confidential in a secure and password protected location at Michigan State University, United State for a minimum 3 years after finishing the study. Only the appointed researchers and the MSU Human Research Protection Program (HRPP) will have the access to data. Confidentiality will be protected to the maximum extent allowable by law. The results of this study may be published or presented in group format at professional meetings, but the identities of all research participants will remain confidential.

Approved by a Michigan State University Institutional Review Board effective 4/11/2022. This version supersedes all previous versions. MSU Study ID STUDY00006023.

Thank you so much in advance for your assistance with this important project. In the event of that you suffer a research-related injury, or if you have questions about the study, please feel free to contact me. My contact information is given below.

Muna Alali Kingdom of Saudi Arabia Eastern Region Email: alalimun@msu.edu Tel: If you have questions or concerns about your role and rights as a research participant, would like to obtain information or offer input, or would like to register a complaint about this study, you may contact, anonymously if you wish, the Michigan State University's Human Research Protection Program at 517-355- 2180, Fax 517-432-4503, or e-mail irb@msu.edu or regular mail at 4000 Collins Rd, Suite 136, Lansing, MI 48910.

After you have reviewed the consent form, please select below:

- I agree to participate in the study.
- I am not interested in participating.

Approved by a Michigan State University Institutional Review Board effective 4/11/2022. This version supersedes all previous versions. MSU Study ID STUDY00006023.

إقرار موافقه أحد الوالدين

جامعة ولاية ميشيغان تطلب مشاركة ابنتك في در اسة بحثية تحت إشر اف باحثي الجامعة لتقييم العو امل النفسية والاجتماعية المؤثرة على النشاط البدني.

المشاركة تتطلب تعبئة استبانة بحثية فقط، وتستغرق ١٠ دقائق لإكمالها. سيتم حفظ خصوصية ابنتك، حيث إن الاسم أو المعلومات الخاصة غير مطلوبة ولن تُعرف.

> عنوان الدراسة: "تقييم نظرية السلوك المخطط لتوقع النشاط البدني لدى الفتيات السعوديات" الباحث والعنوان: منى العلي، طالب دكتوراه القسم والجامعة: كلية تمريض، جامعة ولاية ميشيغان معلومات الاتصال: المنطقة الشرقية، المملكة العربية السعودية، 966562889951+

الغرض من البحث: نحن نطلب إذنك بالسماح لابنتك بالمشاركة في در اسة بحثية لتقييم العو امل النفسية و الاجتماعية التي تؤثر على النشاط البدني بين الفتيات السعوديات في المنطقة الشرقية، المملكة العربية السعودية.

> ا**لمتطلبات:** سيُطلب من ابنتك تعبئة استبانة عبر الإنترنت، يجب أن تكون ابنتك:

- بین ۱۳ ـ ۱۸ سنة.
- قادرة على التحدث، والقراءة، وفهم اللغة العربية للمشاركة.
 - لا توجد مشاكل صحية تمنعها من ممارسة الرياضة.

الفوائد المحتملة: توفّر هذه المشاركة في البحث الفرصة لابنتك لمشاركة أفكار ها حول النشاط البدني. ورغم أنها لن تحصل على فائدة مباشرة، إلا أن مشاركتها موضع تقدير شديد حيث ستساعد في استكمال بحث الدكتوراه وتوفير بيانات شاملة عن النشاط البدني للفتيات، وهو ما سيتم استخدامه لتحسين وتطوير البرامج إذا لزم الأمر لتعزيز السلوكيات الصحية للفتيات في مثل سنها.

المخاطر المحتملة: هناك مستوى ضعيف لا يذكر من اختراق الخصوصية للمشاركة في هذا الاستطلاع لأنك قد تقم بكتابة عنوان البريد الإلكتروني في نهاية الصفحة.

حقوق ابنتك للمشاركة في الاستبانة: إن مشاركة ابنتك في هذه الدراسة طوعية ولها كامل الحق في رفض تعبئة الاستبانة او الانسحاب من الدراسة في أي وقت بدون الحاجة لذكر الأسباب التي أدت الى ذلك . انسحابها لن يؤثر على الخدمات التي تقدمها المدرسة. ورفض المشاركة في الدراسة لا يتضمن أي إجراءات جزائية الخصوصية والسرية لن تحتاج ابنتك إلى ذكر اسمها أو أي معلومات اتصال خاصة. أي معلومات توفر ها ابنتك ستبقى سرية. سيتم حماية البيانات التي سوف يتم جمعها لهذه الدراسة وتبقى سرية في مكان آمن مع استعمال كلمة مرور في جامعة ولاية ميشيغان (الولايات المتحدة) لمدة ٣ سنوات على الأقل بعد الانتهاء من الدراسة. الحصول على هذه البيانات مسموح فقط للباحثين المعينين وبرنامج حماية البحوث بجامعة ميشيغن ستيت. البيانات ستكون محمية بثقة إلى الحد الأقصى المسموح به بموجب القانون. قد يتم نشر نتائج هذه الدراسة أو عرضها في مؤتمر ات أو ملتقيات علمية، لكن هويات جميع المشاركين في البحث ستيقى سرية.

> التكاليف والتعويض عن المشاركة في الدراسة لا توجد تكلفة أو تعويض (أموال، هدايا) للمشاركة في الدراسة.

طرق التواصل شكرا جزيلا لكم مقدما لمساعدتكم في هذا المشروع. إذا كانت لديك أسئلة حول الدراسة، فلا تتردد في طرحها. وفي حالة التضرر من الدراسة يرجى التواصل مع الباحث. سوف تجد معلومات الاتصال الخاصة بي أدناه:

منى علي العلي المملكة العربية السعودية المنطقة الشرقية الإيميل: alalimun@msu.edu الجوال: أو ترغب في تسجيل شكوى حول هذه الدراسة، يمكنك الاتصال، بحثية، وترغب في الحصول على معلومات، أو ترغب في تسجيل شكوى حول هذه الدراسة، يمكنك الاتصال، على جامعة ولاية ميشيغان برنامج حماية البحوث على: البوقم: ,517-355-2180 الفاكس: 517-432-4503 ايميل: irb@msu.edu عنوان البريد: 1000 Collins Rd, Suite 136, Lansing, MI 48910

> **بعد أن قمت بمراجعة نموذج الموافقة، يرجى تحديد التالى:** أوافق على مشاركة ابنتي في الدراسة
> أنا لا ار غب بمشاركة ابنتي

إذا وافقت على مشاركة ابنتك في الدراسة وتر غب منا ارسال بريد الكتروني يحتوي على رابط الاستبانة، يرجى كتابة العنوان البريدي الإلكتروني الخاص بك او بإبنتك لإرسال الاستبانة

إذا كانت ابنتك لا تملك بريد إلكتروني، وترغب منها بإكمال الاستبانة الأن، يرجى الضغط على التالي

الغرض من الدراسة

عزيزتي الطالبة،

إن الباحثين في جامعة ولاية ميشيغان يدعونك للمشاركة في استبانة (يستغرق حوالي ١٠ دقائق فقط لإكماله) لتقييم العوامل النفسية والاجتماعية التي تؤثر على النشاط البدني بين الفتيات السعوديات في المنطقة الشرقية، المملكة العربية السعودية. عنوان البحث هو "تقييم نظرية السلوك المخطط لتوقع النشاط البدني لدى المراهقات السعوديات".

النشاط البدني يحتوي على تحريك جسمك وممارسة أي نوع من النشاط يجعلك تتحرك وتتنفس بشده، ويزيد معدل ضربات قلبك. بعض الأمثلة على النشاط البدني هي المشي، والجري، وركوب الدراجات، والسباحة. إذا وافقت على المشاركة في هذه الدراسة، فسيتم توجيهك إلى صفحة الفرز وإذا كنتِ تتوافق مع معايير القبول للدراسة، فسوف يتم توجيهك إلى الاستبانة الرئيسية.

قد تتاح لك الفرصة لمشاركة أفكارك حول النشاط البدني، لكنك قد لا تستفيد بشكل مباشر من مشاركتك في هذه الدراسة. لكن مشاركتك موضع تقدير لأنه سيساعد طالبة دكتوراه من السعودية في جمع معلومات لإكمال رسالتها الدكتوراه.

هناك مستوى ضعيف لا يذكر من اختراق الخصوصية للمشاركة في هذا الاستطلاع. ان مشاركتك في هذه الدراسة طوعيه ولك كامل الحق في رفض تعبئة الاستبانة او الانسحاب من الدراسة في أي وقت بدون الحاجة لذكر الأسباب التي أدت الى ذلك. انسحابك لن يؤثر على الخدمات الى تقدمها المدرسة. ورفض المشاركة في الدراسة لا يتضمن أي إجراءات جزائية.

سيتم حماية البيانات التي سوف يتم جمعها لهذه الدراسة وتبقى سرية في مكان آمن مع استعمال كلمة مرور في جامعة ولاية ميشيغان (الولايات المتحدة) لمدة ٣ سنوات على الأقل بعد الانتهاء من الدراسة. سيكون فقط الباحثين المعينين وبرنامج حماية البحوث البشرية بجامعة مشغن ستيت. (Michigan State University) الوصول إلى البيانات. سوف تكون محمية بثقة إلى الحد الأقصى المسموح به بموجب القانون. قد يتم نشر نتائج هذه الدراسة أو عرضها في مؤتمرات او ملتقيات علمية، لكن هويات جميع المشاركين في البحث ستبقى سرية.

شكرا جزيلا لكم مقدما لمساعدتكم في هذا المشروع. إذا كانت لديك أسئلة حول الدراسة، فلا تتردد في طرحها. وفي حالة التضرر من الدراسة يرجى التواصل مع منى علي العلي المملكة العربية السعودية المنطقة الشرقية الإيميل: alalimun@msu.edu الجوال: إذا كانت لديك أسئلة أو مخاوف بشأن دورك وحقوقك كمشارك بحثية، وترغب في الحصول على معلومات، أو ترغب في تسجيل شكوى حول هذه الدراسة، يمكنك الاتصال، على جامعة و لآية ميشيغان برنامج حماية البحوث علي: الرقم: ,517-355-2180 الرقم: الفاكس: 517-432-4503 ابميل: irb@msu.edu عنوان البريد: _4000 Collins Rd, Suite 136, Lansing, MI 48910

بعد أن قمت بمراجعة نموذج الموافقة، يرجى تحديد التالى: أوافق على المشاركة في الدراسة

أنا غير مهتم بالمشاركة.

Approved by a Michigan State University Institutional Review Board effective 4/11/2022. This version supersedes all previous versions. MSU Study ID STUDY00006023.

APPENDIX B: ENGLISH AND ARABIC VERSIONS OF SELF-ADMINISTERED

SURVEYS

Demographic Information

- 1. What is your city?
 - a. Khobar
 - b. Dammam
 - c. Qatif
 - d. Other (please mention)
- 2. What is your academic grade?
 - a. 7th grade
 - b. 8th grade
 - c. 9^{th} grade
 - d. 10^{th} grade
 - e. 11th grade
 - f. 12^{th} grade

3. What is your date of Birth (date, month, year):

How tall you are without shoes on?
 Write your height in cm in the blank box ______

Directions: If you don't have a measuring tape, you can use a regular ruler to measure your height. Stand up straight with your back against the wall and have someone mark the wall right above your head with a pencil. Then, use the ruler to measure the distance from the floor to the mark.

6A. Did you measure your height?

- a. No, I did not because I know my height.
- b. Yes, I did.
- How much do you weigh without your shoes on? Write your weight in kg in the blank boxes ______

Directions: Place your scale on a flat surface, remove shoes and heavy clothing, such as sweaters; then step onto the scale.

- 7A. Did you measure your weight?
 - c. No, I did not, because I know my weight.
 - d. Yes, I did.

- 6. What is your Family Monthly Income (Both father and mother):
 - a. Low-income earnings (less than \$1,333USD),
 - b. Medium-income earnings (between \$1,333 \$4,000USD), and
 - c. High income earnings (more than \$4,000USD).
- 7. What is your Father's Highest Completed Education Level: (Please select one) a. Intermediate school or lower.
 - b. High school or high school diploma.
 - c. Undergraduate or graduate degree (diploma, bachelor's, master's, PhD).
- 8. What is your Mother's Highest Completed Education Level: (Please select one)
 - a. Intermediate school or lower.
 - b. High school or high school diploma.
 - c. Undergraduate or graduate degree (diploma, bachelor's, master's, PhD).

Theory of Planned Behavior (TPB) Scale

Instructions:

- This questionnaire is intended to find out what you think about performing physical activity.
- To answer the questions, place a checkmark (\checkmark) next to show your appropriate answer.

Attitude

1- For you, doing a physical activity for at least 60 minutes during most school days is:

	Not at all	Not really	Yes maybe	Yes, for sure
A. Very interesting				
B. Energizing				
C. Something fun				
D. Stress relieving and relaxing				
E. Good for Improving health				
F. Helpful for losing or controlling weight				

2- Do you think that performing a physical activity for at least 60 minutes during most school days is something that:

	Not at all	Not at all	Not really	Yes	Yes, for
		5	maybe	sure	
A. You enjoy doing					
B. Leaves you feeling exhausted					
C. Leads to injury					
D. Consumes too much time					

3- Do you think doing a physical activity for at least 60 minutes during most school days helps you to:

	Not at all	Not really	Yes maybe	Yes, for sure
A. Focus better at school				

B. Feel energized		
C. Be comfortable		
D. Gain body strength (your bones and muscles)		

Subjective norms

4- What do the most important people in your life think about doing physical activity for at least 60 minutes next week?

	Not at all Not really	Not at all Not really	Yes	Yes, for
		maybe	sure	
A. They support the idea of				
physical activity				
B. They advise you to do physical				
activity				
C. They agree to do a physical				
activity				

5- Do the following people encourage you to do physical activities for at least 60 minutes during most school days?

	Not at All	Not really	Yes maybe	Yes, for sure
A. Mother				
B. Father				
C. Sister/Brother				
D. Friends				
E. People on social media				

Perceived Behavior control

6- Do you feel that you will be able to engage in physical activity for at least 60 minutes during most school days, next week?

Not at all	Not really	Yes maybe	Yes, for sure

7- If you wish to, can you do a physical activity for at least 60 minutes during most school days?

Not at all	Not really	Yes maybe	Yes, for sure

8- Do you think doing a physical activity for at least 60 minutes during most school days is:

Very easy	Easy	Difficult	Very difficult

9- Do you think you are able to engage in physical activity for at least 60 minutes during most school days even if:

	Not at all	Not really	Yes maybe	Yes, for sure
A. The weather is very hot				
B. I lack sport machines in the house				
C. I lack time				
D. There is a lack of a fitness center.				

10- Do you think it is easier for you to engage in physical activity for at least 60 minutes during most school days if:

	Not at all	Not really	Yes maybe	Yes, for sure
D. I have sport machine in the				
house				
E. I am wearing comfortable/sport				
clothes outside				
F. I am able to go to fitness center.				

Intention

11-During the next week, will you be physically active for at least 60 minutes?

Not at all	Not really	Yes maybe	Yes, for sure

12- During the next week, what is the possibility that you perform a physical activity for at least 60 minutes?

Not at all	Not really	Yes maybe	Yes, for sure

13- Do you intend to do a physical activity for at least 60 minutes next week?

Not at all	Not really	Yes maybe	Yes, for sure

14- Do you plan to do a physical activity for at least 60 minutes next week?

Not at all	Not really	Yes maybe	Yes, for sure

Physical Activity Questionnaire for Adolescents (PAQ-A)

We are trying to find out about your level of physical activity from *the last 7 days* (in the last week). This includes sports that make you sweat or makes your legs feel tired, or games that make you breathe hard, like tag, skipping, running, climbing, and others.

Remember:

There are no right and wrong answers — this is not a test. Please answer all the questions as honestly and accurately as you can — this is very important.

1. Physical activity in your spare time: Have you done any of the following activities in the past 7 days (last week)? If yes, how many times? (Mark only one circle per row.)

Types of physical activity	No	1-2	3-4	5-6	7 times or
					more
1.Skipping					
2. Games (chase, tag,					
hopscotch)					
3. Walking					
4. Running/jogging					
5. Exercise (push-ups, sit-					
ups, jumping jacks)					
6. Swimming					
7. Zumba					
8. Soccer					
9. Basketball					
10. Outdoor play (hide and					
seek)			_		
11. Indoor chores					
(mopping, vacuuming,					
sweeping, cleaning)					
12. Using stairs					
13. Using treadmill					
14. Karate, Taekwondo					
15. Other (please list here)					

16. Other (please list here)			
17. Other (please list here)			

- **2.** In the last 7 days, what did you normally do at breakfast (besides eating breakfast)? (Check only one).
 - □ Sat down (talking, reading, doing schoolwork)
 - \Box Stood around or walked around
 - □ Ran or played a little bit
 - □ Ran around and played quite a bit
 - □ Ran and played hard most of the time
- **3**. In the last 7 days, on how many days right after school (before 6 pm), did you do sports, or play games in which you were very active? (Check only one).

 \Box None

- \Box 1-time last week
- \Box 2- or 3-times last week
- \Box 4 times last week
- \Box 5 times last week
- **4.** In the last 7 days, on how many evenings (after 6 pm) did you do sports, or play games in which you were very active? (Check only one).

 \Box None

- □ 1-time last week
- \Box 2- or 3-times last week
- \Box 4- or 5-times last week
- \Box 6- or 7-times last week
- **5**. Over the last weekend, how many times did you do sports, or play games in which you were very active? (Check only one).
 - None
 1-time
 2- 3 times
 4- 5 times
 - \Box 6 or more times
- 6. Which one of the following describes you best for the last 7 days? Read all five statements before deciding on the one answer that describes you.

 \Box All or most of my free time was spent doing things that involve little physical effort. \Box I sometimes (1 — 2 times last week) did physical things in my free time (e.g. played sports, went running, swimming, did aerobics).

 \Box I often (3 — 4 times last week) did physical things in my free time.

 \Box I quite often (5 — 6 times last week) did physical things in my free time

□ I very often (7 or more times last week) did physical things in my free time

7. Mark how often you did physical activity (like playing sports, games, or doing any other physical activity) for each day last week (Mark only one box per row with "X").

	None	Little Bit	Medium	Often	Very Often
Sunday					
Monday					
Tuesday					
Wednesday					
Thursday					
Friday					
Saturday					

8. Were you sick last week, or did anything prevent you from doing your normal physical activities? (Check one.)

 \Box Yes

□ No

If Yes, what prevented you?

```
عزيزتي الطالبة، ارجو الإجابة على الأسئلة التالية:

1-هل أنت قادرة على القراءة والفهم والكلام باللغة العربية؟
0 نعم
1 - هل تعاتي من أي مشكله صحية تمنعك من ممارسة الرياضة؟
٢- هم تعاتي من أي مشكله صحية تمنعك من ممارسة الرياضة؟
```

- م صرف. ٥ ١٣ سنة
-) ۱۲ سنة 12 منة
- ر ١٠ سنة o
- 0 ۲۰ سنة ١٦ ٥
- ٥ ١٢ سنة
- ٥ ١٨ سنة
- ں ۲۸ ست o غیرہ
-) طیر ا

٤ - ماهي مرحلتك الدراسية؟

- المتوسطة
 - o الثانوية
 - o أخرى

أداة المسح الاجتماعى

۱ ـ ما هو مقر اقامتك؟

- o الخبر
- 0 الدمام
- o القطيف
- أخرى (الرجاء ذكرها)

٢ - ما هو تاريخ ميلادك بالهجري أو الميلادي (الرجاء كتابته باليوم ، الشهر ، السنة) :.....

٣- ما هو صفك الدراسى؟

- الأولى متوسطً
- الثاني متوسط
- · الثالث متوسط
- الأول ثانوى
- · · الثاني ثانوي
- الثالث ثانوى

۳ کم هو طولك بدون لبس الحذاء ؟

اكتب طولك بالسنتيميتر في الفراغ التالي

اقتراح: إذا لم يكن لديك شريط قياس ، يمكنك استخدام مسطرة عادية لقياس طولك. قف بشكل مستقيم مع وضع ظهرك على الحائط واطلب من شخص ما تحديد الجدار فوق رأسك مباشرةً بقلم رصاص. ثم استخدم المسطرة لقياس المسافة من الأرض إلى العلامة.

٤ أ- هل قمت بقياس طولك؟

لا، لم اقم لأنني اعرف طولي.
 نعم، قمت بقياسه.

حم هو وزنك بدون لبس الحذاء؟
 اكتب وزنك بالكيلوجرام في الفراغ التالي

اقتراح: ضع الميزان على سطح مستوي، وانزع الأحذية والملابس الثقيلة ، مثل السترات ، ثم قف على الميزان.

أ- هل قمت بقياس وزنك؟

لا، لم اقم لأنني اعرف وزني.
 نعم، قمت بقياسه.

٦- ما هو دخل اسرتك الشهري (للأب والأم):

- دخل منخفض (أقل مَن َ ٠٠٠ شهريا)
 دخل متوسط (ما بین ٥٠٠٠ إلى ١٥ ألف شهریا)
 دخل مرتفع (اعلى من ١٥ ألف شهریا)
 - ٧- ما هو مستوى تعليم والدك:
 - شهادة متوسطة أو اقل
 - شهادة ثانويه أو دبلوم عالى
- مؤهل عال (دبلوم جامعي ، بكالوريوس، ماجستير، دكتوراه)

- ٨- ما هو مستوى تعليم والدتك:
 شهادة متوسطة أو اقل
 شهادة ثانويه أو دبلوم عالي
 مؤهل عال (دبلوم جامعي، بكالوريوس، ماجستير، دكتوراه)

رأيك حول القيام بنشاط بدني

تعليمات الإجابة:

- الأسئلة التالية تهدف إلى معرفة رأيك حول "القيام بنشاط بدنى مدة <u>٢٠ دقيقة</u> على الأقل خلال الأسبوع.
 - حاول أن تحصر إجابتك بالنشاطات البدنية التي تقوم بها خلال اليوم.

١-بالنسبة لك، القيام بنشاط بدنى مدة ٦٠ دقيقة على الأقل خلال أيام المدرسة، هو شىء :

1	لا، أبداً	لا، قليلا	نعم، يمكن	نعم، أكيد
تع جداً				
يد النشاط				
ىىلي				
ففف من الضغوط النفسيه ويساعد على الاسترخاء				
يد للصحه				
اعد على خسارة الوزن أو المحافظة على الوزن				

٢- هل تعتقد أن القيام بنشاط بدني، مدة ٦٠ دقيقة على الأقل خلال أيام المدرسة، هو شي :

?	لا، أبداً	لا، قليلا	نعم، يمكن	نعم، أكيد
- تستمتع بعمله				
-يجعلك تشعر بالإر هاق				
- يسبب إصابات جسديه -				
- يسبب ضياع وقتك				

٣ - هل تعتقد أن القيام بنشاط بدنى، مدة ٦٠ دقيقة على الأقل خلال أيام المدرسة ، يساعدك في ان :

	لا، أبداً	لا، قليلا	نعم، يمكن	نعم، أكيد
أ – تركز افضل في المدرسة				
ب-تكون نشيطا				

		ت- تشعر بالراحة
		ث- يقوي جسمك (عضلاتك وعظامك)

٤- ماذا يعتقد الأشخاص المهمون في حياتك من القيام بالنشاط البدني (الرياضه) مدة ٦٠ دقيقة على الأقل ، خلال الأسبوع القادم؟

	لا، أبداً	لا، قليلا	نعم، يمكن	نعم، أكيد
ـ يؤيدون فكرة القيام بنشاط بدني 				
-ينصحونك بالقيام بنشاط بدني				
، يو افقون على ان تقوم بنشاط بدني ·				

٥- هل هؤلاء الأشخاص يشجعونك على القيام بنشاط بدني مدة ٦٠ دقيقة على الأقل خلال معظم أيام المدرسة:

	لا، أبداً	لا، قليلا	نعم، يمكن	نعم، أكيد
_ والدتك				
ب۔ والدك				
ت-اخوانك او اخوانك				
ث۔ اصدقائك				
ج- المؤثرين بمواقع التواصل الاجتماعي				

٦- هل تشعر أنك قادر على القيام بنشاط بدني مدة ٦٠ دقيقة على الأقل خلال معظم أيام المدرسة، الأسبوع القادم؟

نعم، أكيد	نعم، يمكن	لا، قليلا	لا، أبداً

٧-إذا أنت تريد ان تقوم بنشاط بدني، هل تستطيع القيام بنشاط بدني مدة ٦٠ دقيقة على الأقل خلال أيام المدرسة؟

نعم، أكيد	نعم، يمكن	لا، قليلا	لا، أبداً

٨ - بالنسبة لك، القيام بنشاط بدنى مدة ٦٠ دقيقة على الأقل خلال معظم أيام المدرسة، هو أمر:

صعب جدا	صعب	سەل	سهل جدا

٩-هل تعتقد أنك قادر على القيام بنشاط بدنى، مدة ٦٠ دقيقة خلال معظم أيام المدرسة، حتى لو:

	لا، أبداً	لا، قليلا	نعم، يمكن	نعم، أكيد
أ ـ كان الجو حارا				
ب- عدم امتلاك اجهزه رياضية بالمنزل				
ت- ضيق الوقت				
ث-قلة النوادي الرياضية				

١٠ - هل تعتقد أنه من الأسهل لك القيام بنشاط بدنى، مدة ٦٠ دقيقة على الأقل خلال أيام المدرسة، إذا :

<u>لا</u>	لا، أبداً	لا، قليلا	نعم، يمكن	نعم، أكيد
فرت الاجهزه الرياضيه في المنزل				
متطعت لبس ملابس مريحة خارج المنزل				
متطعت الذهاب للأندية الرياضية				

١١ - خلال الأسبوع القادم، هل ستقوم بنشاط بدنى مدة ٦٠ دقيقة على الأقل ؟

نعم، أكيد	نعم، يمكن	لا، قليلا	لا، أبداً

١٢ - خلال الأسبوع القادم، ما هي امكانية قيامك بنشاط بدني مدة ٦٠ دقيقة على الأقل ؟

نعم، أكيد	نعم، يمكن	لا، قليلا	لا، أبداً

١٣- هل لديك النية في القيام بنشاط بدني مدة ٦٠ دقيقة على الأقل خلال الاسبوع ؟

نعم، أكيد	نعم، يمكن	لا، قليلا	لا، أبداً

٤ ١- هل تخطط للقيام بنشاط بدني مدة ٦٠ دقيقة على الأقل خلال معظم أيام المدرسة، خلال الأسبوع القادم؟

نعم، أكيد	نعم، يمكن	لا، قليلا	لا، أبداً

الاستبانة الخاصة بالنشاط البدني

نحن نحاول معرفة معلومات عن مستوى نشاطك البدني خلال السبع ايام الماضية (الأسبوع الماضي). و هذا يتضمن الرياضات

الذي يجعلك تتصبب عرقاً أو يجعل ساقيك يؤلمانك، أو الألعاب التي تجعلك تتنفسي بصعوبة مثل الوثب بالحبل والجري

والتسلق وغير ها من الألعاب .

تذكري :

لا توجد إجابة صحيحة وإجابة خاطئة ـ هذا الاستبانة ليس امتحانا .

من فضلك أجيب عن الأسئلة بأمانة ودقة قدر استطاعتك - هذا مهم جدا .

		•			
۷ أو أكثر	٥-٦ مرات	۳-۶ مرات	۱-۲ مرات	لا	الأنشطة
					١ -النط بالحبل
					٢- الألعاب (المطاردة)
					۳-المثبي
					-
					٤ - الجري/ الركض
					 التمرينات (تمرينات الضغط، تمرينات
					البطن، القفز)
					٦-السباحة
					۷- الزومبا
					٨-كرة القدم
					٩- كرة السلة
					 ۱۰ - اللعب في الأماكن المفتوحة (الغميمة)
					١١-الأعمال الروتينيه في الأماكن المغلقه
					(مسح الأرضيات، الكنس بإستخدام المكنسة
					الكهربائيه، الكنس بإستخدام المكنسة اليدوية،
					التنظيف)
					١٢ - أستخدام السلالم
					· · · ·
					١٣-استخدام جهاز السير

١. النشاط البدني في وقت فراغك: هل قمتي بأي نشاط من الأنشطة التالية خلال الأيام السبعة الماضية (الأسبوع الماضي)؟ إذا كانت إجابتك نعم، فكم مرة حدث ذلك؟ قومي بوضع علامة(X) في مربع واحد بكل صف
		١٤-الكار اتيه، التابكواندو
		 ۱۰ انشطه أخرى (الرجاء ذكر ها هنا)
		١٦- أنشطه آخرى (الرجاء ذكر ها هذا)
		۱۷- انشطه أخرى (الرجاء ذكرها هنا)

٢ .خلال الأيام السبعة الماضية، ما الذي كنت تقومي به عادة في وقت الإفطار (إلى جانب تناول الإفطار)؟ (اختاري اجابة واحدة فقط)

الجلوس (الحديث، القراءة، أداء الواجبات المنزلية)
 الوقوف أو التجول
 الجري أو اللعب قليلا
 الركض واللعب لبعض الوقت
 الجري واللعب معظم الوقت

٣ .خلال الأيام السبعة الماضية، كم مرة قمتي بعد انتهاء المدرسة مباشرة) قبل السادسة مساء(بممارسة الرياضة أو لعب بعض الألعاب التي كنت نشيطاً جداً فيها؟ (اختاري اجابة واحدة فقط)

- لا يوجد
 مرة واحدة خلال الأسبوع الماضي
 مرتان أو ثلاث مرات خلال الأسبوع الماضي
 أربع مرات خلال الأسبوع الماضي
 - خمس مرات خلال الأسبوع الماضي

 ٤. خلال الأيام السبعة الماضية، كم مرة قمتي خلال فترة المساء (بعد السادسة مساء) بممارسة الرياضة أو لعب بعض الألعاب التي كنت نشيطاً جداً فيها؟ (اختاري اجابة واحدة فقط)

لا يوجد
 مرة واحدة خلال الأسبوع الماضي
 مرتان أو ثلاث مرات خلال الأسبوع الماضي
 أربع مرات خلال الأسبوع الماضي
 خمس مرات خلال الأسبوع الماضي

 خلال اجازة نهاية الأسبوع الماضي، كم مرة قمتي بممارسة الرياضة أو لعب بعض الألعاب التي كنت نشيطاً جدا فيه (اختاري اجابه واحدة فقط)

لا یوجد
 مرة واحدة
 مرتان-ثلاث مرات
 ٤-٥ مرات
 ٢ مرات او أكثر

٢. أي عبارة من العبارات التالية تناسب حالتك خلال الأيام السبعة الماضية؟ اقرأ كل العبارات الخمس قبل أن تقوم بتحديد العبارة التي تصف حالتك.

- قضيت كل أو معظم أوقات فراغي في القيام بأمور تتضمن القليل من المجهود البدني
- قمت في بعض الأحيان (مره-مرتّان خلال الأسبوع الماضي) بأمور نتطلب مجهوداً بدنيا (على سبيل المثال ممارسة الرياضة، الجري، السباحة، التمرينات الرياضية)
 قمت مرارا (٣-٤ مرات خلال الأسبوع الماضي) بأنشطة بدنيه في وقت فراغي
 - قمت كثيرا (٥-٦ مرات حكر الأسبوع الماضي) بانشطة بدنية في وقت فراغي
 قمت كثيرا (٥-٦ مرات خلال الأسبوع الماضي) بأنشطة بدنية في وقت فراغي
 - □ قمت كثير (-) مرات كارل الإسبوع الماضي) بالسطة بدنية في وقت فراغي
 □ مت كثير اجدا (٧ مرات او أكثر خلال الأسبوع الماضي بأنشطة بدنية في وقت فراغي

 ٧. حددي عدد المرات التي قمتي بها بنشاط بدني (مثل ممارسة الرياضة، أو الألعاب، أو أي نشاط بدني آخر) في كل يوم من أيام الأسبوع الماضي. (قومي بوضع علام(X) في مربع واحد بكل صف)

	لا يوجد	قليل جدا	متوسط	کثیرا	کثیرا جدا
الأحد					
الاثنين					
0,					
الثلاثاء					
الأربعاء					
الخميس					
الجمعة					

٨. هل كنتي مريضة خلال الأسبوع الماضي، أو هل منعك أي شيء من القيام بأنشطتك البدنية المعتادة؟ (اختاري اجابة واحدة فقط)

> □ نعم □ لا

لو كانت إجابتك "نعم" فما الذي منعك؟

APPENDIX C: INTERNATIONAL (IOTF) BMI'S CUT-OFFS FOR FEMALES (2-18

YEARS OLD)

Table 21

International (IOTF) BMI's Cut-Offs for Females (2-18 years old)

			Fei	males					
				BMI	(kg/m²) at a	ge 18 year	rs		
Age months	Age (years)	16	17	18 5	23	25	27	30	35
24	2	12.4	14.05	14.06	17.25	19.00	10.02	10.91	21 12
24	2 08	13.4	14.05	14.90	17.25	18.09	18.05	19.81	21.15
26	2.00	13 35	14.02	14.55	17.21	18	18.75	19.77	21.05
27	2.25	13.32	13.97	14.86	17.13	17.96	18.71	19.68	21.03
28	2.33	13.3	13.94	14.83	17.09	17.92	18.67	19.64	20.97
29	2.42	13.27	13.91	14.8	17.05	17.88	18.63	19.6	20.94
30	2.5	13.25	13.88	14.77	17.01	17.84	18.59	19.57	20.9
31	2.58	13.22	13.86	14.74	16.98	17.81	18.55	19.53	20.87
32	2.67	13.2	13.83	14.71	16.94	17.77	18.52	19.5	20.84
33	2.75	13.18	13.8	14.68	16.91	17.74	18.48	19.47	20.81
34	2.83	13.15	13.78	14.65	16.88	17.71	18.45	19.44	20.79
35	2.92	13.13	13.75	14.62	16.85	17.68	18.42	19.41	20.77
36	3	13.11	13.73	14.6	16.82	17.64	18.39	19.38	20.74
37	3.08	13.09	13.7	14.57	16.79	17.62	18.36	19.36	20.72
38	3.17	13.07	13.68	14.54	16.76	17.59	18.34	19.33	20.7
39	3.25	13.04	13.66	14.52	16.73	17.56	18.31	19.31	20.69
40	3.33	13.02	13.63	14.49	16.7	17.53	18.29	19.29	20.67
41	3.42	12.09	13.01	14.47	10.08	17.51	18.20	19.27	20.00
42	3.5	12.96	12.59	14.44	16.63	17.40	19.24	19.25	20.05
45	3.58	12.90	13.50	14.42	16.6	17.40	18.22	19.23	20.04
45	3 75	12.94	13.54	14.35	16.58	17.44	18 18	19.21	20.05
46	3.83	12.89	13.49	14.34	16.55	17.39	18.16	19.18	20.62
47	3.92	12.87	13.47	14.32	16.53	17.37	18.14	19.17	20.62
48	4	12.85	13.45	14.3	16.51	17.35	18.13	19.16	20.61
49	4.08	12.83	13.43	14.27	16.49	17.34	18.11	19.15	20.62
50	4.17	12.81	13.4	14.25	16.47	17.32	18.1	19.15	20.62
51	4.25	12.78	13.38	14.23	16.45	17.31	18.09	19.14	20.63
52	4.33	12.76	13.36	14.2	16.43	17.29	18.08	19.14	20.64
53	4.42	12.74	13.34	14.18	16.42	17.28	18.07	19.14	20.66
54	4.5	12.72	13.31	14.16	16.4	17.27	18.06	19.14	20.67
55	4.58	12.7	13.29	14.14	16.39	17.26	18.06	19.15	20.69
56	4.67	12.67	13.27	14.12	16.37	17.25	18.06	19.15	20.72
5/	4.75	12.05	13.25	14.1	16.30	17.24	18.06	19.16	20.74
50	4.03	12.05	13.25	14.06	16.35	17.24	18.00	19.17	20.77
60	4.52	12.01	13.21	14.00	16 33	17.23	18.00	19.19	20.81
61	5.08	12.56	13.16	14.02	16.32	17.23	18.07	19.22	20.89
62	5.17	12.54	13.14	14	16.32	17.23	18.08	19.24	20.93
63	5.25	12.52	13.12	13.98	16.31	17.23	18.09	19.27	20.98
64	5.33	12.5	13.1	13.97	16.31	17.24	18.1	19.3	21.04
65	5.42	12.48	13.08	13.95	16.3	17.24	18.12	19.33	21.09
66	5.5	12.45	13.06	13.93	16.3	17.25	18.13	19.36	21.16
67	5.58	12.43	13.04	13.92	16.3	17.26	18.15	19.4	21.22
68	5.67	12.41	13.02	13.9	16.3	17.27	18.18	19.43	21.29
69	5.75	12.39	13	13.89	16.31	17.28	18.2	19.48	21.37
70	5.85	12.57	12.99	13.87	16.31	17.3	10.22	19.52	21.44
71	5.92	12.30	12.97	13.80	16.32	17.31	18.23	19.57	21.52
73	6.08	12.34	12.94	13.84	16.33	17.35	18 31	19.67	21.01
74	6.17	12.31	12.93	13.83	16.34	17.37	18.35	19.72	21.79
75	6.25	12.29	12.92	13.82	16.36	17.39	18.38	19.78	21.89
76	6.33	12.28	12.9	13.82	16.37	17.42	18.42	19.84	21.99
77	6.42	12.27	12.9	13.81	16.39	17.45	18.46	19.9	22.09
78	6.5	12.26	12.89	13.81	16.4	17.48	18.5	19.96	22.19
79	6.58	12.25	12.88	13.81	16.42	17.51	18.55	20.03	22.3
80	6.67	12.24	12.88	13.81	16.44	17.54	18.59	20.1	22.41
81	6.75	12.23	12.87	13.81	16.47	17.58	18.64	20.17	22.53
82	6.83	12.23	12.87	13.81	16.49	17.61	18.69	20.24	22.64
83	6.92	12.23	12.87	13.82	16.52	17.65	18.74	20.32	22.76
84	7.00	12.23	12.87	13.83	16.54	17.69	18.8	20.39	22.88
85	7.08	12.23	12.88	13.83	16.57	17.73	18.85	20.47	23
87	7.1/	12.23	12.00	13.84	16.64	17.22	18.91	20.55	23.13
88	7.33	12.25	12.05	13.87	16.67	17.87	19.03	20.05	23.39
89	7.42	12.24	12.9	13,88	16,71	17.91	19.09	20.8	23.52
90	7.5	12.25	12.91	13.9	16.74	17.96	19.15	20.89	23.65

Table 21 (cont'd)

			Fei	males					
				BMI	(kg/m²) at a	ige 18 year	rs		
Age months	Age (years)	16	17	18.5	23	25	27	30	35
91	7.58	12.25	12.92	13.91	16.78	18.01	19.22	20.98	23.79
92	7.67	12.26	12.93	13.93	16.82	18.07	19.28	21.07	23.93
93	7.75	12.27	12.95	13.95	16.86	18.12	19.35	21.16	24.07
94	7.83	12.28	12.96	13.96	16.9	18.17	19.42	21.25	24.21
95	8	12.29	12.97	13.98	16.94	18.25	19.49	21.55	24.50
97	8.08	12.31	13	14.02	17.03	18.34	19.63	21.54	24.65
98	8.17	12.32	13.01	14.04	17.07	18.39	19.7	21.64	24.8
99	8.25	12.33	13.03	14.06	17.12	18.45	19.77	21.74	24.95
100	8.33	12.34	13.04	14.08	17.16	18.51	19.85	21.84	25.1
101	8.42	12.35	13.06	14.1	17.21	18.57	19.92	21.94	25.26
102	8.58	12.37	13.09	14.12	17.3	18.69	20.07	22.04	25.58
104	8.67	12.39	13.1	14.17	17.34	18.75	20.15	22.24	25.74
105	8.75	12.4	13.12	14.19	17.39	18.81	20.22	22.35	25.9
106	8.83	12.41	13.13	14.21	17.44	18.87	20.3	22.45	26.06
107	8.92	12.42	13.15	14.23	17.48	18.93	20.38	22.56	26.22
108	9.08	12.44	13.10	14.20	17.55	19.99	20.46	22.00	26.59
110	9.17	12.46	13.2	14.3	17.63	19.12	20.61	22.88	26.72
111	9.25	12.47	13.22	14.33	17.68	19.18	20.69	22.99	26.88
112	9.33	12.49	13.23	14.35	17.73	19.24	20.77	23.09	27.05
113	9.42	12.5	13.25	14.38	17.78	19.31	20.85	23.2	27.21
114	9.5	12.52	13.27	14.4	17.83	19.38	20.94	23.31	27.38
116	9.67	12.55	13.31	14.46	17.94	19.51	21.1	23.53	27.71
117	9.75	12.57	13.33	14.49	17.99	19.58	21.18	23.64	27.88
118	9.83	12.59	13.36	14.52	18.04	19.64	21.27	23.75	28.04
119	9.92	12.61	13.38	14.55	18.1	19.71	21.35	23.86	28.2
120	10 10 08	12.63	13.4	14.58	18.16	19.78	21.43	23.97	28.36
122	10.17	12.67	13.46	14.64	18.27	19.92	21.6	24.19	28.68
123	10.25	12.69	13.48	14.68	18.33	19.99	21.69	24.29	28.83
124	10.33	12.72	13.51	14.71	18.39	20.07	21.77	24.4	28.98
125	10.42	12.74	13.54	14.75	18.45	20.14	21.86	24.51	29.14
126	10.5	12.77	13.57	14.78	18.51	20.21	21.95	24.62	29.28
128	10.58	12.75	13.63	14.86	18.63	20.28	22.03	24.72	29.58
129	10.75	12.85	13.67	14.9	18.7	20.43	22.2	24.94	29.72
130	10.83	12.88	13.7	14.94	18.76	20.51	22.29	25.04	29.86
131	10.92	12.91	13.74	14.98	18.82	20.58	22.38	25.15	30
132	11	12.94	13.//	15.03	18.89	20.66	22.47	25.25	30.14
133	11.08	13.01	13.81	15.11	19.02	20.73	22.55	25.46	30.28
135	11.25	13.04	13.88	15.16	19.09	20.89	22.73	25.57	30.54
136	11.33	13.08	13.92	15.2	19.15	20.96	22.81	25.67	30.67
137	11.42	13.11	13.96	15.25	19.22	21.04	22.9	25.77	30.8
138	11.5	13.15	14	15.3	19.29	21.12	22.99	25.87	30.93
140	11.58	13.18	14.04	15.39	19.30	21.27	23.16	26.08	31.17
141	11.75	13.26	14.13	15.44	19.49	21.35	23.25	26.18	31.3
142	11.83	13.3	14.17	15.49	19.56	21.43	23.34	26.28	31.42
143	11.92	13.34	14.22	15.54	19.63	21.51	23.42	26.38	31.54
144	12 08	13.38	14.26	15.59	19.7	21.59	23.51	26.47	31.00
145	12.00	13.47	14.35	15.7	19.84	21.74	23.68	26.67	31.89
147	12.25	13.51	14.4	15.75	19.91	21.82	23.76	26.76	32
148	12.33	13.55	14.45	15.8	19.98	21.9	23.85	26.86	32.11
149	12.42	13.6	14.5	15.86	20.05	21.97	23.93	26.95	32.22
150	12.5	13.64	14.54	15.91	20.12	22.05	24.02	27.05	32.33
152	12.58	13.73	14.59	16.02	20.19	22.2	24.18	27.22	32.43
153	12.75	13.78	14.69	16.07	20.33	22.27	24.26	27.31	32.63
154	12.83	13.82	14.74	16.13	20.39	22.35	24.34	27.4	32.73
155	12.92	13.87	14.79	16.18	20.46	22.42	24.42	27.49	32.82
156	13	13.92	14.84	16.23	20.53	22.49	24.49	27.57	32.91
13/	13.00	13.90	14.03	10.29	20.39	22.30	24.3/	21.05	22

Table 21 (cont'd)

			Fe	males					
				BMI	(kg/m²) at a	ige 18 year	rs		
Age months	Age (years)	16	17	18.5	23	25	27	30	35
158	13.17	14.01	14.94	16.34	20.66	22.63	24.64	27.73	33.09
159	13.25	14.06	14.99	16.4	20.72	22.7	24.71	27.81	33.17
160	13.33	14.1	15.04	16.45	20.79	22.77	24.79	27.88	33.24
161	13.42	14.15	15.09	16.5	20.85	22.84	24.80	27.90	33.32
163	13.58	14.24	15.18	16.61	20.98	22.97	24.99	28.1	33.47
164	13.67	14.29	15.23	16.66	21.04	23.03	25.06	28.16	33.53
165	13.75	14.34	15.28	16.71	21.1	23.09	25.12	28.23	33.6
166	13.83	14.38	15.33	16.76	21.15	23.15	25.18	28.29	33.66
167	13.92	14.43	15.38	16.81	21.21	23.21	25.25	28.36	33.72
168	14	14.47	15.42	16.86	21.27	23.27	25.31	28.42	33.78
169	14.08	14.52	15.47	16.91	21.33	23.33	25.37	28.48	33.83
170	14.17	14.57	15.52	17.01	21.50	23.39	25.42	28.59	33.93
172	14.33	14.65	15.61	17.06	21.49	23.5	25.53	28.64	33.98
173	14.42	14.7	15.66	17.11	21.54	23.55	25.59	28.69	34.03
174	14.5	14.74	15.71	17.16	21.59	23.6	25.64	28.74	34.07
175	14.58	14.79	15.75	17.2	21.64	23.65	25.69	28.79	34.11
176	14.67	14.83	15.8	17.25	21.69	23.7	25.74	28.84	34.15
177	14.75	14.87	15.84	17.3	21.74	23.75	25.78	28.88	34.18
1/8	14.83	14.92	15.88	17.34	21.79	23.8	25.83	28.92	34.21
180	14.52	14.50	15.97	17.33	21.85	23.84	25.97	29.01	34.23
181	15.08	15.04	16.01	17.47	21.92	23.93	25.96	29.05	34.31
182	15.17	15.08	16.05	17.51	21.96	23.97	26	29.08	34.33
183	15.25	15.12	16.09	17.56	22.01	24.01	26.04	29.12	34.36
184	15.33	15.16	16.13	17.6	22.05	24.05	26.08	29.15	34.39
185	15.42	15.2	16.17	17.64	22.09	24.09	26.12	29.19	34.41
186	15.5	15.24	16.21	17.68	22.13	24.13	26.15	29.22	34.43
188	15.58	15.27	16.25	17.72	22.17	24.17	26.19	29.23	34.43
189	15.75	15.34	16.32	17.79	22.24	24.24	26.26	29.31	34.49
190	15.83	15.38	16.36	17.82	22.28	24.28	26.29	29.34	34.51
191	15.92	15.41	16.39	17.86	22.31	24.31	26.32	29.37	34.53
192	16	15.45	16.42	17.9	22.35	24.34	26.36	29.4	34.54
193	16.08	15.48	16.46	17.93	22.38	24.38	26.39	29.42	34.56
194	16.17	15.51	16.49	17.96	22.41	24.41	26.42	29.45	34.58
195	16.33	15.54	16.52	18.02	22.44	24.44	26.43	29.40	34.62
197	16.42	15.6	16.58	18.06	22.51	24.5	26.5	29.53	34.63
198	16.5	15.63	16.61	18.08	22.54	24.53	26.53	29.55	34.64
199	16.58	15.65	16.64	18.11	22.57	24.56	26.56	29.58	34.66
200	16.67	15.68	16.66	18.14	22.59	24.59	26.59	29.6	34.68
201	16.75	15.7	16.69	18.17	22.62	24.61	26.61	29.63	34.7
202	16.83	15.73	16.71	18.19	22.05	24.64	26.64	29.65	34.71
203	10.92	15.78	16.76	18.22	22.00	24.07	26.69	29.7	34.75
205	17.08	15.8	16.78	18.27	22.73	24.72	26.72	29.73	34.77
206	17.17	15.82	16.81	18.29	22.76	24.75	26.74	29.75	34.78
207	17.25	15.84	16.83	18.31	22.78	24.77	26.77	29.77	34.8
208	17.33	15.86	16.85	18.34	22.81	24.8	26.8	29.8	34.82
209	17.42	15.88	16.87	18.36	22.83	24.82	26.82	29.82	34.84
210	17.5	15.9	16.89	18.38	22.86	24.85	26.85	29.85	34.87
212	17.67	15.93	16.93	18.42	22.00	24.00	26.9	29.9	34.91
213	17.75	15.95	16.95	18.44	22.93	24.93	26.92	29.92	34.93
214	17.83	15.97	16.96	18.46	22.95	24.95	26.95	29.95	34.95
215	17.92	15.98	16.98	18.48	22.98	24.98	26.97	29.98	34.98
216	18	16	17	18.5	23	25	27	30	35

APPENDIX D: MINISTRY OF EDUCATION IRB APPROVAL

Figure 7

Ministry of Education IRB Approval

الرقـم : التاريـخ :		المملكت العربية السعودية وزارة الثعليم (۲۸۰)
المرفقات :	مالتصليم Ministryol Education	الإدارة العامة للتعليم بالمنطقة الشرقية إدارة التخطيحا والتعلوير PD
الليم: المواطنة -الإتفان -العدل -العمل بروح الفريق -التنمية الذاتية -الممتوولية الاجتماعية	رسالة: تقديم خدمات تربوية وتعليمية ذات جودة عالية وفق معايير عالية بهشاركة مجتمعية	الروية: الريادة لبناء جيل مبدع

الموضوع: تسهيل مهمة الباحثة منى العلي.

وفقهم الله

المكرمين/ مديري ومديرات مكاتب التعليم (بنات)

السلام عليكم ورحمة الله وبركاته ، ، ،

بناءً على إحالة سعادة المدير العام رقم ٤٣٠٠٦٥٣٣٦ وتاريخ ١٩شعبان ١٤٤٣هـ. والمبنية على خطاب مدير عام مركز بحوث سياسات التعليم.

آمل منكم التكرم بتسهيل مهمة الباحثة / منى بنت علي العلي طالبة الدراسات العليا لدرجة الدكتورة في جامعه (MICHIGAN STATE UNIVERSITY)، والتي تقوم بإعداد دراسة بعنوان "معرفة مفاهيم الفتيات المشاركات اتجاه النشاط الرياضي (البدني) مع تقييم ونشاطهم البدني " حيث تتطلب الدراسة استيفاء استبانة من قبل طالبات مدارس البنات الحكومية المتوسطة والثانوية على الرابط أو QR-Code التالى:

https://cutt.us/j6MXK

مع ضرورة التقيد بالآتي:

- أخذ موافقة ولي أمر الطالبة الخطية المسبقة.
 - ۲ . ألا يتزامن التطبيق مع وقت الحصص.

شاكرين لكم تسهيل مهمتها وفق اللواثح والأنظمة المنظمة لذلك. والله ولي التوفيق ، ، ،

مديرة إدارة التخطيط والتطوير

غزيل بنت عبد المحسن العتيبي

-	
	٦٤٤٣/٩/١٣
	ب/آل ڪداش
	2

