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PERCEIVED FATIGUE AND LOW-IMPACT AEROBIC EXERCISE IN THE THIRD TRIMESTER OF PREGNANCY

By

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ABSTRACT

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The purpose of this non-experimental, cross sectional, two-group descriptive study was to explore the association between low-impact aerobic exercise and women's perceived fatigue in the third trimester of pregnancy. The Model of Fatigue During the Childbearing Experience, (Pugh, Milligan & Kitzman, 1991) was used to conceptualize and guide the investigation of the variables. A convenience sample (N = 54) included: (a) one group of pregnant women (n = 27) participating in a formalized, structured, low-impact aerobic exercise program, and (b) a second group of pregnant women (n = 27) not participating in regular aerobic exercise.

Significant differences were found between the groups with the low-impact aerobic exercise group perceiving less fatigue than the non-exercising group. The results of this study serve as a starting point to expand the healthcare profession's limited knowledge about methods to reduce or prevent the occurrence of fatigue in pregnancy.

To Kirk

for your love, patience, and faith in me.

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CHAPTER I

The Problem

Introduction

The concept of fatigue is one of the most common and least understood symptoms in health care (Eidelman, 1980). A patient's perception of fatigue is a significant complaint due to its: (a) potentially adverse effects on a person's well-being, (b) interference with activities of daily living, and (c) impact on relationships with family and/or friends (Aistars, 1987).

Fatigue is also a common complaint during pregnancy (Pugh, Milligan & Kitzman, 1991). Even though fatigue is considered a normal occurrence in pregnancy, it merits attention by healthcare professionals providing prenatal care. Some authors approach fatigue as being recoverable by rest while others believe that it is caused by rest and can be lessened by exercise (Piper, 1986, 1989). The frequency with which complaints of fatigue surface in pregnancy reinforces the need to further explore fatigue in relation to exercise in pregnant women.

Improvements in aerobic power through exercise have been postulated to help deter acute fatigue (Shephard, 1974). Does a relationship between aerobic exercise and fatigue also exist for the pregnant woman during pregnancy? The risks and benefits of exercise have been determined for individuals not pregnant, but are not conclusive for the pregnant woman. The healthcare provider often extrapolates from the existing research on the benefits of exercise for those not pregnant and then applies those findings to the pregnant population. It is necessary to determine the relationship between fatigue and exercise in pregnancy in order for the healthcare provider to supply accurate information to pregnant women.

Background of the Problem

Fatigue is considered to be a multidimensional concept without a unified definition. Currently, it is thought that the best way to measure fatigue is to determine the individual's perception of his/her fatigue (Piper, Lindsey & Dodd, 1987). Fatigue is defined by Piper (1986) as a subjective feeling of tiredness that varies in pleasantness, intensity and duration. The perceived fatigue experienced by pregnant woman may vary in intensity throughout the three trimesters of pregnancy. Of particular interest in this study is the occurrence of fatigue in the third trimester of pregnancy. Fatigue in the third trimester of prenancy is most likely related to the multiple anatomical and physiological changes occurring at this time (Olds, London & Ladewig, 1988). The physiological feelings associated with fatigue can be conceptualized as a state of increased discomfort and decreased efficiency (Hart & Freel, 1982). These feelings include: (a) tired, drowsy feelings, (b) a sense of decreased energy (c) inability to concentrate, and (d) decreased motivation. Pregnant women's perceptions of fatigue may interfere with activities of daily living, affect relationships, and ultimately affect the health of the women.

In a transient state such as pregnancy, fatigue is generally described as an acute state as opposed to a chronic state. Acute fatigue usually responds to rest or sleep while chronic fatigue does not (Hart & Freel, 1982). Piper (1986) postulates that the early recognition of acute fatigue can prevent the occurrence of chronic fatigue or injury.

The difficulty with the management of fatigue is that it is not known exactly what it is or what can be done about it. When pregnant women complain of fatigue, the healthcare provider is challenged to develop a treatment plan and a strategy for prevention with minimal information. The Clinical Nurse Specialist (CNS) is a healthcare provider directly involved in the care of pregnant women, especially in the areas of education and counseling. The CNS needs to know what alternatives, one of which might be exercise, would help alleviate or

decrease the intensity of a pregnant woman's perceived fatigue. In order to recommend exercise as an appropriate intervention for fatigue, the CNS needs to understand the association, if any, between exercise and perceived fatigue.

Patterns of physical activity can play a significant role in the prevention, cause, and alleviation of fatigue (Piper, 1989). Physical activity is defined by Caspersen, Powell and Christenson (1985) as bodily movements by skeletal muscles resulting in an expenditure of energy. Exercise is differentiated from physical activity because it is a planned, structured, and repetitive sequence of bodily movements with an objective of maintaining or improving physical fitness.

Exercise during pregnancy is a relatively new concept, although pregnant women are physically active as part of their daily routines. Much of the information disseminated on exercise in pregnancy focuses on the preparation of the woman's body for labor and delivery; however, there is often no reference to the overall benefits of exercise during pregnancy (Richards, 1985).

Researchers have begun to address the issue of exercise during pregnancy to determine the physiological effects of exercise on the pregnant woman and the unborn fetus. Early studies were done with animals because of safety and ethical considerations of conducting studies on pregnant women (Clapp, 1980; Curet, Orr, Rankin, & Ungerer, 1976; Hohimer, Bissonnette, Metcalf, & Kean, 1984; Lotgering, Gilbert, & Longo, 1983). The results of these studies completed on animals have limited applicability to humans, due to anatomical and physical differences (Fishbein & Phillips, 1990; Wallace & Engstrom, 1987). It was found in other studies that Olympic stars or trained athletes who participate in regular exercise during pregnancy maintain or improve their physical fitness, although these studies cannot be generalized to the average pregnant female who is not a trained athlete (Collings, Curet, & Mullin, 1983; South-Paul, Rajagopal, & Tenholder, 1988). Most researchers have not recorded any harm to a woman or a fetus as a result of exercise during pregnancy (Collings *et al.*, 1983; Dressendorfer &

Goodlin, 1980; Jarrett & Spellacy, 1983; Lotgering, Gilbert & Longo, 1985; Pomerance, Gluck, & Lynch, 1974).

Standards for exercise in pregnancy have been developed by the American College of Obstetricians and Gynecologists (ACOG) (1985). These guidelines include recommendations on the types of exercise considered to be acceptable during pregnancy. In addition, the ACOG guidelines also include the medical conditions that are contraindicated for exercise. Aerobic exercise, particularly the low-impact style, is an acceptable form of exercise during pregnancy according to these guidelines. Based on the ACOG (1985) standards for exercise in pregnancy, the low-impact type of aerobic exercise will be further explored in this research study.

Purpose of the Study

Knowledge regarding the impact of participation by pregnant women in the third trimester of pregnancy in low-impact aerobic exercise on perceived fatigue as compared with the perception of fatigue in pregnant women not participating in low-impact aerobic exercise would provide the nurse with objective data to promote low-impact aerobic exercise in pregnancy. Currently, empirical evidence does not exist about the association between low-impact aerobic exercise and the perception of fatigue in pregnancy. Knowledge of this information enables the CNS to appropriately counsel and educate pregnant women regarding low-impact aerobic exercise in pregnancy. Ultimately, this information serves as a tool to promote health. Therefore, the purpose of this research study is to describe pregnant women's perceived fatigue in the third trimester of pregnancy by comparing a group of pregnant women participating in a low-impact aerobic exercise program with pregnant women not doing low-impact aerobic exercise during the third trimester of pregnancy.

Statement of the Problem

Pregnant women in the third trimester of pregnancy are commonly thought to complain of fatigue. Exercise has been reported to lessen subjective perceptions of fatigue (Amundsen, 1979). What effect, then, does low-impact aerobic exercise have on pregnant women's perceived

fatigue? If participation by pregnant women in low-impact aerobic exercise results in less reported perceived fatigue, then this may be an incentive for women to exercise during pregnancy. The reduction of women's perceived fatigue during pregnancy could improve their overall state of well being, thus contributing to a more positive pregnancy outcome and improved future parent-child relationships.

The problem can thus be stated as: What is the association between low-impact aerobic exercise in pregnancy and perceived fatigue for women in the third trimester of pregnancy? Pugh, Milligan, and Kitzman's (1991) Model of Fatigue During the Childbearing Experience was used to guide the investigation of the variables, perceived fatigue and low-impact aerobic exercise in pregnancy. The variables were studied using a non-experimental, descriptive research design. The sample consisted of a select group of pregnant women half of whom participated in a low-impact aerobic exercise program and the other half attended childbirth preparation classes but did not engage in any exercise.

Outline of Proposal

Chapter II includes a discussion of the conceptual framework used to guide the study. In Chapter III, a review of the relevant literature is presented. The research methodology is described in Chapter IV. The data analysis is discussed in Chapter V with recommendations, interpretation, and implications of that data addressed in Chapter VI.

CHAPTER II

Conceptual Framework

Overview

In this chapter the conceptual framework used to guide this research study is presented along with the applicability and relevance of the conceptual framework to the problem under study. Also included are the conceptual definitions of the variables in this study, fatigue and exercise in pregnancy.

Introduction to the Conceptual Framework

Pregnant women in the third trimester of pregnancy often experience or perceive themselves to be fatigued. Fatigue is a common complaint during pregnancy (Pugh *et al.*, 1991). This complaint is so common that it is usually not considered a priority concern in the prenatal care of women. The perceived sensation of fatigue can impede the performance of day to day activities. If the cycle continues, it may impact pregnant women's perceived quality of life, overall state of health, and personal well-being. The influence of fatigue may also impact the process of the delivery of the infant and the postpartum period (Pugh *et al.*, 1991).

Lifestyle factors such as rest and sleep, nutrition, smoking and alcohol habits, and exercise have been correlated with fatigue (Pugh *et al.*, 1991). Each of these factors requires further exploration in order to understand each one's relationship with fatigue. In this research study, pregnant women's perceived fatigue was explored in relation to low-impact aerobic exercise. In order to conceptualize pregnant women's perceived fatigue in the third trimester of pregnancy, Pugh, Milligan and Kitzman's (1991) Model of Fatigue During the Childbearing Experience was used. In the next section, the main concepts in the study are defined, consistent with Pugh *et al's.*, (1991) model.

Conceptual Definitions

The main concepts explored in this research study on healthy pregnant women include fatigue and exercise.

Fatigue

A general consensus has not been reached on a definition of fatigue despite the numerous studies that have been completed (Eidelman, 1980). Hart and Freel (1982) describe fatigue as the most prevalent symptom in the healthcare field with patients often accepting the occurrence of fatigue as an accompaniment to illness or pregnancy.

Historically, fatigue has been measured in terms of how the individual felt towards his/her work or activity in terms of his/her ability to perform the task (Bartley, 1965). In a later work, Bartley (1976) emphasized the importance of self-evaluation when assessing fatigue. Bartley (1976) also added to the definition of fatigue that individuals desired to escape the feeling. Laymen then interchanged descriptors such as tiredness or weariness with the word fatigue (Bartley, 1976). Physiologists consider fatigue as simply a decrease in one's physical performance (Grandjean, 1968). Psychologists view fatigue as a condition affecting the whole person, including the deterioration of mental and physical activities while pathologists categorize it as an indicator of disorders of the neuromuscular or metabolic systems (Hart & Freel, 1982). Fatigue is often categorized on a continuum from tiredness to exhaustion (Morris, 1982). Piper (1986, 1980) defines fatigue as "a subjective feeling of tiredness that is influenced by circadian rhythm and varies in pleasantness, intensity, and duration" (p. 220).

The variation in definitions of fatigue are reflected in the many classification systems found in the literature for fatigue. First is the perception that fatigue is confined to a muscle group or groups and/or the generalized state of fatigue throughout the body (Hart & Freel, 1982). Then physiologists, Gibson and Edwards (1985), presented fatigue in terms of central and peripheral dimensions within the neuromuscular system. Another system categorized fatigue as normal, pathological, situational, or psychological (Kellum, 1985). Piper (1986) divided stressors associated with the phenomenon of fatigue into

situational and developmental. In this distinction, a state of pregnancy is considered a developmental stressor.

The phenomenon of fatigue has also been classified by its duration into acute and chronic fatigue (Piper, 1986, 1989). The differences between these divisions have been addressed by Cameron (1973), McFarland (1971), Piper (1989), and Riddle (1982). Hart and Freel (1982) synthesized these meanings with acute fatigue considered to be a temporary state that is a result of difficult or physical work but that can be resolved by rest or sleep. Chronic fatigue is considered a cumulative condition over a longer time period without immediate improvements following modifications in activity. Piper (1989) goes one step further by stating that fatigue "when acute, it serves as a protective function; when it becomes unusual, excessive, or constant (chronic), it no longer serves this function..." (p. 220). Piper's categorization of acute versus chronic states of fatigue is consistent with Bartley (1965, 1976).

Fatigue can be thought of as a defense mechanism or protective function of the body but if it is left unaddressed it could result in a chronic state of fatigue. In order to adequately assess the fatigue experienced by the individual, the subjective feelings of the individual need to be determined (Kellum, 1985; Piper, 1986; Piper, Lindsey & Dodd, 1987).

For the purpose of this research study, the focus is on the subjective dimension of pregnant women's perceived fatigue in the third trimester of pregnancy. Perceived fatigue during pregnancy has been described as being a normal occurrence, acutely occurring, experienced as a generalized feeling of discomfort as a result of the developmental stressor of pregnancy. It is assumed that interrelationships exist between fatigue and physiological, psychological, and situational factors in the childbearing experience for the pregnant woman. Lifestyle factors such as hours of sleep, nutrition, smoking and alcohol habits, and exercise history are considered for their potential

influence or modification on the perception of fatigue (Pugh *et al.*, 1991).

Consistent with Pugh *et al.* (1991), fatigue is conceptualized in this study as a subjective perception reflecting an unpleasant sensation representing an overtired experience. That unpleasant sensation includes both psychological and physiological indicators of a pregnant woman's perceived fatigue. The psychological and physiological dimensions of the perceived fatigue can be captured by symptoms in the following categories: (a) sleepy, dull feeling of fatigue; (b) decrease in concentration; and (c) projection of the fatigue to some parts of the body (Pugh, 1990).

In this research study, perceived fatigue is defined as a normal acute occurrence described as an overtired experience; it includes both psychological and physiological dimensions of three aspects of fatigue symptoms described previously. These symptoms may be influenced or modified by other physiological, psychological, and situational factors.

Exercise

Exercise is a concept that needs to be differentiated from physical activity. Physical activity is defined by Caspersen *et al.*, as "any bodily movement produced by skeletal muscles that results in energy expenditure" (1985, p. 126). Exercise is a subcategory of physical activity, "that is planned, structured, and repetitive and has as a final or intermediate objective, the improvement or maintenance of physical fitness" (Caspersen *et al.*, 1985, p. 126).

Exercise includes activities considered to be both aerobic and anaerobic. Aerobic exercise extracts energy through inspired oxygen (Campbell, 1981). Cooper (1982) expands on that definition of aerobic exercise to include any activity that requires oxygen for prolonged periods of time and forces the body to improve it's ability to handle the inspired oxygen. The American College of Obstetrics and Gynecology (ACOG) (1985) considers aerobic metabolism to occur when a physical activity forces the body to utilize increased amounts of oxygen from one minute to the next for minimal periods of 12-15 minutes.

Aerobic exercise has been further differentiated into low and high impact. Both types consist of a series of choreographed dance moves to enhance the exchange of oxygen. The aerobic routine should increase flexibility, improve muscular endurance, and strengthen and tone the body (Garvin, 1988). The low-impact type of aerobics allows the fitness benefits of high-impact while minimizing the risk of injury (Francis & Francis, 1989).

For the purpose of this study, exercise was considered to be a lifestyle factor consistent with Pugh *et al.* (1991). The type of exercise was aerobic in nature and of the low-impact variety. In addition, the low-impact aerobic exercise was performed in a formal, structured class that followed the ACOG (1985) exercise guidelines for pregnant women. In the next section, the conceptual framework used in this study is presented.

Conceptual Framework

In the Model of Fatigue During the Childbearing Experience, Pugh *et al.* (1991) identified specific physiological, psychological, and situational factors that relate to fatigue (see Figure 1). Fatigue can be influenced or modified by those factors (Pugh *et al.*, 1991). Fatigue is defined as an unpleasant state, without specific symptoms, that indicates to the woman that she is overtired (Pugh *et al.*, 1991). If that cycle is not interrupted, it may lead to exhaustion and affect the performance of daily activities.

Since fatigue is considered a multidimensional concept, it is extremely relevant to discuss fatigue in terms of physiological, psychological, and situational factors. A discussion about fatigue would be incomplete without consideration of the many aspects of the pregnant woman's life that influence her perceived fatigue. In this study, data was collected on the various situational and physiological factors that may have influenced fatigue in order to rule out their effects on the pregnant woman's perceived fatigue.

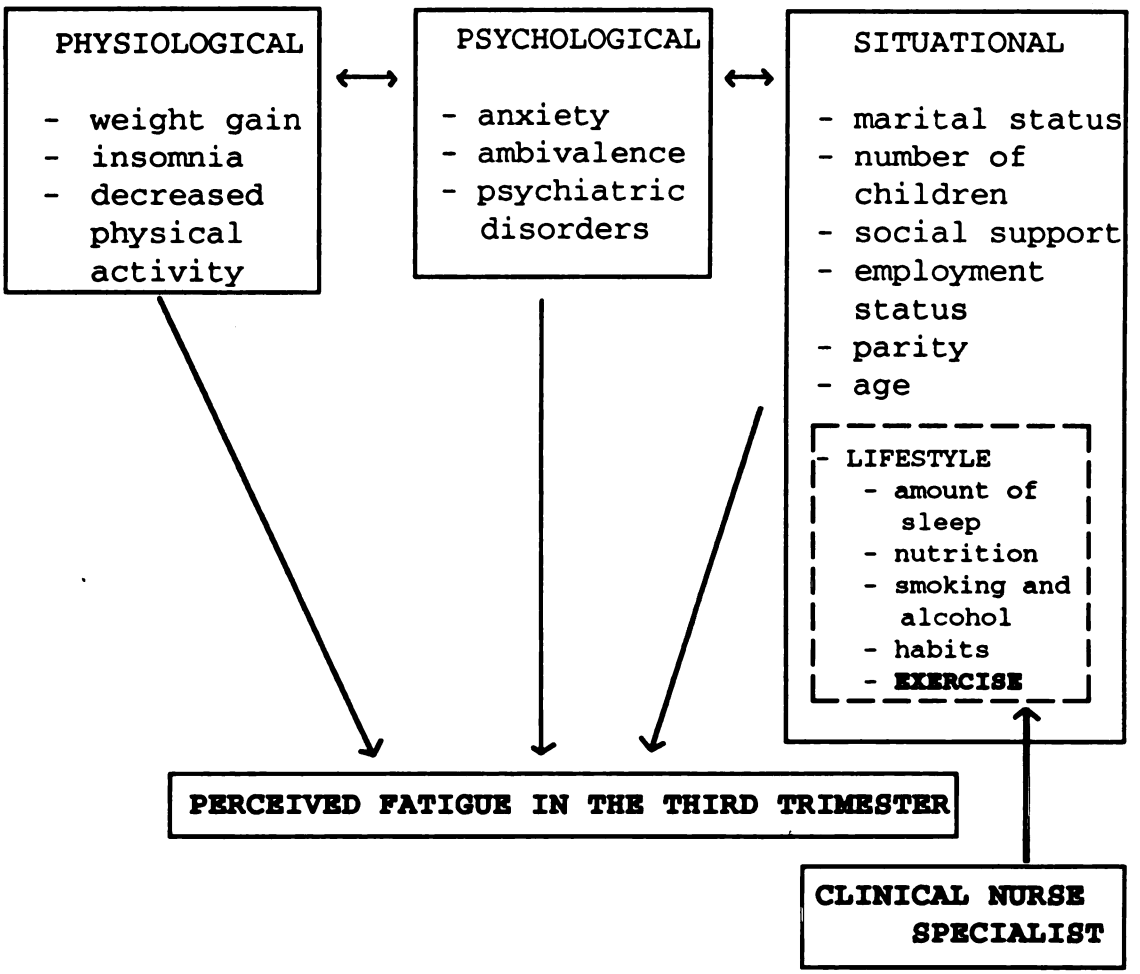

Figure 1. Model of Fatigue During the Childbearing Experience

The Model of Fatigue During the Childbearing Experience (Pugh *et al., 1991)* promotes the recognition of the problem of fatigue during pregnancy and contributing factors to that fatigue. It provides the nurse in advanced practice a way to recognize, diagnose, and recommend the appropriate interventions to minimize the level or occurrence of fatigue during pregnancy. Overall, the model allows nurses to pursue health promoting activities with the maternal population for the common complaint of fatigue (see Figure 1).

Pugh *et al.* (1991) discussed the applicability of the model for the antepartum, intrapartum, and postpartum periods of the childbearing experience. The only period addressed in the present study is the antepartum period. The antepartum period can be further divided into three trimesters. The Model of Fatigue During the Childbearing Experience (Pugh *et al.*, 1991) was applied to the third trimester of pregnancy in the present study. Pugh *et al.* (1991) discussed the common occurrence of fatigue in the third trimester of pregnancy in relation to physiological changes occurring in the pregnant woman's body, with psychological factors, and situational factors (Pugh *et al.*, 1991).

The physiological factors that were suggested by Pugh *et al.* (1991) to have a potential influence on the perception of fatigue included changes during pregnancy in the cardiovascular, respiratory, urinary, and metabolic systems. Pugh *et al.* (1991) more specifically discussed the influence of changes in hormones and basal body temperature on perceived fatigue, but also discussed the influence of pathologic causes of fatigue such as infection, anemia, and malignant disease. Specific anatomical changes, for example, the enlarging abdomen and the increased weight, determine the physiological factors for the third trimester of pregnancy. These anatomical changes are frequently accompanied by insomnia and decreased activity levels. The third trimester of pregnancy was the focus of this research study because of the multiple anatomical changes and their potential influence on the perceived fatigue of pregnant women.

Psychological factors were discussed in terms of the additional stress they place on the perceived fatigue of women during pregnancy and included factors such as anxiety, ambivalence, and psychiatric disorders (Pugh *et al.*, 1991). This study focused on the physiological and situational factors, therefore data was not obtained on the psychological factors.

The situational factors included by Pugh *et al.* (1991) that may influence fatigue during pregnancy are a lack of, or insufficient amount of social support, employment status, number of children, marital status, parity, age, and lifestyle factors. Lifestyle factors include amount of sleep, nutrition, smoking and alcohol habits, and exercise. The lifestyle factor, exercise, was the focus of this study. Therefore, the Model of Fatigue During the Childbearing Experience (Pugh *et al.*, 1991) provided an organized framework for exploring the impact of exercise on pregnant women's perceived fatigue in the third trimester.

A lack of exercise may contribute to the development of fatigue during pregnancy (Pugh *et al.*, 1991). Whether or not pregnant women include exercise in their regular routine is considered to be a lifestyle factor. The chosen lifestyle of pregnant women in the third trimester of pregnancy may impact and have a relationship to their perception of fatigue. If pregnant women perceive themselves to be fatigued, their performance of daily activities and their overall well-being in life may be affected.

The Clinical Nurse Specialist (CNS) is in a strategic position to assist pregnant women in recognizing their perceived fatigue and determine if a change in their current activity level is necessary. The CNS may reinforce current exercise practices or suggest exercise as a potential intervention. Figure 1 depicts the relationship of exercise, perceived fatigue, and the role of the nurse in advanced practice within the Model of Fatigue in the Childbearing Experience (Pugh *et al.*, 1991) for the third trimester. Based on the Model of Fatigue During the Childbearing Experience by Pugh *et al.* (1991) this research study focused on the antepartum period of the pregnancy and the relationship

of a lifestyle factor, exercise, within the situational factors, and the perceived fatigue of pregnant women.

Summary

In this chapter, the conceptual definitions of the study variables were provided. The concepts were placed in a model depicting the interrelationship of the variables. The Model of Fatigue During the Childbearing Experience by Pugh *et al.* (1991) provided the conceptual framework for this study. In the next chapter, a review of the literature is presented.

CHAPTER III

Review of Literature

Overview

In this chapter, the relevant literature is presented in order to provide support for the exploration of the concepts of perceived fatigue and exercise in pregnancy. Included in the review is an historical presentation on the study of fatigue. In order to establish the link between exercise and fatigue, the potential connection between fatigue and physical activity and fatigue in women is presented. The establishment of a connection between fatigue in women leads into a discussion of the importance of the relationship of fatigue in the childbearing experience with a connection to exercise. The identification of the need for research on fatigue and exercise in pregnancy also means determining the safety of exercising during pregnancy. And finally, the psychological benefits of exercise on perceived fatigue in pregnancy are presented.

The focus of this research study is the acute occurrence of fatigue in healthy pregnant women, therefore the research studies that addressed fatigue in clinical populations with diseases will not be presented. The condition of chronic fatigue syndrome will not be explored in this chapter due to the chronicity of this condition.

Historical Background on the Study of Fatigue

The concept of fatigue is not unique to health care. In fact, the early research studies focused on industrial fatigue experienced by employees in relation to their productivity (Cameron, 1973). Cameron (1971) expressed dissatisfaction with early studies on fatigue because they did not recognize the industrial worker's general health and well-being. Yoshitake (1971) elaborated on those concepts with the proposal that the study of industrial fatigue should include consideration for worker performance, changes in psychological and physiological function, and subjective feelings of fatigue.

In the 1960's, The Japanese Industrial Research Committee developed the Fatigue Symptom Checklist (FSC) to measure industrial fatigue (Yoshitake, 1971). Yoshitake (1978) challenged the ability of the FSC to measure subjective feelings of fatigue. When Yoshitake (1971) investigated the relationship of subjective symptoms of fatigue to levels of fatigue among broadcasting and bank workers, it was found that the more numerous the subjective symptoms of fatigue, the greater the level of fatigue.

The extent of information known about fatigue in specific clinical populations is limited (Piper, 1989). Piper *et al.* (1987) suggest that the most appropriate method to assess fatigue in clinical populations is to determine each individual's perception of his/her fatigue. Information collected on patients' perceptions of fatigue are necessary to guide future nursing assessments and interventions (Piper, 1989). The identification that minimal amounts of information are currently known about fatigue in specific populations lends further credibility to the need for research on fatigue in women during pregnancy. In addition, the information that is most relevant for nursing action is the identification of perceived fatigue of patients. The next section includes a discussion about the relationship between fatigue and physical activity in order to begin to establish a link between fatigue and exercise.

Fatigue and Physical Activity

Chen (1986) explored the relationship between self-perceived fatigue and anthropometric, lifestyle, health status, psychological, and nutritional factors through the secondary analysis of data from the Health and Nutrition Examination Survey of adults 25-74 years of age. Chen (1986) found a negative association between fatigue and physical activity for both men and women. The inactive subjects were identified as having more than twice the risk of being fatigued than the physically active subjects. Chen (1986) could not determine a cause and effect relationship between fatigue and physical activity. The report did not provide the survey or sampling details or how the variables were

defined, particularly the variable of physical activity. A statistically significant difference was found in the incidence of fatigue based on gender in the study by Chen (1986). Women had a 1.5 times greater risk of being fatigued than men. The proposition that women are at a greater risk for fatigue is a stimulus for further investigation regarding fatigue in women. The concept of fatigue in women is presented in the next section.

Fatigue in Women

The increased risk of fatigue in women may be related to physical causes such as hormonal changes during pregnancy, dietary problems, and a lack of physical fitness (Riddle, 1982). Gendel (1973) reviewed college age women's physical activity histories from childhood to determine the impact on current daily functioning. The sample included 67 women (of moderately affluent backgrounds) who were not pregnant or professional athletes. The women in the sample were assigned to either a physically active group (n = 46) or a nonactive group (n = 21) based on physical activity history, physical exam, medical complaint history, and physical fitness tests (Gendel, 1973). The physically active group had fewer complaints of fatigue than the nonactive group of college women. The exact criteria used by Gendel (1973) to determine eligibility into the two groups is unclear. Gendel's (1973) research study supports the association between exercise and fatigue for women. The findings have limited applicability for the population, however, due to the small, self-selected, homogeneous sample.

The report by Gendel (1973) also included a discussion about eight women (11%) of the total sample that had previously experienced a pregnancy. These eight women in the study showed high correlations with fatigue. Gendel (1973) proposed a link between fatigue in the childbearing period and a lack of exercise, although failed to recognize a potential relationship between fatigue and childcare responsibilities for these eight women in the study. The involvement of women in regular physical activity during pregnancy was advocated by Gendel (1973) for two reasons. One reason is to prepare for childbirth and the other is

to prepare for motherhood and the great number of responsibilities. The concept of fatigue in the childbearing period is reviewed in the next section.

Fatigue in Childbearing

Fatigue is considered a common complaint during pregnancy (Pugh *et al.*, 1991). There is a minimal number of research studies that address the issue of fatigue during the childbearing experience. No research studies were found that specifically addressed fatigue in the antepartum period. Fatigue in childbearing, therefore, is reviewed through analysis of several research studies from the intrapartum and the postpartum periods.

Fatigue in the Intrapartum Period

The research on fatigue in the intrapartum period was limited to only one study. Pugh (1990) studied levels of fatigue and the associated maternal factors in 100 primiparous women as they progressed through their labor and delivery experiences. The study was a descriptive, longitudinal design. A measurement of subjective fatigue using the Modified Fatigue Symptom Checklist was completed within the first six hours of labor and then again 12 to 24 hours into the postpartum period. The results of this study are currently in the process of publication. L.C. Pugh (personal communication, August 12, 1991) found a strong correlation between increased levels of fatigue in the intrapartum period and increased levels of fatigue in the postpartum period. The recognition of a relationship between levels of fatigue in the intrapartum and postpartum periods raises the question about the impact of fatigue perceived in the antepartum period on later phases in the childbearing experience, especially the postpartum period.

Fatigue in the Postpartum Period

The occurrence of fatigue in the postpartum period does not only impact the woman and her family but also the future relationship with the new baby. Despite the potentially negative effects of fatigue in pregnancy the number of studies approaching this issue are extremely limited. A study completed in 1965 reported on 100 women who were

between the ages of 18 and 23 and who complained of chronic low backache and fatigue in the postpartum period (Gendel, 1973). The author of this study suggested that the women's complaints affected their functioning as mothers and wives. Over a period of 6-10 months, the 35 women participated in individualized conditioning programs and at the same time had decreased numbers of complaints of chronic low backache and fatigue (Gendel, 1973). The generalizability of this study is limited, due to the lack of definition of the concepts of physical activity, postpartum, and fatigue. It is also not known what methods or instruments were used to measure the concepts.

Gardner (1991) also investigated fatigue in the postpartum period. A sample of 35 women who had normal spontaneous vaginal deliveries were surveyed at two days, two weeks, and six weeks postpartum to determine their levels of fatigue (Gardner, 1991). The Rhoten Fatigue Scale was used to measure the level of postpartum women's perceived fatigue. Findings of mild fatigue without significant changes in that fatigue over the three measurement times were reported.

Gardner (1991) also analyzed the demographic characteristics of the sample to determine the relationship to high levels of fatigue. Correlations were found between fatigue and childcare arrangement problems at two days postpartum ($r = .27$), and with age ($r = -.34$) and mother's education ($r = -.48$) at six weeks postpartum. These findings were interpreted by Gardner (1991) that older mothers with childcare problems experienced more fatigue. These findings have implications for maternal-child nurses working with postpartum women that have uncomplicated vaginal deliveries. The occurrence of fatigue in the postpartum may impact the health and parenting ability of women (Gardner, 1991). The generalizability of this study is limited by the small sample size and bias sample of predominantly older, white, and married postpartum women.

The frequency with which pregnant women experience fatigue merits attention by healthcare professionals. Research studies have begun to demonstrate that the occurrence of fatigue in the intrapartum period may

continue into the postpartum period. Perceived fatigue in the postpartum period may affect women's overall well-being and relationships with the new infant and the family.

The identification of fatigue in the postpartum period supports the need to discover methods to prevent fatigue from occurring in the antepartum period that may continue into the postpartum period. It has been reported that non-pregnant women have experienced positive benefits of exercise with improvements noted in quality of life, self concept and decreased feelings of fatigue (Aistars, 1987; Amundsen, 1979; Frank-Stromberg, 1986). The link between exercise and fatigue for non-pregnant women supports the need to further explore exercise in pregnancy. Future research needs to study the role of exercise in preventing or alleviating fatigue for pregnant women. Of particular interest in this research study is the analysis of the antepartum period to determine if an association exists between the perception of fatigue and exercise during pregnancy.

Exercise in Pregnancy

Physiological Effects

A review of the numerous physiological studies completed on exercise in pregnancy reveals some major limitations. First, much of the research has been completed on animals. Several studies completed on pregnant animals have revealed decreases in uterine blood flow by 20-60% during exercise (Clapp, 1980; Lotgering *et al.*, 1983), however blood flow reduction may be compensated for by other changes (Curet *et al.*, 1976; Hohimer *et al.*, 1984). The results of animal studies have limited applicability to humans due to anatomical and physiological differences (Fishbein & Phillips, 1990; Wallace & Engstom, 1987). Secondly, ethical and legal issues limit studies with pregnant women. Researchers must carefully protect the physical and psychological well-being of both the mother and the fetus. Most studies have small sample sizes of highly selective women and few studies involve exhaustive exercise because of potential harm to the fetus (Lotgering *et al.*, 1984; Wallace & Engstrom, 1987).

The limitations imposed by pregnancy on exercise are considered in terms of fetal and maternal risks (Huch & Erkola, 1990). The pregnant woman's body makes physiological adjustments to meet the demands of the pregnancy (Fishbein & Phillips, 1990). These physiological alterations include maternal weight, basal body temperature, resting heart rate, and alveolar ventilation (Artal, 1986). Exercise then places additional demands on the body which must be carefully assessed to protect the safety of the mother and the fetus. The hypothetical risks of exercise during pregnancy include whether or not the uterine blood flow is adequately maintained to meet the oxygen needs of the fetus (Clapp, 1980, 1985; Curet *et al.*, 1976).

Another area of concern is thermoregulation during pregnancy since elevations in maternal temperature have been associated with teratogenetic effects (Lotgering *et al.*, 1984). Jones, Botti, Anderson and Bennett (1985) disputed this argument with postulations that pregnant women appear capable of dissipating the heat produced by metabolic activities associated with exercise.

The regulation of the fetal heart rate during exercise for pregnant women presents another potential risk. Results of research studies in this area range from increases in fetal heart rate after exercise, bradycardia during exercise, or an absence of significant changes (Artal, Rutherford, Romen, Kammula, Dorey, & Wiswell, 1986; Clapp, 1985; Collings & Curet, 1985; Curet *et al.*, 1976; Hauth, Gilstrap & Widmer, 1982; Pijpers, Wladimiroff & McGhie, 1984).

A final area of concern is the risk to the mother related to changes in connective tissue and the body's center of gravity during pregnancy (ACOG, 1985). These changes make pregnant women more susceptible to injury during exercise (ACOG, 1985).

Despite the conflicting research findings a number of researchers propose that exercise during an uncomplicated pregnancy is not harmful to the pregnant woman or the fetus (Collings *et al.*, 1983; Dressendorfer & Goodlin, 1980; Jarrett & Spellacy, 1983; Lotgering *et al.*, 1985;

Pomerance *et al.*,1974). ACOG (1985) developed exercise guidelines specifically for low risk pregnant women with uncomplicated pregnancies.

The benefits of exercise in pregnancy include a proposed relationship between exercise and shortened labors and/or increased endurance for labor (Clapp & Dickstein, 1984; Collings *et al.*, 1983; Kulpa, White, & Visscher, 1987). Exercise has been shown to improve or maintain physical fitness during pregnancy among pre-conditioned athletes (Collings *et al.*, 1983; South-Paul *et al.*, 1988). Some athletes improved their performance during pregnancy (Zaharieva, 1972).

The physiological effects of exercise have been reviewed with the literature suggesting relative safety for the pregnant woman including exercise in her lifestyle. The relative safety for the pregnant woman and the fetus during exercise supports further exploration of the concept of exercise in the antepartum period. The next step is to review the physiological effects of exercise during pregnancy.

Psychological Effects

The psychological benefits of exercise for nonpregnant individuals are well established. Those benefits include increased self-esteem, confidence, happiness, energy and productivity with decreased depression, anxiety, and fatigue (Cooper, 1982; Garvin, 1988; Hughes, 1984). It would appear that exercise should have the same effects for pregnant women, although this area has not been well researched. Pregnancy is a time when many women experience fatigue, as well as other psychosomatic complaints, sleeping problems, and negative body images; therefore the psychological effects of exercise are worthwhile to discover (Reich, 1987).

A descriptive study at the Melpomene Institute for Women's Health completed in 1983 surveyed 77 runners, 27 swimmers, and 27 non-exercising women at two and six months postpartum about their medical histories, patterns of exercise, nutrition, discomforts, and labor and delivery experiences. The main psychological benefits revealed through the retrospective questioning was the discovery of a

relationship between inactivity and fatigue (Melpomene, 1990). The actual strength of that relationship was not reported.

A pre-experimental study by Wallace, Boyer, Dan and Holm (1986) investigated the relationship among aerobic exercise, self-esteem, and physical discomforts occurring during pregnancy through comparison of a group of 31 exercising women with a group of 22 nonexercising women. All subjects were at least 27 weeks pregnant and participating in prenatal classes. A tool, the Physical Discomfort Checklist, was designed specifically for this study to measure the women's perceptions of the frequency and intensity of 29 minor symptoms during pregnancy (Wallace *et al.*, 1986). Overall, the exercising group had higher self-esteem scores and fewer physical complains than the nonexercising group. Significantly lower scores for fatigue were found for the exercising group. In addition, Wallace *et al.* (1986) found the relationship between the amount of exercise and reported symptoms in the third trimester to have significant inverse relationship ($r = -.49$; $p = .03$). In other words, the women who exercised more had fewer symptoms of physical discomfort.

Wallace *et al.* (1986) suggested possible explanations for exercise's relationship with fewer physical complaints. Physiological alterations produced by changes in aerobic capacity may have influenced the actual discomforts of pregnancy. Exercise may have improved the women's attitudes about their health and therefore made them less vulnerable to minor physical discomforts. Finally, exercise may have provided a technique to manage stress and decrease the incidence and perception of physical discomforts. Limitations of this study included a lack of random assignment of subjects to the groups and a biased sample. The majority of the pregnant women in the sample were white, married, and older. The findings from this study demonstrate a relationship between fatigue and exercise in the antepartum period and supports the need to further explore that relationship.

Research has demonstrated relative safety for low risk pregnant women and their fetuses while engaging in exercise. A link between

inactivity and fatigue has been recognized in several research studies. One research study suggested a relationship between fatigue and exercise, but requires further investigation in order to validate this finding. A similar study would assist the healthcare professional to understand the relationship of fatigue and exercise in pregnancy.

Summary

The review of the literature provided background information and support for a research study to investigate the relationship between fatigue and exercise in pregnancy. The discovery of only one research study that directly addressed the relationship between fatigue and exercise in the third trimester of pregnancy further supports the need for additional research on this topic. Future research is needed to document the role of exercise in preventing or alleviating perceived fatigue during pregnancy. Knowledge regarding the positive impact of exercise on fatigue during pregnancy provides the healthcare professional with an objective intervention to recommend to low risk pregnant women. This research study will provide information on the association between exercise in pregnancy and perceived fatigue. The next chapter includes the methodology used in the study.

CHAPTER IV

Methods

Overview

In this chapter, the research methods and design that guided this research study are presented. This chapter also includes operational definitions of the variables and the criteria for the selection of subjects for the sample. In addition, a description of the field procedures, instrumentation, data collection and analysis procedures, methodological assumptions and limitations, and the protection of human rights are discussed.

Methods

A non-experimental two-group descriptive design was used to explore the association between low-impact aerobic exercise in the third trimester of pregnancy and women's perceived fatigue. The two groups include one group of pregnant women participating in a formalized structured low-impact aerobic exercise program and a second group of pregnant women not participating in regular aerobic exercise. The data were collected cross-sectionally and analyzed quantitatively for both groups. The independent variable, exercise in pregnancy, was measured on a nominal scale. The dependent variable, perceived fatigue, was measured on an interval scale.

Operational Definitions

Perceived Fatigue

Perceived fatigue was determined by the pregnant woman's subjective perception and report of an unpleasant sensation which consisted of symptoms representative of an overtired experience. These symptoms included both psychological and physiological indicators of a woman's perceived fatigue. The Modified Fatigue Symptom Checklist (MFSC) adapted by Pugh (1990) consists of symptoms divided equally among three subscales that measure psychological and physiological indicators of perceived fatigue. The three subscales include 10 subjective symptoms regarded as the sleepy, dull feeling of fatigue, another 10 symptoms

characterized as a decrease in concentration, and 10 symptoms as a projection of the fatigue to some parts of the body (Pugh, 1990). A total summative score on the MFSC was used to measure the pregnant woman's perceived fatigue. The perceived fatigue may be modified or influenced by physiological, psychological and/or situational factors.

The potential range of scores was from 30 to 120, with the higher scores indicating a greater perception of fatigue. The MFSC was chosen to measure perceived fatigue in this study because this tool was developed to study the subjective feelings of fatigue (Yoshitake, 1971). This instrument has also been utilized in healthy populations which is consistent for pregnant women.

Exercise in Pregnancy

For the purpose of this research study, exercise was operationalized as low-impact aerobic exercise. It was defined as a choreographed activity that utilizes oxygen with one foot always in contact with the floor to prevent injury. The aerobic component of the exercise class was at least 12 minutes in length. The low-impact aerobic exercise for pregnant women was performed in a formally structured program at least twice a week with the goal of improving or maintaining physical fitness. The exercise program was based on the ACOG Guidelines for aerobic exercise for pregnant women (1985). Exercise in pregnancy was scored as a dichotomous measure. The pregnant women participating in a formally structured low-impact aerobic exercise program on a regular basis were scored as a one for yes. The pregnant women not participating in a formally structured low-impact aerobic exercise program or any other type of aerobic exercise on a regular basis were scored as a two for no.

Research Question

The purpose of this study was to determine the association between exercise in pregnancy and perceived fatigue. The research question addressed in this study was as follows: What is the association between low-impact aerobic exercise in pregnancy and perceived fatigue for women in the third trimester of pregnancy?

Sample

The target population of this research study consisted of pregnant women with low risk pregnancies in the third trimester of pregnancy. A convenience sample was recruited through investigator solicitation at prenatal exercise classes, specifically low-impact aerobic exercise classes, provided by YMCA's, community centers, hospitals, private health clubs and at childbirth preparation classes provided by a local community organization in lower Michigan. A list of the sites utilized in this research study for data collection can be found in Appendix A.

Females who met the following criteria were recruited: (a) in the third trimester of pregnancy; and (b) able to understand and write English in order to give consent and complete the questionnaire. Women were excluded if they reported a history of heart disease, three or more spontaneous abortions, vaginal bleeding or placenta previa, premature rupture of membranes or preterm labor, incompetent cervix, or multiple gestation on the self-history form.

Two groups were identified from the sample: one group of pregnant women participating in a formalized structured low-impact aerobic exercise program, and a second group of pregnant women not participating in regular aerobic exercise. The estimated sample sizes for the groups were based on power analysis. At a significance criterion of 0.05, a power of 0.8, and with a large effect size, the suggested group size was 26. The actual sample size was 54, with 27 in each group.

Data Collection Procedure

The investigator explained the study to the contact persons at the various sites and elicited permission to identify potential participants for the study (see Appendix B). The data collection procedure was as follows:

1. At each class the investigator/data collector solicited participation in the study by explaining the study to potential subjects at the various prenatal exercise and childbirth preparation classes (see Appendix C).

2. The investigator/data collector then provided interested subjects with a cover consent letter (Appendix D), the Self-History Form (Appendix E), and Fatigue Instrument (Appendix F)
3. The subjects read the cover letter and gave consent to participate in the research study by completing the forms while waiting for their classes.
4. Subjects returned the self-history form and fatigue instrument to the investigator/data collector.
5. The investigator then assigned or excluded the women from the study based on the self-report of aerobic exercise on the self-history form.

Data collection took place between January and February 1992.

Instrumentation

Self-History form

A questionnaire was developed by this researcher to obtain demographic data (age, race, marital status, educational level, employment, and family income), parity, number of preschool age children, relevant medical and obstetrical history, and lifestyle factors. Lifestyle factors included exercise history, number of hours of sleep, and smoking and alcohol habits. This information was used to identify eligible participants and to describe the sample (Appendix E).

Modified Fatigue Symptom Checklist

This tool is a modification of the Fatigue Symptom Checklist (FSC) which was designed by the Industrial Research Committee of the Japanese Association of Industrial Health in 1949 (Yoshitake, 1971). The purpose of the FSC was to measure industrial workers' subjective feelings of fatigue. The 30-item FSC is equally divided into three subscales with 10 items in each. The first subscale contains symptoms categorized as the "dull, sleepy" feeling of fatigue. The second subscale includes symptoms that are thought to indicate a decrease in concentration, and the third subscale contains symptoms categorized as a projection of fatigue to some parts of the body (Yoshitake, 1971). Kinsman and Weiser

(1976) completed a factor analysis on the FSC that demonstrated that the factors were three dimensions of perceived fatigue.

In the MFSC, Pugh (1990) retained the 30-items divided into three subscales, each consisting of 10 items. The modifications in the FSC by Pugh (1990) included: (a) Subjects were informed to respond on the checklist exactly how they were feeling at that particular moment; (b) items on the tool were made into complete sentences in the present tense; and (c) the response options were scaled to increase the variability. A total summative score was used to represent the pregnant woman's perceived fatigue. For Pugh's (1990) study, the subscale scores were not reported. Pugh (1990) reported reliability estimates for the MFSC in terms of alpha coefficients for the total score and the subscales at two different measurement times. The first measurement time was during the first six hours of a woman's hospitalization for labor and the second measurement was within 24 hours of the delivery (Pugh, 1990). The alpha coefficients were .92 and .94 respectively for the total score. The subscales had alpha coefficients between .77 and .87 for the first measurement time and between .80 and .90 for the second time. The alpha coefficient was consistently lower for the subscale of items representing the projection of fatigue to some part of the body, although the results still suggested that the performance on one item is a good indicator of performance on another item for the total tool as well as the subscales. Putt (1976) and Rhoten (1982) also modified the FSC but failed to report reliability or validity.

Concurrent validity testing between the MFSC and the Fatigue Visual Analogue Scales used in Pugh's (1990) study were reported to be significantly correlated. This supports the assumption that the instruments were measuring the same construct. See Appendix F for a copy of the MFSC.

Data Analysis

The investigator did all the data coding and entry. Descriptive and inferential statistics were used to analyze the data. Descriptive statistics were computed on the demographic data, relevant medical and

obstetrical data, and lifestyle factors collected on the sample. Descriptive statistics included frequency distributions, measures of central tendency, and measures of variability. The equivalence of groups on selected demographic, lifestyle factors, and pregnancy characteristics were analyzed by using the Chi-square analyses of association for categorical variables of race, marital status, educational level, job category, total family income, and alcohol use. ANOVA's were computed for the continuous variables of age, work hours, number of pregnancies and preschool children, weeks gestation, weight gain, smoking habits, and number of hours sleep. Covariates were selected from the analysis of group differences on variables thought to potentially impact perceived fatigue and from correlations with the selected variables with perceived fatigue. ANCOVA was used to determine if there was a difference between the groups. The alpha level of significance was set at .05.

Methodological Limitations

Several limitations were presented in the methodology used for this research study:

1. A non-experimental design does not allow for testing of causality, however, it does allow for inferring functional relationships among variables.
2. There may be other physiological or psychological factors that influence perceived fatigue that were not addressed in this study.
3. The non-random assignment of subjects to the groups limits the generalizability of the findings to the general population.
4. Access to pregnant women participating in formalized, structured low-impact aerobic exercise was limited by the small number of available classes of this type.

Protection of Human Subjects

The rights of the subjects were protected by following the established criteria of the University Committee on Research Involving Human Subjects (UCRIHS). Approval of the research study was obtained prior to the collection of data (see Appendix G).

At the time of the classes, the investigator/data collector emphasized that all participation was voluntary and anonymous. The confidentiality and anonymity of all subjects was maintained because the researcher did not have access to subjects' names only to the class in which they participated.

Summary

In summary, analysis of the data collected as guided by this research design attempted to find an association between exercise in pregnancy and perceived fatigue. The next chapter, Chapter V, includes data analysis procedures and the findings of the study. A discussion of the implications of the results and recommendations for future research is presented in Chapter VI.

CHAPTER V

Data Analysis

Introduction

In this chapter, the results of the study are presented. Descriptive characteristics are presented on the demographic and obstetrical data and lifestyle factors collected on the sample. Data relevant to the research question and the data collection instrument are discussed.

Description of the Sample

The results presented were obtained from the Self-History Form completed by each pregnant woman.

Overall Sample

A total of 97 questionnaires were distributed. Forty-seven questionnaires were distributed to pregnant women enrolled in low-impact aerobic exercise classes. Of the 47 returned, 20 (43%) were excluded because the participants' gestational age was less than 27 weeks. Five of the women were in the first trimester of pregnancy and the other 25 women were in the second trimester of pregnancy. The remaining 27 pregnant women were assigned to the low-impact aerobic exercising group.

Fifty questionnaires were distributed to pregnant women attending childbirth preparation classes. Of the 50 returned, 22 (44%) were excluded from the study because they participated in low-impact aerobic exercise on a regular basis. Fifteen of the women walked and seven women performed other types of low-impact aerobic exercise. One woman had premature labor. The remaining 27 pregnant women were assigned to the non-exercising group.

The subjects (N = 54) were between 21 and 38 years of age (M = 28.9, SD = 3.9), white (94.5%), married or cohabitating (94.5%), and well-educated, with 50 women (92.5%) having completed at least some college and, of these, 7.6% had advanced study beyond four years of college. Of the 44 women who worked outside of the home, 52.7% were employed 40 or more hours per week. More than three quarters of the

women reported total family income to be $35,000 or more per year, with 49.1% above $50,000 per year.

The majority of the women were pregnant for the first time (65.5%), without preschool children living at home (80%). Weeks of gestation for these women ranged between 27 to 40 weeks (M = 33, SD = 3.5) and was not significantly correlated with perceived fatigue.

Differences Between the Low-Impact Aerobic Exercising Group and the Non-Exercising Group

Differences between the low-impact aerobic exercising group and the non-exercising group of pregnant women were examined by means of one-way analysis of variance (ANOVA) and Chi-square analysis of association. One-way ANOVA was done for age, weeks of gestation, number of pregnancies, number of preschool children living at home, weight gain during pregnancy, number of cigarettes smoked per day, the number of hours worked per week, and number of hours sleep in a 24-hour period. The characteristics of the two groups of women on the continuous variables examined by the one-way ANOVA are presented in Table 1. Chi-square analysis of association was done to test for differences on race, marital status, education completed, job activity, total family income, and alcohol use. The characteristics of the women in the two groups on the categorical variables tested by the Chi-square analysis of association are presented in Table 2.

The one-way ANOVA revealed a statistically significant difference between the groups for the average number of hours slept in a 24-hour period (F = 4.9, p = .03, df = 1). The low-impact aerobic exercising group reported sleeping an average of 7.15 hours compared to an average of 8.15 hours for the non-exercising group. The one-way ANOVA was not statistically significant for any of the other continuous study variables.

A statistically significant difference was not found between the groups on weight gain during the pregnancy; however non-exercising women gained an average of approximately four pounds more than the low-impact aerobic exercising women for the same equivalent weeks of gestation.

Table 1
Characteristics of the Pregnant Women by Group (n = 27 for Each Group) for the Continuous Variables

Characteristics	Group	
	Low-Impact Aerobic Exercising	Non-Exercising
Age		
M	29.1	28.7
SD	3.1	4.7
Range	24-38	21-36
Number of Work Hours		
M	25.6	31.5
SD	18.2	15.0
Range	0-50	0-40
Weeks Gestation		
M	32.7	33.2
SD	4.2	2.7
Range	27-40	28-39
Number of Pregnancies		
M	1.6	1.3
SD	1.0	0.7
Range	0-4	0-3
Number of Preschool Children		
M	0.4	0.4
SD	0.8	1.7
Range	0-3	0-9
Hours of Sleep		
M	7.2	8.2
SD	1.7	1.7
Range	6-9	6-12

table continues

Table 1 continued

Characteristics	Group	
	Low-Impact Aerobic Exercising	Non-Exercising
Weight Gain		
M	23.6	27.6
SD	9.9	8.0
Range	10-54	15-45
Cigarettes/day		
M	0.44	1.4
SD	1.7	4.7
Range	0-7	0-20

Table 2

Characteristics of the Pregnant Women by Group (n = 27 for Each Group) for the Categorical Variables

Characteristics	Group			
	Low-Impact Exercising		Non-Exercising	
	n	%	n	%
Race				
White	26	96.3	26	96.3
Black	1	3.7	1	3.7
Marital Status				
Never Married	0	0	1	3.7
Married/Cohabitating	27	100	25	92.6
Divorced/Separated	0	0	1	3.7
Education Completed				
High School/GED	1	3.7	3	11.1
Some College	8	29.6	13	48.1
College Graduate	17	63.0	7	25.9
Some Graduate School	63	3.7	0	0
Completed Graduate School	0	0	3	11.1
Total Family Income				
$10,000-19,999	0	0	7	25.9
$20,000-34,999	2	7.4	1	3.7
$35,000-49,999	7	25.9	10	37.0
$50,000-74,000	7	25.9	6	22.2
$75,000-99,000	9	33.3	2	7.4
$100,000 or more	2	7.4	1	3.7

table continues

Table 2 continued

Characteristics	Group			
	Low-Impact Exercising		Non-Exercising	
	n	%	n	%
Alcohol Use				
1-2x/week	2	7.4	0	0
1-2x/month	1	3.7	1	3.7
less than 1x/month	5	18.5	2	7.4
none since pregnant	14	51.9	19	70.4
never	5	18.5	5	18.5

The Chi-square analysis of association revealed statistically significant differences between the two groups for the factors of total family income and level of education completed. The total family income was significantly higher for the low-impact aerobic exercising group than the non-exercising group of pregnant women (χ^2 = 12.72, p = .03, df = 5). Sixty-six percent of the low-impact aerobic exercising group reported a total family income of $50,000 or more per year as compared to 33.3% of the non-exercising group. Overall, higher total family income was associated with participation in an exercise program.

The level of education completed by the pregnant women was significantly different between the two groups (χ^2 = 10.34, p = .04, df = 4). The low-impact aerobic exercising group had 18 (66.7%) pregnant women that graduated from college and the non-exercising group had 10 (37%). The non-exercising group had three individuals (11.1%) with education not beyond high school as compared to one woman (3.7%) in the exercising group. A greater amount of variation was found in education levels for the non-exercising group. The low-impact aerobic exercising group of women had a higher overall education level.

The Activity Levels of the Groups

Each woman in the study was asked to compare her current activity level to other pregnant women, although no definition of activity level was provided for the participants. The majority of the exercising pregnant women in this study described their activity level as more than other pregnant women (n = 20, 74.1%) while 25.9% (n = 7) described their activity level as the same as other pregnant women. A greater percentage of non-exercising women in this study described their activity level as the same (n = 14, 51.9%) as other pregnant women, 25.9% (n = 7) reported their activity as more than other pregnant women, and 11.1% (n = 3) described their activity level as less than other pregnant women.

Of the pregnant women in the exercising group, 15 (55.6%) reported performing the low-impact aerobic exercise in the pre-pregnant state. Sixteen (59.3%) of the pregnant women in the exercising group performed

the low-impact aerobic exercise in the first trimester. The number of pregnant women performing the exercise increased to 24 (88.9%) in the second trimester, and 27 (100%) in the third trimester. Data was not collected on the activity levels prior to nor during the first and second trimesters for the non-exercising group of women.

Analysis of the Data Collection Instrument

In this section the reliability of the Modified Fatigue Symptom Checklist (MFSC) is presented in terms of the overall instrument for the sample, the sample groups, and the internal consistency of the subscales of the instrument. As seen in Table 3, the Cronbach alpha coefficients obtained for the total MFSC for the entire sample and the individual group (r = .89 - .91) was just slightly lower than Pugh (1990) (r = .92, .94). The internal consistency of the subscales presented a pattern similar to the findings of Pugh (1990) for the first measurement time, with subscale 2 having a slightly higher alpha coefficient than subscale 1, and subscale 3 with a lower alpha than the other two subscales. The alpha coefficients for the total score and the subscales appear in Table 3.

Research Question

In reviewing the lifestyle factors (Pugh *et al.*, 1991) that could influence or modify perceived fatigue in pregnant women in the third trimester of pregnancy two lifestyle factors emerged that were different between the two groups of pregnant women. The hours of sleep reported by the women in this study were statistically different between the two groups based on the one-way ANOVA with the exercising pregnant women reporting significantly less hours of sleep than the non-exercising pregnant women. Hours slept in a 24-hour period were correlated with perceived fatigue for the entire sample, but were not statistically significant (r = .15). The amount of weight gained was not significantly different between the two groups, however, amount of weight gain was significantly correlated with perceived fatigue for the sample (r = .49, p = .001) and for the non-exercising group of pregnant women (r = .47, p = .01).

Table 3

Reliability Scores for the Modified Fatigue Symptom Checklist for Low-Impact Aerobic Exercising and Non-Exercising Groups (n = 27 for Each Group) and as Reported by Pugh (1990)

Scale	Group				
	Low-Impact Aerobic Exercising	Non-Exercising	Entire Sample	Pugh (1990) Time 1	Time 2
Total	.89	.90	.91	.92	.94
Subscale 1	.77	.80	.80	.85	.90
Subscale 2	.80	.81	.83	.87	.84
Subscale 3	.61	.72	.71	.77	.80

The hours of sleep and weight gain were then selected as co-variates with low-impact aerobic exercise due to the significant differences between the two groups on sleep and the correlation of weight gain and perceived fatigue. Hours of sleep and weight gain were entered into an analysis of covariance to determine if the differences in perceived fatigue were due to the exercise or these factors.

Exercise was found to account for a significant portion ($eta^2 = .19$) of the effect on fatigue following the analysis of co-variance (ANCOVA). The mean difference in the total fatigue score between the two groups was significantly different ($F = 12.35$, $p = .00$, $df = 1, 42$), with the mean adjusted total summative fatigue score for the low-impact aerobic exercising group significantly lower ($M = 48.5$) than the mean adjusted total summative score for the non-exercising group ($M = 57.3$). A difference was found in the perceived fatigue between pregnant women doing low-impact aerobic exercise in a formalized, structured class and those women not performing regular aerobic exercise.

Summary

The statistical analyses have been presented with an answer to the research question. In Chapter VI the findings will be discussed and interpreted including the implications for nursing practice, education, and research.

CHAPTER VI

Recommendations, Interpretation, and Implications

Introduction

The interpretation of the research findings in terms of the conceptual framework, literature, and methods employed in this study is presented in this chapter. Also included in this chapter is the discussion of the implications for advanced nursing practice and primary care and recommendations for future research.

Interpretation of Findings

Overview

This research study was guided by the Model of Fatigue During the Childbearing Experience (Pugh *et al.*, 1991). This model was selected because it provided a means to explore the association between exercise and fatigue. In this model, exercise is identified as a lifestyle factor, broadly categorized as a situational factor, that influences fatigue (Pugh *et al.*, 1991). Perceived fatigue is considered a multidimensional feeling affected by situational factors such as sleep, nutrition, social support, employment status, income educational level, alcohol and smoking habits, parity, marital status, number of children, and age (Pugh *et al.*, 1991). In this study, data was collected on these situational factors in order to identify any differences that existed between the low-impact aerobic exercising group and the non-exercising group of pregnant women in the third trimester of pregnancy.

The two groups of pregnant women were found to be similar on all of the situational factors except for significant differences on income, educational level, and hours of sleep in a 24-hour period. The low-impact aerobic exercise group of pregnant women had both a higher income and educational level, and slept fewer hours for the same average weeks of gestation than the non-exercising group of pregnant women. Weight gain was found to be moderately correlated with perceived fatigue for the non-exercising group of pregnant women, although a statistically significant difference was not found between the two groups on weight

gain. Based on the model and these findings, an analysis of covariance was completed. Once the effects of sleep and weight gain were statistically controlled for, a significant difference in perceived fatigue was found to exist between the exercising and non-exercising groups of pregnant women. This indicates that the additional variation in perceived fatigue between the two groups in this study was associated with the exercise component and not the influence of differences in weight gain or sleep.

Knowledge that the participation of pregnant women in low-impact aerobic exercise during the third trimester of pregnancy is associated with less perceived fatigue provides nurses in advanced practice with an intervention to recommend to clients that complain of fatigue as well as a health promotion activity to prevent the occurrence of fatigue during pregnancy. This knowledge enables the CNS to counsel and educate pregnant women about the positive benefits of exercising in the third trimester of pregnancy. The reduction of pregnant women's perceived fatigue may improve women's overall state of well-being and contribute to more positive pregnancy outcomes. The results also add empirical evidence, of which minimal current research currently exists, to provide the nurse with objective data to promote exercise in pregnancy.

Conceptual Framework

The findings in this research study support the premise of the Model of Fatigue During the Childbearing Experience (Pugh *et al.*, 1991) that situational factors can influence perceived fatigue in the third trimester of the antepartum period. The model also suggests that situational factors may modify the perceived fatigue of pregnant women, although the investigator of this research study did not explore this type of relationship between exercise and fatigue.

Based on the findings from this study, several modifications are recommended in the Model of Fatigue During the Childbearing Experience for the third trimester of the antepartum period. The authors of the model (Pugh *et al.*, 1991) proposed an interrelationship between the

physiological, psychological, and situational factors that directly influence and/or modify perceived fatigue. This author proposes that two-way arrows be placed between these factors (Figure 2). Two-way arrows also need to replace the one-way arrows between the categories of factors and perceived fatigue, since this was found to be a multi-directional relationship (Figure 2).

In addition, lifestyle factors were found to be separate from situational factors. The lifestyle factors are factors that the CNS and/or other healthcare professionals may be able to influence or modify. The CNS is in a key position to influence pregnant women to exercise to alleviate and/or prevent fatigue during pregnancy. The situational factors are preestablished for pregnant women regardless of the influence of the CNS. The situational factors are similar to demographic data. The lifestyle factors would also be interrelated with the other categories and directly influence maternal perceived fatigue.

The physiological, psychological, situational, and lifestyle factors indirectly influenced perceived fatigue by impacting exercise in the third trimester of pregnancy. At the same time, these factors directly influenced perceived fatigue. The fatigue perceived by pregnant women could also impact the categories of factors, therefore a feedback loop is included in this model. For instance, if a pregnant woman was fatigued it may modify her preexisting condition in terms of the various factors and potentially change her future reaction and perception of fatigue.

In summary, several modifications are recommended in the Model of Fatigue During the Childbearing Experience based on the findings in this study. These changes include: (a) establishing a separate category for lifestyle factors, (b) inserting two-way arrows between the categories of factors and with perceived fatigue, (c) establishing a feed-back loop from perceived fatigue to the category and, (d) the CNS influences the lifestyle factors. Recommended changes in the Model of Fatigue During

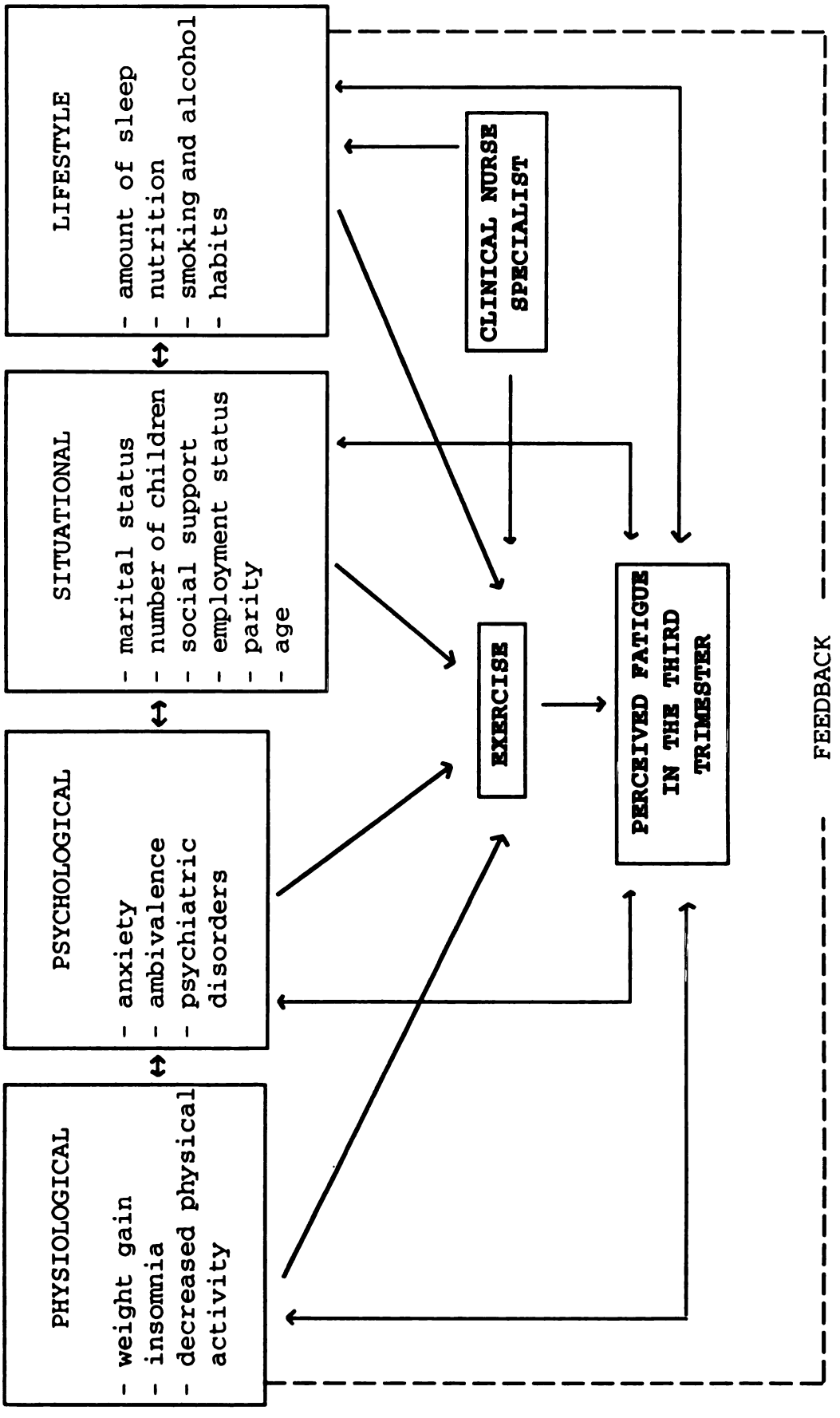

Figure 2. Modified Version of the Model of Fatigue During the Childbearing Experience

the Childbearing Experience based on the findings in this study are depicted in Figure 2.

Related Research Study

From the literature reviewed, one research study was found that addressed the association between low-impact aerobic exercise and perceived fatigue during the antepartum period. The results of this study support the findings of the study completed by Wallace *et al.* (1986). The authors found an association between low-impact aerobic exercise and perceived fatigue such that women in the third trimester of pregnancy who engaged in low-impact aerobic exercise reported less fatigue. The identification of the positive benefit of decreased fatigue for women that participate in low-impact aerobic exercise during the third trimester of pregnancy supports the need to determine ways to motivate pregnant women to exercise. Because of the positive benefit of exercise, it would be helpful for healthcare providers to know why some women choose to participate in low-impact aerobic exercise and why others do not. Besides knowing what motivates women to exercise, it is also important to understand what pregnant women perceive as barriers to participating in exercise. Further research is necessary to determine what the motivating factors and/or barriers are for pregnant women to exercise.

Social Support

The two groups of women in this study were found to be fairly homogeneous with respect to age, gestational age, parity, number of school children at home, race, and marital status. One characteristic, however, was found to distinguish the exercising and non-exercising groups or women. The exercising group was found to receive support from other pregnant women in their exercise classes. The support that the exercising group of women reported could be labelled as a form of social support. Social support for these women seemed to be related to the benefits of group participation, socialization, and reinforcement by other pregnant women.

Social support is consistent with the conceptual framework used to guide this study. Social support is considered a situational factor that influences, or modifies perceived fatigue (Pugh *et al.*, 1990). The non-exercising group of women did not report receiving support from other pregnant women attending their childbirth preparation classes. These women reported more perceived fatigue than the exercising group of women. One explanation for this may be that the childbirth preparation classes may not have been perceived as a source of social support to these women, possibly due to the lack of time for socialization and/or the presence of other non-pregnant women and men at these classes. The relationship of social support to perceived fatigue needs to be further studied.

Differences in Education Level and Total Family Income

The characteristics of educational level and total family income were found to differ significantly between the two groups of women in this study. The low-impact aerobic exercise group of women reported higher levels of education and income. The higher income may have provided the pregnant women who participated in the low-impact aerobic exercise class with the financial resources to pay for the class. Despite the significant difference in total family income between the two groups, it needs to be noted that for more than three quarters of all the women in the sample, total family income was reported to be $35,000 or more. Most of the women in both groups, therefore, were probably able to afford the low-impact aerobic exercise classes. The fee required to take low-impact aerobic exercise classes, however, may present a problem for women of lower income levels.

The low-impact aerobic exercising group's higher income may also mean that these women have a means of transportation to the exercise classes. Pregnant women with incomes lower than the women in this study might lack the funds necessary to have personal transportation and then have to rely on public transportation. The site of the exercise classes may not be accessible by public transportation.

Another issue related to the income level of pregnant women is the convenience of attending exercise classes. If there are childcare responsibilities at home, babysitting services may be needed. The additional cost for childcare may prohibit women from attending exercise classes. Other household responsibilities and work schedules might also interfere with women attending exercise classes outside of the home. The accessibility of low-impact aerobic exercise classes for pregnant women of all income levels needs to be addressed by the CNS.

The higher educational level of the exercising group of women suggests that this group of women may be more knowledgeable about the benefits of exercise. If the exercising women were more knowledgeable about the benefits of exercise it could be assumed that they would have engaged in similar exercise activities prior to and during the first two trimesters of their pregnancy. Interestingly, only 15 (55.6%) of the exercising women in this study reported engaging in any exercise prior to pregnancy. The number of these women exercising in the first trimester of pregnancy increased to 16 (59.3%), and then to 24 (88.9%) of the women in the second trimester. Since only slightly more than half of the exercising group reported participating in exercise prior to pregnancy, it is unclear what the factors were that stimulated them to participate in exercise by the third trimester of pregnancy. It is possible that they were informed of the benefits of exercise by their primary healthcare provider during their prenatal care appointments. Information was not collected on the exercise activity of the non-exercising group of pregnant women neither prior to pregnancy nor from the first two trimesters of pregnancy.

Knowledge about the benefits of exercise does not, in itself, seem sufficient to stimulate pregnant women to participate in exercise classes. The stimulus may be the combination of information about the benefits of exercise in conjunction with the pregnant state. In other words, pregnancy seems to be a time in a woman's life when she may be motivated to modify her health habits to include exercise. The addition

of exercise to a pregnant woman's habits may last a lifetime and continue to improve her overall health and well-being. Reasons why women participate in exercise during pregnancy and whether the healthcare provider influences that decision warrants further investigation.

Differences Between Sleep and Weight Gain

It is important to further study the differences found in the number of hours of sleep in a 24-hour period and the weight gained between the two groups of pregnant women. The non-exercising group of pregnant women may have slept more because they perceived themselves to be more fatigued, or because they slept more, they may have perceived themselves to be more fatigued. The exercising group of pregnant women may have slept less because they perceived less fatigue, or because they slept less they may have had less perceived fatigue. The results of this study do not provide answers for the relationship between sleep and perceived fatigue, which future research needs to investigate.

Although the weight gain of the two groups was not significantly different, the non-exercising group of women gained an average of about four more pounds for the same average weeks gestation than the exercising group. The mean gestational length of the pregnancies in each of the groups of women was 32 weeks. The average weight gain for the pregnant women in each group was within the National Academy of Sciences (1990) overall total weight gain recommendations for weight gain of a woman during pregnancy. It is unknown if the weight gain of these pregnant women would be outside of the normal recommended range once they reach 40 weeks gestation. Additional information needs to be collected in future studies to determine the weight for height relationship for pregnant women to determine the recommended total weight gain based on body mass index (National Academy of Sciences, 1990).

The greater weight gain of the non-exercising group of women may have influenced their decision not to participate in low-impact aerobic

exercise during pregnancy. The non-exercising group of women may have perceived themselves to be fatigued prior to pregnancy or the third trimester of pregnancy. These women may have been uncomfortable with their own body images due to the extra weight gained during the pregnancy. The weight gain could be related to the lack of aerobic exercise in the lives of these pregnant women.

Again, it is not known whether or not the exercising group of pregnant women weighed less because they performed low-impact aerobic exercise of if they performed that exercise because they had less additional weight during the pregnancy. The additional weight gain for the non-exercising women could be reflective of unhealthy nutritional habits that would also impact their perceptions of fatigue, although information on the nutritional quality of the diets of the women was not obtained by the investigator in this study. Future investigation of weight gain as a potentially confounding factor to perceived fatigue would provide some direction for healthcare providers working with pregnant women in the third trimester of pregnancy.

The Modified Fatigue Symptom Checklist

The identification of an association between low-impact aerobic exercise and perceived fatigue for pregnant women in the third trimester was measured by the total summative score on the MFSC. The calculated reliability based on the Cronbach alpha of the MFSC and the three subscales for the entire sample and the two groups of pregnant women were presented in Chapter V. Subscale 3 had a consistently low alpha coefficient compared to the total scale and the other two subscales in both groups, the entire sample, as well as in a study completed by Pugh (1990) on maternal perceived fatigue in the intrapartum period ($\underline{r}$ = .61 - .80). The lower alpha coefficient of Subscale 3 threatens the equivalence of this subscale to the other two subscales to measure the attribute of perceived fatigue. The low-impact aerobic exercising group of women had the lowest alpha ($\underline{r}$ = .61). The other concern is

whether the disproportionately low alpha of subscale 3 resulted in a falsely elevated alpha coefficient for the total instrument ($\underline{r}$ = .89).

Instruments are designed to measure variation among the objects being measured and the more homogeneous the sample the lower the reliability coefficient may be (Polit & Hungler, 1991). The sample in this study was homogeneous. The reliability of an instrument is related only in part to the sample in which it was used (Polit & Hungler, 1991), therefore modifications may need to be made in subscale 3.

The low reliability of subscale 3 brings into question the ability of this subscale and the total scale to measure the attribute of fatigue as opposed to another concept. It was suggested by Morris (1982) that the concepts of anxiety and depression have symptoms similar to fatigue. In fact, it is often unclear if depression and/or anxiety are the cause or the result of fatigue (Montgomery, 1983). In order to validate that the MFSC is measuring perceived fatigue, future studies should conduct concurrent testing with instruments designed to measure related phenomena such as depression and anxiety as well as other measures of fatigue. Factor analysis needs to be continued on the MFSC when used in larger samples to demonstrate that the factors in each of the subscales are all measuring dimensions of fatigue.

The recognition of an association between low-impact aerobic exercise and perceived fatigue for pregnant women has many implications for healthcare professionals in primary care. The implications for primary care and nurses in advanced practice are discussed in the next section.

Implications for Clinical Practice

Primary Care

The healthcare providers in primary care are concerned with health promotion and disease prevention of clients. Many pregnant women receive health care through the primary care system. Fatigue is often a complaint of pregnant women. Perceived fatigue can interfere with activities of daily living and established relationships with family and

friends (Aistars, 1987). Healthcare providers need to assess clients for complaints of fatigue. Strategies to reduce fatigue during pregnancy need to include exercise. Low-impact aerobic exercise was found to be associated with less perceived fatigue in the third trimester of pregnancy for women in this study. Low-impact aerobic exercise can be an effective intervention for the reduction of fatigue during pregnancy. Healthcare providers also need to provide accurate, up-to-date information about exercise in pregnancy. The information needs to be provided to all women during pregnancy.

Advanced Nursing Practice

The Clinical Nurse Specialist (CNS) as a primary healthcare provider is able to assess and diagnose fatigue during pregnancy. The CNS has a holistic approach to patient care with expertise in health promotion, education, and counseling.

As a primary care clinician, the CNS utilizes critical assessment skills to recognize signs and symptoms of fatigue that validate clients' complaints of fatigue. If the client perceived fatigue to be negatively affecting her life, the CNS needs to assist the client to identify potential interventions appropriate to the woman's pregnancy risk status. The CNS assumes the role of both educator and counselor. The CNS needs to be prepared to provide accurate information on all the options for reduction of fatigue during pregnancy; one such option is engaging in low-impact aerobic exercise. The CNS also needs to be knowledgeable about the potential risks and benefits of exercise in pregnancy.

Even if fatigue is not a major complaint of the client, the CNS is able to provide anticipatory guidance on ways to avoid fatigue during pregnancy. Pregnancy is also an excellent time to promote health. Exercise is an important aspect of health living (Cooper, 1982). Women may be motivated to engage in exercise if they knew that it could lessen fatigue during pregnancy. The establishment of a health habit may begin

during pregnancy. Exercise needs to be discussed with all low-risk pregnant women.

Fatigue during pregnancy can negatively influence pregnancy outcome and/or family relationships. Pugh (1990) discussed that if women are fatigued during the pregnancy, it may continue during the delivery of the infant and then into the postpartum period. The presence of fatigue may make it difficult to complete the normative transition to parenthood and interfere with the necessary bonding process. The influences of family on women's perceived fatigue are important areas for the CNS to assess during pregnancy. The support received from a spouse or significant other and the number of other children women must provide care for may influence pregnant women's perceived fatigue (Pugh *et al.*, 1991).

The other challenge to the CNS is to provide information on the benefits of exercise during pregnancy to women of lower income and educational levels that were not represented in the sample of this study. This information needs to be included as part of the standard prenatal care education for all pregnant women. The CNS needs to determine if exercise classes are accessible to all pregnant women. The exercise classes need to be offered at a convenient location and time of day and for a reasonable fee or on an ability to pay scale to reach all pregnant women. Childcare services during class times also need to be available.

Despite these recommendations, not all pregnant women desire to engage in exercise that is offered in a structured, formalized class. Some women may prefer to perform low-impact aerobic exercise in their own homes by following an audiotape or videotape. If that is not convenient for the pregnant woman, she may choose to engage in other types of low-impact aerobic exercise at home, such as walking or cycling. Pregnant women that choose to perform exercise without formalized instruction continue to need information regarding recommended types and quantities of exercise suitable during pregnancy.

The CNS who delivers health care to pregnant women is responsible to share information about the benefits of exercise in low risk pregnancies and creatively assist women to include exercise in their daily routines.

The CNS is also in an ideal position to participate in further research on the relationship of exercise and perceived fatigue in pregnancy. The CNS works directly with pregnant women in the roles of clinician, educator, and counselor. It is through these roles that the CNS can collect information about perceived fatigue in pregnancy and assess the outcome of pregnant women participating in exercise. In the next section, recommendations for future research are discussed.

Recommendations for Future Research

As association between exercise and perceived fatigue in the third trimester of pregnancy was identified in this study. That association provides support for the use of The Model of Fatigue During the Childbearing Experience (Pugh *et al.*, 1991) to guide future research on fatigue in pregnancy. The model needs to be tested in it's modified version. The model needs to be tested longitudinally. Longitudinal research is indicated in order to examine perceived fatigue prior to pregnancy, through each trimester, and after the birth of the infant.

The model addresses the multiple factors that influence and modify fatigue during pregnancy (Pugh *et al.*, 1991). Further testing of this model is recommended, controlling for the distinguishing factors between the low-impact aerobic exercising and non-exercising group of pregnant women in this study (sleep, weight gain, education level, and income). The influence of the social support reported by the pregnant women participating in the low-impact aerobic exercise class also needs to be assessed in future research.

In order to further distinguish the role of these factors in relation to fatigue, more information needs to be collected about them throughout pregnancy and prior to pregnancy. The Self-History Form used in this study needs to be modified for future studies in order to

accurately gather information on the type and amount of other physical activity that pregnant women engage in throughout their daily schedules.

The similarities between the two groups of pregnant women support the importance of determining if the sample characteristics in this study are representative of the type of women that participates in low-impact aerobic exercise during pregnancy. Repeated descriptive studies are recommended in samples of pregnant women with different characteristics than the pregnant women in this study before the findings of this study can be generalized to the population.

In future studies with pregnant women, it is recommended that the MFSC be used with concurrent testing of other instruments that measure fatigue, anxiety, and depression to validate the measurement of fatigue. The reliability of the total scale and the three subscales needs to continue to be established to determine the consistency of the instrument to measure fatigue. In studies with larger sample sizes, it is recommended that factor analysis be completed.

Qualitative research is recommended to identify the motivating factors for pregnant women that choose to participate in low-impact aerobic exercise. It is also important to conduct research to determine the barriers for pregnant women that do not exercise during pregnancy. The identification of motivating factors and barriers to exercise in pregnancy will help the healthcare professional define his/her role to better meet the needs of the pregnant woman. Additional research is needed to establish the role of exercise in preventing, minimizing, and/or alleviating the common complaint of perceived fatigue during pregnancy. In addition, other types of low-impact aerobic exercise also need to be studied to determine their effects on fatigue during pregnancy.

Overall, limited research exists on the association between perceived fatigue and exercise in pregnancy. This study has shown an important association between these two variables which have a strong impact on a pregnant woman's life. Additional research is needed in

this area. The healthcare professional, particularly the nurse in advanced practice, needs to be challenged to further explore the relationship between exercise and perceived fatigue for pregnant women.

Summary

This study explored the association between perceived fatigue and exercise in pregnancy in the third trimester of pregnancy. The Model of Fatigue During the Childbearing Experience (Pugh *et al.*, 1991) was used to guide the exploration of the study variables. The findings of this study support an association between perceived fatigue and low-impact aerobic exercise in pregnancy. Pregnant women who engaged in low-impact aerobic exercise in the third trimester of pregnancy perceived less fatigue than pregnant women not exercising.

This study investigated perceived fatigue during pregnancy from a nursing perspective. The findings in this study offered a revised model for fatigue during the antepartum period of pregnancy as well as implications for advanced nursing practice. Future research is recommended to establish the association between perceived fatigue and exercise in pregnancy. Nursing interventions have been identified for the alleviation and prevention of fatigue for pregnant women. The reduction of women's perceived fatigue during pregnancy could improve overall well-being, thus contributing to more positive pregnancy outcomes and women's future health.

APPENDICES

APPENDIX A

Sites Utilized for Data Collection

Sites for Obtaining Women in the Low-Impact Aerobic Exercise Group

1. Brighton Community Education, class session x 8 weeks.
2. Bon Secours (St. Clair Shores) - continuous class.
3. Four Flags Health and Racquet Club (Saginaw) - continuous classes.
4. Hackley Women's Center (Muskegon) - continuous class.
5. Jewish Community Center (Southfield) - continuous classes.
6. Lansing YMCA (Oak Park Branch) - "You and Me Baby", class session x 7 weeks.
7. Midland Community Center, class session x 5 weeks.
8. Saginaw YMCA - "You and Me Baby", class session x 7 weeks.
9. Up With Life Center (DOW - Midland) - continuous classes.

Site for Obtaining Women in the Non-Exercising Group

1. Expectant Parents Organization (Lansing) - childbirth preparation classes.

APPENDIX B

Solicitation Letter to Data Collection Sites

Dear :

It was a pleasure to talk with you on the phone regarding your organization's prenatal exercise/childbirth preparation class. We verbally discussed and agreed upon the opportunity for me to work with pregnant women from your class for the research study I am conducting. As a follow-up to that conversation, we also agreed that I would mail you the details of the study in writing and then you would send back to me verification in writing, expressing your consent for me to collect data for the study through your prenatal exercise/childbirth preparation class for pregnant women.

I am a graduate student pursuing a Masters of Science in Nursing Degree in the Family Clinical Nurse Specialist Program through the College of Nursing at Michigan State University. This research study fulfills the necessary requirements for a Master's Thesis.

The purpose of this research study is to determine the relationship between fatigue and exercise in pregnancy. It is a non-experimental, descriptive research study with the comparison of two groups. The sample will be composed of pregnant women in the third trimester of pregnancy participating in low-impact aerobic exercise classes or childbirth preparation classes that are not doing aerobic exercise. This is where I am asking for your assistance. I need your organization's written consent to come to your classes to solicit women's voluntary participation in this research study. The data collection will all be self-report by the pregnant women on the following forms: (a) Self-History Form (demographic data) and (b) Modified Fatigue Symptom Checklist (a one-page instrument to measure perception of fatigue). All data collected will be kept anonymous and confidential. I will personally come to your classes at times prearranged with instructor(s) to explain, distribute, and collect forms between mid-December and mid-February.

Your assistance in this process is greatly appreciated. I have attached a sample of a verification letter which may be copied onto your letterhead, signed, and returned to:

Dawn M. Popovics, RNC
Michigan State University, College of Nursing
A230 Life Sciences Building
East Lansing, MI 48824-1317

Please feel free to call me with any questions, comments, or concerns. I am looking forward to working with you. Thank you again!

Sincerely,

Dawn M. Popovics, RNC

APPENDIX C

Data Collection Instructions

Dear Childbirth Education Instructor:

I am a graduate student pursuing a Master of Science in Nursing Degree in the Family Clinical Nurse Specialist Program through the College of Nursing at Michigan State University. I am doing a research study about fatigue and exercise in pregnancy.

Your assistance in distributing and collecting forms for this research study contributes immensely to the success of this project. I realize that you have a very full schedule and I want you to know that I appreciate your help.

I have attached data collection procedure instructions and may I suggest the following verbal explanation for your class:

> Good (morning, evening). Dawn Popovics, a graduate student in the College of Nursing at Michigan State University, is conducting a research study about fatigue and exercise in pregnancy. She is seeking pregnant women, like yourself, at least 27 weeks gestation to participate in this study. The Expectant Parent Organization has given permission to explain the study and seek your participation. Whether or not you decide to participate in the study will not in any way affect your class participation.
>
> Participation will involve the completion of two short questionnaires during your class. It is anticipated that it will take approximately 10 minutes to complete the questionnaires. You will not be asked to provide your name. Your participation is voluntary. The information gained in this study will help nurses to improve the care that they provide to pregnant women and their families. Your participation is very valuable. If you wish to participate in the study, I will give you a stapled packet. Please keep the forms stapled together and return them in this envelope once you have completed them. Thank you.

Once again, thank you for your assistance. If you have any questions, please feel free to call or write.

Sincerely,

Dawn M. Popovics, RNC, Graduate Student
Michigan State University, College of Nursing
A230 Life Sciences Building
East Lansing, MI 48824-1317
517/355-6523

Perceived Fatigue and Exercise in Pregnancy

Directions for Data Collection

1. The Childbirth Education Instructor explains the research study to the childbirth preparation class (preferably, prior to the onset of the class, to limit the effects of fatigue related to sitting through a class session as a pregnant woman).
2. The Instructor then provides the interested pregnant women with a consent letter, self-history form, and fatigue instrument (the three forms are already stapled together and can be found in the attached envelope.
3. The pregnant women then need to read the consent letter. They give consent to their participation in the research study by completing the forms. (It would be ideal for the pregnant women to complete the forms prior to leaving the childbirth preparation class).
4. The pregnant women return the self-history form and fatigue instrument to the attached envelope.
5. The instructors return the envelope with the completed forms to _____.

** YOUR ASSISTANCE IN THIS PROCESS IS GREATLY APPRECIATED, THANK YOU! **

APPENDIX D

Consent Letter

December , 1991

Dear Expectant Mother:

I am a graduate student pursuing a Master of Science in Nursing Degree in the Family Clinical Nurse Specialist Program through the College of Nursing at Michigan State University. I am doing a research study about fatigue and exercise in pregnancy.

As a registered nurse, my background has been in working with pregnant women. Pregnant women frequently complain of fatigue in their third trimester. The purpose of this research study is to find out if women in their third trimester of pregnancy perceive themselves to be fatigued.

If you are a pregnant woman in your third trimester of pregnancy, 27 or more weeks gestation, I am asking you to participate in this research study. As a participant, you are asked to complete one questionnaire with personal information such as your age, income, occupation and a second questionnaire to find out if you are feeling fatigued. The two short questionnaires will take approximately 10 minutes to complete.

Although this study will not benefit you directly, in the long run it is hoped that this information can be used to improve our knowledge about ways to reduce or prevent the occurrence of fatigue in pregnancy. Whether or not you agree to participate in the study is completely up to you. If at any time you decide not to continue in the project, you are free to refuse without any disadvantage to you.

No ill effects or stress are expected for you. All information will be numbered and your name will not be used. All information is confidential and the results will be reported only for the total group. You indicate your voluntary agreement o participate by completing and returning this questionnaire.

I would be most happy to answer any questions you might have. Please write or call. Thank you for your assistance

Cordially,

Dawn M. Popovics, RNC, Graduate Student
Michigan State University, College of Nursing
A230 Life Sciences Building
East Lansing, MI 48824-1317
517/355-6523

APPENDIX E

Self-History Form

Check the category that best applies to you or fill in the blank

ID # _____
DATE _____

1. AGE IN YEARS: _____

2. RACE:
   ____ BLACK
   ____ WHITE
   ____ ASIAN
   ____ HISPANIC
   ____ OTHER

3. MARITAL STATUS:
   ____ NEVER MARRIED
   ____ MARRIED/CO-HABITATING
   ____ WIDOWED
   ____ DIVORCED/SEPARATED

4. YOUR EDUCATION ENDED WITH:
   ____ GRADE SCHOOL
   ____ SOME HIGH SCHOOL
   ____ HIGH SCHOOL GRADUATE/GED
   ____ SOME COLLEGE
   ____ COLLEGE GRADUATE
   ____ SOME GRADUATE SCHOOL
   ____ COMPLETED GRADUATE SCHOOL

5. NUMBER OF HOURS PER WEEK PRESENTLY EMPLOYED OUTSIDE OF YOUR HOME: _____

* IF YOU ARE NOT CURRENTLY EMPLOYED OUTSIDE THE HOME, GO TO QUESTION #7

6. CATEGORY OF JOB THAT MOST CLOSELY RESEMBLES YOUR ACTIVITY AT YOUR JOB:
   ____ SECRETARY
   ____ SALESPERSON
   ____ TEACHER
   ____ NURSE
   ____ MANUAL LABOR
   ____ OTHER

7. TOTAL FAMILY INCOME LAST YEAR BEFORE TAXES:
   ____ LESS THAN $10,000
   ____ $10,000 - 19,999
   ____ $20,000 - 34,999
   ____ $35,000 - 49,999
   ____ $50,000 - 74,999
   ____ $75,000 - 99,999
   ____ $100,000 OR MORE

8. NUMBER OF PREGNANCIES (INCLUDING THIS ONE): _____

9. NUMBER OF PRESCHOOL CHILDREN WHO LIVE WITH YOU: _____

10. NUMBER OF WEEKS PREGNANT YOU ARE NOW: _____

11. PRE-PREGNANCY WEIGHT (IN POUNDS): _____

12. CURRENT WEIGHT (IN POUNDS): _____

13. HEIGHT (IN FEED & INCHES): _____

14. AVERAGE NUMBER OF HOURS SLEEP PER 24 HOURS: _____

15. HOW MANY CIGARETTES DO YOU SMOKE PER DAY: _____

16. HOW OFTEN HAVE YOU BEEN DRINKING SOME KIND OF ALCOHOLIC BEVERAGE:
   ____ DAILY
   ____ 3-4 TIMES PER WEEK
   ____ 1-2 TIMES PER WEEK
   ____ 1-2 TIMES PER MONTH
   ____ LESS THAN ONCE PER MONTH
   ____ NONE SINCE BECOMING PREGNANT
   ____ NEVER

17. WHO ARE YOU SEEING FOR YOUR PRENATAL CARE:
   ____ NURSE MIDWIFE
   ____ NURSE PRACTITIONER
   ____ PHYSICIAN
   ____ PHYSICIAN'S ASSISTANT

Self-History Form - page two

18. DID THAT HEALTHCARE PROVIDER YOU CHECKED IN QUESTION #17 TALK TO YOU ABOUT EXERCISE IN PREGNANCY: _____ YES _____ NO

19. HAVE YOU EVER BEEN GOLD BY YOUR HEALTHCARE PROVIDER THAT YOU HAVE THE FOLLOWING CONDITIONS: (CHECK ALL THAT APPLY)

THREE OR MORE SPONTANEOUS ABORTIONS	____ YES	____ NO
PREMATURE RUPTURE OF MEMBRANES	____ YES	____ NO
PREMATURE LABOR (BEFORE 37 WEEKS)	____ YES	____ NO
MULTIPLE GESTATION (TWINS, ETC.)	____ YES	____ NO
INCOMPETENT CERVIX	____ YES	____ NO
BLEEDING OR DIAGNOSIS OF PLACENTA PREVIA	____ YES	____ NO
DIAGNOSED CARDIAC DISEASE	____ YES	____ NO

20. DO YOU CURRENTLY PARTICIPATE IN ANY OF THE FOLLOWING ACTIVITIES ON A REGULAR BASIS FOR AEROBIC EXERCISE (2-3 TIMES PER WEEK). CHECK ALL THAT APPLY:

LOW IMPACT AEROBIC EXERCISE CLASS	____ YES	____ NO
HIGH IMPACT AEROBIC EXERCISE CLASS	____ YES	____ NO
WALKING 2 MILES IN LESS THAN OR EQUAL TO 30 MINUTES	____ YES	____ NO
JOGGING/RUNNING 1 MILE IN LESS THAN 9 MINUTES	____ YES	____ NO
CYCLING 5 MILES IN 20 MINUTES OR LESS	____ YES	____ NO
SWIMMING 600 YARDS IN 15 MINUTES OR LESS	____ YES	____ NO
OTHER (WRITE IN TYPE EXERCISE, AMOUNT & FREQUENCY	_____	

_____

21. ACTIVITIES IDENTIFIED IN QUESTION #20 HAVE BEEN DONE:

____ PRE-PREGNANCY
____ FIRST TRIMESTER
____ SECOND TRIMESTER
____ THIRD TRIMESTER

22. HOW DO YOU PERCEIVE YOUR ACTIVITY LEVEL AS COMPARED TO:

OTHER PREGNANT WOMEN?	____ LESS THAN	____ THE SAME AS	____ MORE THAN
NON-PREGNANT WOMEN?	____ LESS THAN	____ THE SAME AS	____ MORE THAN

APPENDIX F

Modified Fatigue Symptom Checklist

Directions: A number of statements are given below that people have used when they feel tired. Read each statement and then circle the number on the scale that describes how you felt on average this past week. There are no right or wrong statements. Do not spend too much time thinking about each item, but give the best answer for how you felt on average this past week. (Number designations: 1 = not at all; 2 = somewhat; 3 = moderately; 4 = very much so)

1.	I feel that my head is heavy	1	2	3	4
2.	I feel tired over my whole body	1	2	3	4
3.	I feel tired in my legs	1	2	3	4
4.	I feel like yawning	1	2	3	4
5.	I feel like my brain is hot and muddled	1	2	3	4
6.	I feel drowsy	1	2	3	4
7.	I feel like my eyes are strained	1	2	3	4
8.	I feel clumsy when moving	1	2	3	4
9.	I feel unsteady when standing	1	2	3	4
10.	I feel I want to lie down	1	2	3	4
11.	I feel I can't think	1	2	3	4
12.	I feel I am weary of talking	1	2	3	4
13.	I feel nervous	1	2	3	4
14.	I feel I am unable to concentrate	1	2	3	4
15.	I feel I am unable to take an interest in things . .	1	2	3	4
16.	I feel I am apt to forget things	1	2	3	4
17.	I feel that I lack self-confidence	1	2	3	4
18.	I feel anxious	1	2	3	4
19.	I feel I am unable to straighten my posture	1	2	3	4
20.	I feel that I have no patience	1	2	3	4
21.	I feel like I have a headache	1	2	3	4
22.	I feel stiff in the shoulders	1	2	3	4
23.	I feel a pain in my back	1	2	3	4
24.	I feel oppressed in my breathing	1	2	3	4
25.	I feel thirsty	1	2	3	4
26.	I feel like my voice is husky	1	2	3	4
27.	I feel dizzy	1	2	3	4
28.	I feel like I have spasms of the eyelids	1	2	3	4
29.	I feel like I have tremors in my limbs	1	2	3	4
30.	I feel ill	1	2	3	4

APPENDIX G

MICHIGAN STATE UNIVERSITY

OFFICE OF VICE PRESIDENT FOR RESEARCH
AND DEAN OF THE GRADUATE SCHOOL

EAST LANSING • MICHIGAN • 48824-1046

January 8, 1992

Dawn Popovics, RNC

RE: PERCEIVED FATIGUE AND EXERCISE IN PREGNANCY, IRB #91-579

Dear Ms. Popovics:

The above project is exempt from full UCRIHS review. I have reviewed the proposed research protocol and find that the rights and welfare of human subjects appear to be protected. You have approval to conduct the research.

You are reminded that UCRIHS approval is valid for one calendar year. If you plan to continue this project beyond one year, please make provisions for obtaining appropriate UCRIHS approval one month prior to December 22, 1992.

Any changes in procedures involving human subjects must be reviewed by the UCRIHS prior to initiation of the change. UCRIHS must also be notified promptly of any problems (unexpected side effects, complaints, etc.) involving human subjects during the course of the work.

Thank you for bringing this project to our attention. If we can be of any future help, please do not hesitate to let us know.

Sincerely,

David E. Wright, Ph.D.
Chair, UCRIHS

DEW/deo

cc: Dr. Mildred Omar

LIST OF REFERENCES

List of References

Aistars, J. (1987). Fatigue in the cancer patient: A conceptual approach to a clinical problem. Oncology Nursing Forum, 14(6), 25-30.

American College of Obstetricians and Gynecologists (1985). Exercise during pregnancy and the postnatal period. ACOG Home Exercise Programs, 4, 1-6.

Amundsen, L. R. (1979). Assessing exercise tolerance: A review. Physical Therapy, 59(5), 534-536.

Artal, R. (1986). Hormonal responses to exercise in pregnancy. *In* R. Artal, & R. A. Wiswell (*Eds.*), Exercise in pregnancy (pp. 139-146). Baltimore: Williams & Wilkins.

Artal, R., Rutherford, S., Romem, Y., Kammula, R. K., Dorey, F. J., & Wiswell, R. A. (1986). Fetal heart rate responses to maternal exercise. American Journal of Obstetrics and Gynecology, 155, 729-733.

Bartley, S. H. (1965). Fatigue: Mechanism and management. Springfield: Charles C. Thomas.

Bartley, S. H. (1976). What do we call fatigue? *In* E. Simonson & P.C. Weiser (*Eds.*), Psychological aspects and physiological correlates of work and fatigue. (pp. 409-414). Springfield: Charles C. Thomas.

Cameron, C. (1971). Fatigue problems in modern industry. Ergonomics, 14, 713-720.

Cameron, C. (1973). A theory of fatigue. Ergonomics, 16, 633-646.

Campbell, K. G. (1981). Exercise, physical fitness, and health. *In* G.S. Thomas, P. R. Lee, P. Franks, & R. S. Paffenbarger (*Eds.*), Exercise and health (pp. 99-113). Cambridge: Oelgeschlager, Gunn & Hain.

Caspersen, C. J., Powell, K. E., & Christenson, G. M. (1985). Physical activity, exercise and physical fitness: definitions and distinctions for health-related research. Public Health Reports, 100(2), 126-131.

Chen, M. K. (1986). The epidemiology of self-perceived fatigue among adults. Preventive Medicine, 15, 74-81.

Clapp. J. F. (1980). Acute exercise stress in the pregnant ewe. American Journal of Obstetrics & Gynecology, 136, 489-494.

Clapp, J. F. (1985). Fetal heart rate response to running in mid-pregnancy and late pregnancy. American Journal of Obstetrics and Gynecology, 153, 251-252.

Clapp, J. & Dickstein, S. (1984). Endurance exercise and pregnancy outcome. Medicine and Science in Sports and Exercise, 16(6), 1157-1170.

Collings, C. & Curet, L. G. (1985). Fetal heart rate responses to maternal exercise. American Journal of Obstetrics and Gynecology, 151, 498-501.

Collings, C. A., Curet, L. B., & Mullin, J. P. (1983). Maternal and fetal responses to a maternal aerobic exercise program. American Journal of Obstetrics and Gynecology, 145, 702-707.

Cooper, K. H. (1982) The Aerobics program for total well-being. New York: M. Evans & Company.

Curet, L. B., Orr, J. A., Rankin, J. H. G., & Ungerer, T. (1976). Effect of exercise on cardiac output and distribution of uterine blood flow in pregnant ewes. Journal of Applied Physiology, 40,725-728.

Dressendorfer, R. H. & Goodlin, R. C. (1980). Fetal heart rate response to maternal aerobic exercise testing. Physician & Sports Medicine., 8, 90.

Eidelman, D. (1980). Fatigue: Towards an analysis and a unified definition. Medical Hypotheses, 6, 517-526.

Fishbein, E. G. & Phillips, M. (1990). How safe is exercise during pregnancy? Journal of Obstetric, Gynecologic, and Neonatal Nurses, 19, 45-49.

Francis, P. & Francis L. (1989, July/August). High and low-impact aerobics. Idea Today, 56-63.

Frank-Stromborg, M. (1986). Health promotion behaviors in ambulatory cancer patients: Facts or fiction? Oncology Nursing Forum, 13(4), 37-43.

Gardner, D. L. (1991). Fatigue in postpartum women. Applied Nursing Research, 4(2), 57-62.

Garvin, J. (1988). Body moves. Harrisburg, PA: Stackpoole Books.

Gendel, E. S. (1973). Women: Fitness and fatigue. The West Virginia Medical Journal, 69(5), 112-118.

Gibson, H. & Edwards, R. H. T. (1985). Muscular exercise and fatigue. Sports Medicine, 2(2), 120-132.

Grandjean, E. P. (1968). Fatigue: Its physiological and psychological significance. Ergonomics, 11, 427-436.

Hart, L. K. & Freel, M. I. (1982). Fatigue. *In* C.M. Norris (*Ed.*) Concept clarification in nursing (pp. 251-261). Rockville, MD: Aspen.

Hauth, J. C., Gilstrap, L. C. & Widmer, K. (1982). Fetal heart rate reactivity before and after maternal jogging during the third trimester. American Journal of Obstetrics & Gynecology, 142, 545-547.

Hohimer, A. R., Bissonnette, J. M., Metcalfe, J., & Kean, T. A. M. (1984). Effect of exercise on uterine blood flow in the pregnant pygmy goat. American Journal of Physiology, 246, 207-212.

Huch, R. & Erkkola, R. (1990). Pregnancy and exercise -- exercise and pregnancy. A short review. British Journal of Obstetrics and Gynaecology, 97, 208-214.

Hughes, J. R. (1984). Psychological effects of habitual aerobic exercise: A critical review. Preventive Medicine, 13, 66-78.

Jarrett, J. C. & Spellacy, W. N. (1983). Jogging during pregnancy: An improved outcome? Obstetrics and Gynecology, 61, 705.

Jones, R. J., Botti, J., Anderson, W. M., & Bennett, N. L. (1985). Thermoregulation during aerobic exercise in pregnancy. Obstetrics & Gynecology, 65, 340-345.

Kellum, M. D. (1985). Fatigue. *In* M. M. Jacobs & W. Geels (*Eds.*), Signs and symptoms in nursing: Interpretation and management. (pp. 103-118). Philadelphia: J. B. Lippincott.

Kinsman, R. A. & Weiser, P.C. (1976). Subjective symptomatology during work and fatigue. *In* E. Simonson & P.C. Weiser (*Eds.*), Psychological aspects and physiological correlates of work and fatigue. (pp. 336-405). Springfield, IL: Charles C. Thomas.

Kulpa, P. B., White, B. M., & Visscher, R. (1987). Aerobic exercise in pregnancy. American Journal of Obstetrics and Gynecology, 156, 1395-1403.

Lotgering, F. K., Gilbert, R. D., & Longo, L. D. (1983). Exercise responses in pregnant sheep: oxygen consumption, uterine blood flow, and blood volume. Journal of Applied Physiology, 55, 834-841.

Lotgering, F. K., Gilbert, R. D., & Longo, L. D. (1984). The interaction of exercise and pregnancy: a review. American Journal of Obstetrics & Gynecology, 149, 560-568.

Lotgering, F., Gilbert, R., & Longo, L. (1985). Maternal and fetal responses to exercise during pregnancy. Physiological Review, 65(1), 1-36.

McFarland, R.A. (1971). Understanding fatigue in modern life. Ergonomics, 14(1), 1-10.

Melpomene Institute for Women's Health Research (1990). The bodywise woman. New York: Prentice Hall Press.

Montgomery, G. K. (1983). Uncommon tiredness among college undergraduates. Journal of Counseling and Clinical Psychology, 51, 517-525.

Morris, M. L. (1982). Tiredness and fatigue. *In* C. M. Norris (*Ed.*), Concept clarification in nursing (pp. 263-275). Rockville, MD: Aspen.

National Academy of Sciences (1990). Nutrition During Pregnancy - 1990 Weight Gain Recommendations.

Olds, S. B., London, M. L., & Ladewig, P. A. (*Eds.*) (1988). Maternal-newborn nursing: A family-centered approach, (3rd Ed.). California: Addison-Wesley.

Pijpers, L., Wladimiroff, J. W., & McGhie, J. (1984). Effect of short-term material exercise on maternal and fetal cardiovascular dynamics. British Journal of Obstetrics & Gynaecology, 91, 1081-1086.

Piper, B. F. (1986). Fatigue. *In* V. K. Carrieri, A. M. Lindsey, & C. M. West (*Eds.*), Pathophysiological phenomena in nursing. (pp. 219-234). Philadelphia: W. B. Saunders.

Piper, B. F. (1989). Fatigue: Current bases for practice. *In* S. G. Funk, E. M. Tornquist, M. T. Champagne, L. A. Copp, & R. A. Wiese (*Eds.*), Key aspects of comfort: Management of pain, fatigue, and nausea. (pp. 187-198). New York: Springer.

Piper, B. F., Lindsey, A. M., & Dodd, M. J. (1987). Fatigue mechanisms in cancer patients: developing nursing theory. Oncology Nursing Forum, 14(6), 17-23.

Polit, D. F. & Hungler, B. P. (1991). Nursing research (4th ed.). Philadelphia: J. B. Lippincott.

Pomerance, J. J., Gluck, L., & Lynch, V.A. (1974). Physical fitness in pregnancy. Its effect on pregnancy outcome. American Journal of Obstetrics & Gynecology, 119, 867.

Pugh, L. C. (1990). Psychophysiological correlates of fatigue during childbirth. Unpublished doctoral dissertation. University of Maryland, Baltimore, MD.

Pugh, L. C., Milligan, R., & Kitzman, H. (1991). A framework for research: Fatigue during the childbearing experience. Manuscript submitted for publication.

Putt, A. M. (1977, March). Effects of noise on fatigue in healthy middle-aged adults. Communicating Nursing Research, 8, 24-34.

Reich, C. L. (1987). Exercise in pregnancy: A review for nurse practitioners. Health Care for Women International, 8, 349-360.

Rhoten, D. (1982). Fatigue and the postsurgical patient. *In* C. M. Norris (*Ed.*), Concept clarification in nursing (pp. 277-300). Rockville, MD: Aspen.

Richards, D. H. (1985). Guidelines for exercise during pregnancy. Occupational Health Nursing, 33(10), 508-509.

Riddle, P. K. (1982). Chronic fatigue and women: A description and suggested treatment. Women & Health, 7(1), 37-47.

Shephard, R. J. (1974). A brief bibliography on fatigue and fitness. Journal of Occupational Health, 16, 804-808.

South-Paul, J. E., Rajagopal, K. R., & Tenholder, M. F. (1988). The effect of participation in a regular exercise program upon aerobic capacity during pregnancy. Obstetrics & Gynecology, 71, 175-179.

Wallace, A. M., Boyer, D. B., Dan, A., & Holm, K. (1986). Aerobic exercise, maternal self-esteem, and physical discomforts during pregnancy. Journal of Nurse-Midwifery, 31(6), 255-261.

Wallace, A. & Engstrom, J. (1987). The effects of aerobic exercise on the pregnant woman, fetus, and pregnancy outcome: A review. Journal of Nurse Midwifery, 32(5), 277-290.

Yoshitake, H. (1971). Relations between the symptoms and the feeling of fatigue. Ergonomics, 14, 175-186.

Yoshitake, H. (1978). Three characteristic patterns of subjective fatigue symptoms. Ergonomics, 21(3), 231-233.

Zaharieva, E. (1972). Olympic participation by women. Effects on pregnancy and childbirth. Journal of the American Medical Association, 221(9). 992-995.