THE RELATIONSHIP BETWEEN MATERNAL FITNESS LEVEL AND LENGTH OF ACTIVE LABOR, USE OF ANALGESICS, AND INCIDENCE OF PERINEAL LACERATION IN PRIMIPARAS

by

Audrey M. Stevenson-Brim

A thesis submitted to the faculty of
The University of Utah
in partial fulfillment of the requirements for the degree of

Master of Science

College of Nursing

University of Utah

June 1990

THE UNIVERSITY OF UTAH GRADUATE SCHOOL

SUPERVISORY COMMITTEE APPROVAL

of a thesis submitted by

Audrey M. Stevenson-Brim

This thesis has been read by each member of the following supervisory committee and by majority vote has been found to be satisfactory.

February 19, 1990

February 19, 1990

February 19, 1990

Thomas C. Skidmore

THE UNIVERSITY OF UTAH GRADUATE SCHOOL

FINAL READING APPROVAL

To the Graduate Council of The University of Utah:

I have read the thesis of Audrey M. Stevenson-Brim in its final form and have found that (1) its format, citations, and bibliographic style are consistent and acceptable; (2) its illustrative materials including figures, tables, and charts are in place; and (3) the final manuscript is satisfactory to the Supervisory Committee and is ready for submission to the graduate school.

[illegible]-90
Date

Elizabeth J. Pugh
Member, Supervisory Committee

Approved for the Major Department

Linda K. Amos
Chairman/Dean

Approved for the Graduate Council

B. Gale Dick
Dean of the Graduate School

ABSTRACT

Thirty-five primiparas were tested for aerobic fitness levels and assigned to either a control or experimental group based on fitness level. The experimental group represented primiparas who engaged in regular, sustained, aerobic activity for 20 minutes, three times weekly from 28-36 weeks gestation. The control group was comprised of 17 primiparas who did not perform any sustained, aerobic activity.

After the subjects' deliveries, hospital chart reviews were conducted to determine the length of stage 1 and stage 2 labors, the amount and type of analgesia used, and the incidence of perineal lacerations.

Statistical comparisons between the two groups indicated that no significant difference between the stage 1 or stage 2 labor times was demonstrated. There was also no difference in the incidence of perineal lacerations noted between the control and experimental groups. There was a statistically significant decrease in the use of analgesia by the experimental, exercise group.

CONTENTS

ACKNOWLEDGMENTS

I would like to express my sincere gratitude to the members of my Supervisory Committee: Dr. Elizabeth Pugh, Suzie Tarmina, and Dr. Thomas Skidmore. Not only have these individuals provided technical assistance and expertise, but each one has also contributed to my personal and professional growth.

I would like to acknowledge the expert assistance provided by Bobbi Maire in the manuscript preparation, the computer programming done by Sally Marriot, and the statistical analysis provided by Jeff Jensen.

I am especially indebted to my family and friends for their patience and encouragement. Last, but not least, I thank my beautiful children. It is to them that this work is dedicated.

CHAPTER I

INTRODUCTION

Extent and Importance of the Problem

During the past 30 years, increasingly more North Americans have engaged in some type of fitness activity. Reports suggest that some 85 million North Americans regularly participate in some type of physical fitness program (Hale, 1985). Although it remains unknown how many of this 85 million are women of childbearing age, it is estimated that between 10% and 67% of all women exercise regularly and evidence suggests that this percentage may be on the rise (Gauthier, 1986).

Many women who exercise regularly are interested in continuing to exercise when they become pregnant. Although the benefits of regular aerobic training in improving cardiovascular endurance have been recognized for several years, recent researchers also demonstrated beneficial effects on coagulation (Williams, Logue & Lewis, 1980) and plasma triglycerides (Goldberg & Elliot, 1985; Wallace, Boyer, Yan & Holm, 1986). Based on the research of Korrok (1981), Mason (1984), Wirth, Emmons, and Larson (1978), and Zaharieva (1972), it is suggested that regular exercise during pregnancy may relieve physical discomfort, resulting in a faster and easier labor and a more rapid postpartum recovery.

In addition to the positive physical benefits derived from exercise, several psychological benefits have been identified as well. Glazer (1980) reported that exercise was helpful in reducing anxiety levels among pregnant women. Moore (1978) and Weinberg (1978) reported that women who regularly exercised suffered less body image disturbance and subsequently manifested more self-esteem.

Although the data are inconclusive, they suggest that aerobic exercise during pregnancy is safe for both mother and fetus provided there are no preexisting maternal diseases or obstetrical complications. In addition to being safe, it appears that exercise may have a positive and beneficial effect upon pregnant women.

It 1985, the American College of Obstetrics and Gynecology (ACOG) responded to the growing number of requests from health care providers and patients regarding the safety of exercise during pregnancy. They issued the following standardized guidelines for pregnancy and the postpartum period:

1. Regular exercise (at least three times per week) is preferable to intermittent activity. Competitive activities should be discouraged.

2. Vigorous exercise should not be performed in hot, humid weather or during a period of febrile illness.

3. Ballistic movements (jerky, bouncy motions) should be avoided. Exercise should be done on a wooden

floor or a tightly carpeted surface to reduce shock and provide a sure footing.

4. Deep flexion or extension of joints should be avoided because of connective tissue laxity. Activities that require jumping, jarring motions, or rapid changes in direction, should be avoided because of joint instability.

5. Vigorous exercise should be preceded by a 5-minute period of muscle warm up. This can be accomplished by slow walking or stationary cycling with low resistance.

6. Vigorous exercise should be followed by a period of gradually declining activity that includes gentle stationary stretching. Because connective tissue laxity increases the risk of join injury, stretches should not be taken to the point of maximum resistance.

7. Heart rate should be measured at times of peak activity. Target heart rates and limits established in consultation with the physician should not be exceeded.

8. Care should be taken to gradually rise from the floor to avoid orthostatic hypotension. Some form of activity involving the legs should be continued for a brief period.

9. Liquids should be taken liberally before and after exercise to prevent dehydration. If necessary, activity should be interrupted to replenish fluids.

10. Women who have led sedentary lifestyles should begin with physical activity of very low intensity and advance activity levels gradually.

11. Activity should be stopped and the physician consulted if any unusual symptoms occur (ACOG, 1985, p. 1).

Regarding exercise during pregnancy only, ACOG (1985) made the following recommendations:

1. Maternal heart rate should not exceed 140 beats/minute.

2. Strenuous activities should not exceed 15 minutes in duration.

3. No exercise should be performed in the supine position after the 4th month of gestation is completed.

4. Exercises that employ the Valsalva maneuver should be avoided.

5. Calorie intake should be adequate to meet not only the extra energy needs of pregnancy, but also of the exercise performed.

6. Maternal core temperature should not exceed 38 degrees C (ACOG, 1985, p. 1).

These guidelines are based on laboratory testing that examined the physiologic systems of both the mother and fetus during aerobic exercise. It was determined that aerobic exercise was the activity most women could safely undertake on their own without supervision.

ACOG's guidelines are subject to change as further research is conducted. In September 1985, weightlifting (which was previously unacceptable by ACOG standards as an exercise during pregnancy) was listed as acceptable in an ACOG technical bulletin (Gauthier, 1986). More vigorous activities are recommended only in situations where the individual will be in a supervised setting.

Although significant research has been conducted to determine the influence of exercise on pregnancy, most information regarding the relationship of aerobic training and length of labor, use of analgesics, and postpartum recovery, has been anecdotal in nature. Further information is needed regarding specific benefits that exercise may provide the mother or her fetus.

Purpose

The purpose of this study was to assist health care providers in making individualized exercise recommendations to pregnant women through determination of the health benefits of exercise as they relate to labor, pain control, and incidence of selected labor complications.

Problem Statement

With the current emphasis on physical fitness, more health care providers are faced with the challenge of providing exercise recommendations for their pregnant clients. Such recommendations are often difficult to provide as information is scant and often contradictory. More information is needed in order to make informed recommendations.

Fitness can be assessed using oxygen-pulse, ventilatory equivalents, respiratory exchange ratios, lactic acid production, and maximal oxygen consumption parameters. Of the noninvasive parameters, maximal oxygen consumption has a high correlation with maximal cardiac output and may provide a valid measure of an individual's prior exercise history, as well as serving as the best single measurement of physical working capacity (Artal & Wiswell, 1986; Astrand & Rodahl, 1977).

In order to utilize the criteria developed by Astrand

and Rodahl (1977) for valid testing of individual response to exercise, instrument testing must include: (a) work that involves the large muscle groups, (b) work that is reproducible and measurable, (c) performance that produces results that are comparable and reproducible, (d) tolerance of the test by all healthy individuals, and (e) utilization of uniform mechanical skill for performance.

Although many researchers have studied various maternal and fetal physiological parameters, many questions remain. As more information is made available, health care providers and consumers will be able to make safer, more individualized, and better informed decisions on exercise. With such information, exercise can become an effective adjunct to prenatal care.

Purposes of the Study

The purposes of this study were to:

1. Investigate the relationship between fitness level during pregnancy and the length of active labor in primiparas.

2. Explore the relationship between fitness level and the use of analgesics during active labor.

3. Examine the relationship between fitness level and incidence of perineal lacerations.

Research Hypothesis and Questions

The research hypothesis and questions were developed from the study purpose, the problem statement, and the literature review. The hypothesis stated,

> There will be no significant differences found in the stage 1 and stage 2 labor times, the amount and type of analgesia used during labor, or the incidence and severity of perineal lacerations between primiparas who participate in regular, sustained aerobic exercise and those who do not.

Research Questions

The research questions addressed in this investigation included:

1. What is the relationship between aerobic training during pregnancy and the length of active labor in primiparas?
2. What is the relationship between aerobic training and the use of analgesia during active labor?
3. What is the incidence of perineal lacerations between primiparas who are fit and those who are not?

Definition of Terms

For the purposes of this study, the following operational definitions have been used.

1. Aerobic training: Sustained physical activity

that elevates and sustains the individual's heart rate at 140 beats per minute continuously for 20 minutes.

2. Active labor: Cervical dilation from 3 to 10 centimeters.

3. Primipara: A woman experiencing her first pregnancy.

4. Analgesic: Any pharmacological substance used for the purpose of relieving physical discomfort.

Implications for Nursing

Current nursing education places an emphasis on the holistic approach to health care delivery. The results of this study may assist nurse practitioners, in particular, and other health care providers, in general, in facilitating holistic care for pregnant women and their fetuses.

Nurse practitioners are ideally suited to evaluate and promote the use of exercise during pregnancy by critically examining new research findings as they become available and by performing thorough and critical health care appraisals of their exercising clients. Because more women of childbearing age are exercising than ever before, nurse practitioners can help ensure that the physical and psychological benefits can be continued throughout pregnancy.

CHAPTER II

REVIEW OF LITERATURE

With current interest in the health care benefits of exercise and fitness, an increasing number of women are now participating in exercise during pregnancy. The interaction of the increased metabolic demands of physical activity and those of pregnancy is poorly understood. It is important to understand the extent to which pregnancy affects the woman's ability to perform exercise and the degree to which activity affects the pregnant woman and fetus.

During pregnancy, a number of physiologic and endocrine adjustments occur to provide an optimal environment for the fetus. Every organ system is affected by this complex process. The physiologic changes of pregnancy do not constitute a maternal threat unless an imbalance among the various body systems occurs (Artal & Wiswell, 1986).

Human pregnancy is associated with increases in cardiac output, oxygen consumption, and ventilation. Research evidence indicates that when maternal respiratory and hemodynamic adjustments to pregnancy are compromised, the health and development of the fetus are affected

(Morton, Paul & Metcalfe, 1985). Therefore, it is important to consider the interactions between maternal exercise and pregnancy in providing safe prenatal care.

During exercise, there is additional stress on the respiratory, cardiovascular, musculoskeletal, and metabolic systems beyond those changes associated with pregnancy. Physiologic aspects of exercise that may be inconsequential to the nongravid woman may cause possible side-effects in the fetus (Mullinax & Dale, 1986).

During pregnancy, the cardiovascular system has an increase in blood volume, resting pulse rate, and stroke volume. Total blood volume increases by 35% or more during pregnancy and the cardiac stroke volume increases to accommodate the increase in circulating blood volume (Mullinax & Dale, 1986). Resting cardiac output during midpregnancy increases 30% to 50% over nonpregnant values (Morton et al., 1985). This increase in cardiac output is in excess of the increment in uterine blood flow. The increase in cardiac output may also be attributed to cardiac enlargement, as opposed to changes in loading or contractility (Artal & Wiswell, 1986).

Morton et al. (1985) identified four changes in hemodynamics that may alter exercise capability during pregnancy:

1. Resting cardiac output is increased by an average of 40%, suggesting that here is less margin of

cardiac reserve for the performance of muscular work.

2. Left ventricular volume increases, raising the possibility of an increased myocardial oxygen requirement.
3. The ratio of left ventricular radius to wall thickness increases during pregnancy -- a change that, other factors unaltered, would increase left ventricular wall stress.
4. Perhaps most important, there is a marked tendency for a sudden decrement in venous return and, as a result, in stroke volume in human subjects near term. This tendency increases the importance of the muscle pump and of compensatory tachycardia.

Changes in the respiratory system include anatomic and functional alterations. Although these changes begin in early pregnancy as the result of hormonal influence, primarily progesterone, the growing uterus later mechanically impairs ventilation. Despite the space occupied by the growing uterus, the total lung capacity shows relatively little reduction. Both tidal volume and minute ventilatory volume increase by 40%. Oxygen supply is increased by 40% to 50% due to the alveolar ventilation that increases proportionally to the increased pulmonary ventilation (Artal & Wiswell, 1986).

Additional pulmonary changes include a decrease in the residual volume by 300 ml. This reduces the functional reserve capacity by 300 ml. The result is a smaller oxygen reserve in the lung, and a subsequent decreased ability to withstand periods of apnea. The cause of the reduction in residual volume is thought to be a result of the increased central blood volume (Rovinsky & Jaffin, 1966).

Exercise further impacts the pregnant woman's respiratory system. It has been found that when 50% or more of the muscle mass is exercised, a plateau of oxygen consumption is reached and cardiac output increases. Therefore, the major hemodynamic response to exercise is a redistribution of blood flow to the exercising muscle (Speroff, 1980).

In addition to respiratory changes, pregnancy also causes changes in the endocrine system. During pregnancy, the metabolic rate increases by 25%. Previously, it was believed that this was a result of a hyperactive thyroid during pregnancy. However, measurements of T3 and T4 levels reveal no change in thyroid function from the nonpregnant state. Rather, estrogenic hormones cause increases in the thyroxin-binding globulin (Souma, Niejadlik, Cottrell & Rankel, 1973).

Increased metabolism during pregnancy results in increased body heat production. The physical mechanisms for dissipation of the increased body heat are of particular importance to the woman who exercises. Heat produced in the body must be delivered to the outer layer of the skin for dissipation to occur. Sweat glands provide for evaporation as a mechanism of heat loss (Guyton, 1981).

Increased blood flow to the skin begins during the second trimester. It is peripheral vasodilatation that enables the loss of body heat (Katz & Sokal, 1980).

Energy requirements of pregnancy are estimated to be approximately 80,000 kcal or 300 kcal/day. This energy is utilized in the growth and development of the fetus, growth of maternal tissues such as the breasts and uterus, and to provide for the increased activity of the cardiovascular, respiratory, and urinary systems (Artal & Wiswell, 1986). The energy requirements of pregnancy are met through an increased caloric intake or through a decrease in maternal physical activity. Such a decrease in activity reduces the energy expenditure.

Many pregnant women reduce activity because of changes in the musculoskeletal system, including increased laxity of the joints due to a softening of the ligaments. Another deterrent to activity is an alteration of the posture with resultant changes in center of gravity and maternal balance.

Only during the past 10 years has much of the information regarding the effect of exercise on the mother and her fetus become available. Concerns of exercise during pregnancy include: (a) Fetal hypoxia -- maternal hyperventilation reflects increased maternal oxygen demand during exercise, and the possibility of blood being shunted away from the uterus should be considered. (b) The generation of metabolic acids and alterations in metabolism may affect the fetus. (c) During exercise, a pregnant woman may experience hyperthermia, which increases oxygen requirements. (d) Orthopedic injuries may increase as a result of softening of joints and ligaments.

Several researchers examined the effects of exercise on uterine blood flow in sheep. Their findings revealed that no significant change in uterine blood flow occurred until the animals were exercised to the point of exhaustion (Clapp, 1980; Emmanouilides, Hobel, Yashiro & Klyman, 1972; Longo, Hewitt, Lorijn & Gilbert, 1978; Orr, Ungerer, Will, Wernicke & Curet, 1972; Veille, Hohimer, Burry & Speroff, 1985).

Other researchers found that total uterine blood flow was not altered after strenuous exercise, but the percentage of blood distributed to the placenta was increased. This phenomenon may compensate for hypocapnia resulting from hyperventilation with exercise in which a shift in the maternal oxygen dissociation curve would occur (Curet, Orr, Rankin & Ungerer, 1976).

Despite the reduction in uterine blood flow during maternal exercise, physiological changes in the fetus were small. Minor changes occurred in the blood concentrations of oxygen and substrates during prolonged exhaustive exercise. Additionally, despite a temperature increase of 1° to 2° C, there was little evidence of significant alteration of fetal metabolism, cardiovascular hemodynamics, or blood catecholamine concentrations. These findings suggest that acute exercise generally does not represent a major stress upon the fetus (Lotgering, Gilbert & Longo, 1985).

The fetus is typically warmer than its mother and that heat exchange is primarily accomplished through umbilical circulation. With a .5° to 1.5° C increase in temperature, there was an increase in the fetal heart rate and a 37% increase in umbilical blood flow. Fetal pH became more acidotic as a result of the accumulation of maternal lactic acid (Cefalo & Hellegers, 1978).

In separate studies, Smith, Clarren, and Sedwick-Harvey (1978) and Edwards, Penny, and Zevnik (1971) each found correlations between maternal hyperthermia and an increase in neural tube defects. These researchers reported that at 4-6 weeks gestation, hyperthermia can cause brain dysfunction, hypotonia, convulsions, skeletal malformations, and microcephaly. At 7-16 weeks gestation, hyperthermia can cause central nervous system disorders without skeletal abnormalities. Hyperthermia that accompanied infectious diseases was found to increase the incidence of spontaneous abortion and hyperthermia of greater than 38.5° C after the 16th week of gestation resulted in possible mild brain growth deficiency, decreases in head circumference, and infants who were small for gestational age.

When oxygen consumption was studied at rest and during pregnancy, it was found that the oxygen cost of standard exercise in pregnancy is increased as is the oxygen debt. This is more than can be explained by the increase in respiratory and myocardial workloads. The efficiency of performing mild muscular exercise declines during pregnancy (Pernoll, Metcalfe, Schlenker, Welch & Matsumoto, 1975). In another study by several of the same investigators (Pernoll, Metcalfe, Kovach, Wachtel & Dunham, 1975), it was determined that resting minute ventilation is increased in the gravid female as a result of the increased tidal volumes without any change in respiratory frequency. The increased amounts of progesterone in pregnancy cause the respiratory center to become more sensitive to carbon dioxide and arterial pCO_2. Physiological dead space increases in pregnancy due to decreased resistance to air flow and increased diameters of the conducting airways. This, however, is not altered by exercise in pregnancy.

Maternal exhaustion from acute exercise stress resulted in decreased uterine and umbilical blood flow. Decreased uterine blood flow was also determined to be caused by hyperthermia, alkalosis, and an increase in circulating catecholamines (Clapp, 1980).

Maternal hyperventilation and respiratory alkalosis produced a decrease in fetal pCO_2, an elevation in the fetal serum pH, and a decrease in the fetal pO_2. The decrease in fetal pO_2 may be due to decreased uterine blood flow and the shift of the oxygen affinities of hemoglobin by respiratory alkalosis (Emmanouilides et al., 1972).

The potential hazards of exercise in pregnancy include decreased uterine blood flow, a shift in the maternal/fetal oxygen dissociation curve, maternal/fetal hyperthermia, increased levels of norepinephrine and epinephrine in the maternal and fetal circulation, and the potential for maternal injury. Paisley and Mellion (1988) found, however, that pregnant women generally were able to maintain previous activity levels and sedentary women can begin to exercise if it is done gradually.

Jopke (1983, p. 139) compiled a list of reasons to exercise during pregnancy:

1. to control weight gain
2. to decrease backache
3. to decrease "postpartum belly"
4. to decrease varicose veins
5. to decrease constipation
6. to increase energy during the day and to improve

sleep at night
7. to decrease tension
8. to improve posture and appearance
9. to better cope with the physical and emotional stresses of pregnancy.

Among the positive effects of exercise during pregnancy is that a woman can improve her VO_2 max by performing regular exercise during pregnancy. This increase in VO_2 max may improve a woman's ability to tolerate labor. Furthermore, women that engage in regular exercise during pregnancy will have an enhanced sense of well-being and fewer minor complaints during pregnancy (Dressendorfer, 1978).

Several symptoms such as backache, headache, fatigue, dyspnea, and hot flashes were reduced in exercising women because of the reduction in neuromuscular tension and stress. Dyspnea in exercising, pregnant women was reduced as a result of lowered pCO_2 levels (Wallace et al., 1986).

Primiparas and multiparas involved in aerobic exercise improved or maintained their levels of aerobic fitness. Furthermore, maternal exercising caused no increase in neonatal morbidity or obstetrical complications (Kulpa, White & Visscher, 1987).

Physical conditioning programs during pregnancy have been found to reduce the length of hospitalization, decrease the incidence of cesarean section, and result in higher 1-minute Apgar scores. Women involved in physical conditioning programs also reported improved self-image and a decrease in the common discomforts of pregnancy for the duration of their participation in the exercise regime. Those who stopped exercising for more than 2 weeks experienced a return of the symptoms of physical discomfort (Hall & Kaufman, 1987).

Regular exercise in which there is a continual, moderate usage of the muscles, joints, bones, heart, and circulation serves to maintain these systems in good working order and daily demands are met with less effort. Additionally, moderate exercise during pregnancy has been associated with a reduced incidence of spontaneous abortion and premature labor. Finally, exercise does not appear to affect fetal birthweight, Apgar scores, or duration of gestation (Bassey, Fentem & Turnbull, 1987).

Pregnant women can successfully increase aerobic capacity that otherwise declines with the added burden of pregnancy. Researchers have demonstrated that fetal heart rate increases a small amount during exercise, but remains within normal limits (Artal & Wiswell, 1986; Collings, Curet & Mullin, 1983; Hon & Wohlgemuth, 1961; Pijpers, Wladimiroff & McGhie, 1984; Pomerance, Gluck & Lynch, 1974a,b; Stembera & Hodr, 1967).

When the median maternal heart rate is accelerated to 68% of the expected maximum heart rate, no significant alterations in fetal heart rate, fetal cardiac dimensions or fetal ventricular function have been observed. Only minor accelerations and decelerations were reported. These results indicate that moderate, short-term maternal exercise can be performed without inducing fetal cardiac distress (Sorenson & Borlum, 1986).

Maternal heart rate, cardiac output, cardiac index, placental weight, and the infant's birthweight are not correlated with placental blood flow. Therefore, submaximal exercise performed during a normal pregnancy has little effect on placental blood flow measured after exercise (Rauramo & Forss, 1988).

The effect of exercise on the length of labor and type of delivery remains unclear. Several authors have reported shorter duration of the first and second stages of labor, as well as lower rates of cesarean and forcep deliveries in female athletes. Unfortunately, these researchers did not examine their data for statistical significance, although one study did demonstrate that high fitness levels during pregnancy were associated with shorter labors. Wallace and Engstrom (1987) identified the following activities that are considered safe throughout pregnancy: "Golf, Swimming, Jogging, Bicycling, Racket Sports, Aerobic Dancing, Cross-Country Skiing" (p. 286). These same authors identified the following activities that might become unsafe as the pregnancy progresses: "Basketball, Volleyball, Gymnastics, Horseback Riding, Water Skiing, Downhill Skiing, and Ice Skating" (p. 286).

Finally, Wallace and Engstrom (1987) considered the following activities to be unsafe throughout pregnancy: "Scuba Diving, Boxing, Hockey, Soccer, Tackle Football, and Competitive Events" (p. 286).

Even the most motivated woman may have difficulty maintaining an exercise program throughout pregnancy. In one study, it was found that only 25% of women exercising early in their pregnancies continued throughout the entire gestational period. Among the reasons cited for discontinuing exercise were physical discomfort and insufficient time (maintaining a work schedule) (Clapp & Dickstein, 1984).

The decision to exercise during pregnancy is one that must be made between the woman and her health care provider based on considerations of maternal health, exercise form, duration and intensity, and the impact of each of these factors on fetal outcome.

CHAPTER III

METHODOLOGY

A descriptive design was utilized to investigate the following: (a) the influence of fitness level during pregnancy on the active phase of labor in primiparas, (b) the influence of fitness level during pregnancy on the amount of analgesics used during active labor, and (c) the influence of fitness level during pregnancy on the incidence of perineal laceration.

Subjects

Study participants were selected from existing, organized, childbirth classes in the Salt Lake City area. Participants were selected by means of response to a volunteer questionnaire requesting participation in the study. Control subjects were selected from childbirth education classes in the Salt Lake City, Utah area by response to a questionnaire requesting participation in the study.

All participants were required to meet criteria for participation in the study. These criteria included completion of a health history questionnaire and completion of informed consent forms. Each participant was required to obtain signed approval from her physician to qualify for participation in the study. Only those individuals who reported regular aerobic activity were considered for inclusion in the study group. No participants were asked to begin an exercise program. The investigator was interested in studying individuals that voluntarily performed some type of regular aerobic activity and those who chose not to exercise. The bicycle testing utilized to obtain information on fitness level of the women in both groups is a noninvasive process that measures aerobic fitness level without risk or discomfort to either the mother or fetus.

Procedure and Instrumentation

Women were assigned to either the control or study group based upon the results of the bicycle testing. This testing placed each individual into a fitness category. Individuals who tested in the very low, low, or fair categories were placed in the control group. Individuals who tested in the good, excellent, or superior categories were placed in the study group.

The following criteria were utilized to obtain a homogeneous sample:

1. Maternal age at term 18-35
2. Primigravida
3. Singleton pregnancy
4. Term date well-established

5. Prepregnancy weight appropriate to height
6. Hemoglobin > 11 mg/dl
7. Hematocrit > 35%
8. Smokes < 10 cigarettes/day
9. Absence of the following conditions as established by medical history and physical examination (indicated on the questionnaire): (a) heart disease, (b) renal disease, (c) endocrine disorders, (d) hypertension, (e) seizure disorders, (f) toxemia of pregnancy, (g) respiratory conditions, (h) Rh or other blood group sensitization, (i) drug addiction or abuse, and (j) hematological disorder.

To qualify for participation in the study, the individual must have had no preexisting health or obstetrical problems for which exercise would be contraindicated. Further, participants must have received a signed release from their health care provider allowing participation in the study. All participants were required to complete a questionnaire regarding demographics and health-related information. Any subject failing to meet the qualifying criteria at any point during the study were eliminated.

Both groups of women were tested at the University of Utah Exercise Physiology Laboratory using a stationary bicycle testing using the Astrand method for determining aerobic fitness. Following delivery, a hospital chart review was conducted to determine the length of active labor, use of analgesics, and the incidence of perineal laceration for both groups.

Statistical Analysis

Descriptive statistics were used to describe frequencies of variables including sample social and physical characteristics, medical, obstetrical, and activity histories. *T* tests were computed to assess differences between the two groups with respect to physical characteristics, as well as medical, obstetrical, and activity histories. Analysis of variance was performed for the variables of labor time, differences in the use of analgesics, and incidence of perineal laceration between the two groups. Paired *t* tests were used to compare test values for critical variables by group.

CHAPTER IV

RESULTS

The data collected for this study were analyzed using both parametric and nonparametric statistics. Descriptive statistics were utilized to compare demographic information. Both independent *t* tests and chi-square tests were performed to analyze differences between the two groups studied.

The hypothesis in this study stated:

> There will be no significant differences found in the stage 1 and stage 2 labor times, the amount and type of labor analgesia used, or the incidence and severity of perineal lacerations between primiparas who participate in regular, sustained aerobic exercise and those who do not.

Description of Subjects

Of the initial 40 women qualified for participation in the study, 35 completed the study. Of this 35, 17 were assigned to the control group and 18 were assigned to the experimental group. Of the original 40, 5 women had cesarean births and were eliminated from the study.

The participants in this study ranged in age from 18 to 35 years of age, with the mean age being 23. All participants met the criteria for participation in the study and had uncomplicated pregnancies. Of the 5 women who had cesarean deliveries, 1 was due to a history of antepartum genital herpes, 1 was due to a fetal breech presentation, 1 was performed due to fetal decelerations due to a short umbilical cord, 1 was done as a result of cephalopelvic disproportion, and the last was done because of a nonprogressing labor, despite the use of induction therapy.

The participants in the study were assigned to either the control or the experimental group based upon fitness level as determined by the Astrand stationary bicycle test (Table 1). Of those individuals assigned to the control group, 3 (17.6%) reported regular aerobic activity. Eighty-two percent of the women in the control group did not report participation in any form of sustained aerobic activity. Of the 18 women assigned to the experimental group, 4 (22.2%) reported not engaging in any regular, sustained aerobic activity. Seventy-eight percent of the remaining 14 members of the experimental group reported regular, sustained aerobic activity.

In examining the frequency of individuals assigned to each of the six fitness categories as a result of the Astrand testing, it was found that 45.7% of all women tested had a very low to fair rating. The cumulative percentage (82.9-40.0 = 42.9%) had either fair or good ratings.

Of those individuals reporting participation in

Table 1

Number of Subjects by Fitness Level and Distribution to Control and Experimental Groups

(*N* = 35)

Group	Value	*f*	% of *n*	Valid % of *n*
Control				
Very low	1	5	14.3	14.3
Low	2	9	25.7	25.7
Fair	3	2	5.7	5.7
Experimental				
Good	4	13	37.1	37.1
Excellent	5	4	11.4	11.4
Superior	6	2	5.7	5.7
Total		35	100.0	100.0

regular aerobic activity, 4 (11.4%) reported performing a formal aerobic exercise routine, 6 (17.1%) reported climbing stairs, 14 (40%) reported brisk walking, 1 (2%) reported performing martial arts, and 1 (2%) reported "other." No participants in either group reported bicycling, dancing, swimming, racquetball, volleyball, or jogging.

The majority of participants had physician providers. Thirty-two subjects (91.4%) had physician providers, while only 3 (8.6%) utilized Nurse-Midwives. The gestational age at the time of testing ranged from 32-38 weeks, with the mean testing at 36 weeks gestation. The hematocrit range at the time of testing was from 34-46%.

The stage 1 labor times ranged from 1.5 hours to 22 hours in length. The median time was 9.65 hours. The mode was 12.75 hours. The stage 2 labor times ranged from 8 minutes to 157 minutes. The median time for stage 2 labor was 45 minutes and the mode was 30 minutes.

Twenty-seven (77.1%) women used epidural analgesia. Eight (22.9%) participants utilized no analgesia. Forty-three percent of the 35 women sustained no laceration during delivery, 22.9% sustained a first-degree laceration, and 17.1% sustained second-degree lacerations. Fourteen percent sustained third-degree lacerations and 2.9% sustained fourth-degree lacerations. In evaluating the location of the lacerations, it was noted that 42.9% occurred on the perineum, while only 8.6% occurred in the vagina, and 5.7% occurred in the rectal wall.

Twenty-six (74.3%) participants had episiotomies performed, all of which were midline. Forceps were utilized in 10 of the 35 women, accounting for 28.6% of the group.

Infant birthweights ranged from 2110 to 3827 grams. There were no infants who were considered to be small or large for gestational age. The mean birthweight for the infants was 3311.3 grams. All women in the study delivered viable infants, with 22 being male and 13 being female.

Statistical testing was done to test for additional correlations in the data and to control for internal variables. With the age of the subjects ranging from 18-35, statistical testing with regard to the relationship bewteen maternal age and stage 1 labor indicated no statistical significance.

Therefore, no statistical relationship was demonstrated between maternal age and length of stage 1 labor in either group. Similar data were revealed regarding the relationship between maternal age and stage 2 labor (correlation = -.07186; r^2 = .00516, SE = 41.69227, $p < .6377$).

It was determined that infant birthweight also did not impact stage 2 labor in either the experimental or the control groups (correlation = -0.08247, $\underline{r}^2$ = .00680, SE = 41.65796, $\underline{p}$ = .6377). In comparing stage 2 labor times with stage 1 labor times in both groups, again no statistically significant relationships were revealed (correlation = .11506, $\underline{r}^2$ = .01324, SE = 41.52275, $\underline{p}$ = .5104).

Stage 1 and stage 2 labor times were analyzed in comparison to age and infant weight using Pearson correlations. Additional tests utilizing Spearman Rho and biserial correlations revealed no statistical correlations among the variables. It was concluded that maternal age and birthweight do not statistically affect the variables analyzed.

In examining the relationship between the use of anesthesia and incidence of episiotomy, a Fisher's Exact Test was performed (1-tail $\underline{t}$ = + .01512; 2-tail $\underline{t}$ = .1512). These values represent a statistically significant relationship ($\underline{p}$ = .05) between anesthesia and episiotomy. Interestingly, 50% of the women studied using no anesthesia had an episiotomy, while greater than 50% of the women utilizing anesthesia had an episiotomy.

Research Question One

Research question one asked,

> What is the relationship of fitness level and length of active labor in primiparas?

The experimental group was comprised of 18 women who tested in one of the following fitness categories: very good, excellent, or superior on the Astrand stationary bicycle test. The length of the experimental group's stage 1 labor (from cervical dilation of 4 cms to cervical dilation of 10 cms) was compared to the stage 1 labor times for the 17 women in the control group. With a 2-tailed *t* test comparing stage 1 labor times of the two groups, it was determined that no statistically significant differences in stage 1 labor times occurred bewteen the 2 groups ($t_{33} = .81$, $p > .30$) (Table 2).

Although not directly part of this research question, stage 2 labor time was also observed. Again, it was determined that no statistically significant differences existed between the control and exercise groups for length of stage 2 labor ($t_{33} = .81$, $p > .42$) (Figures 1 and 2).

Research Question Two

Research question two asked,

> What is the impact of aerobic training on the use of analgesics during active labor in primiparas?

Of the women assigned to the control group, 16 (94.1%) utilized epidural anesthesia. In the experimental group, 11 (61.1%) utilized epidural anesthesia. With Fisher's Exact Test analysis, a statistically significant relationship was demonstrated at $p < .05$ (1-tail $t = .02485$; 2-tail $t = .04075$). These results suggested that control group subjects were more likely to use anesthesia than the

Table 2

T Test Results for Stage 1 and Stage 2 Labor Times for the Control and Experimental Groups

	Stage 1		Stage 2	
	Control (*n*=17)	Experi- mental (*n*=18)	Control (*n*=17)	Experi- mental (*n*=18)
Mean (mins)	572.53	688.50	67.47	56.16
Mean (hrs)	10.00	11.40	1.10	.94
SD	279.67	370.28	41.71	41.09
F value	1.75		1.03	
t value	-1.04		0.81	
Degrees of freedom	33.00		33.00	
2-tailed probability	.306		.425	

Note. *T*=35; Stage 1 t_{33} = -1.04 (p > .20); Stage 2 t_{33} = .81 (p > 42).

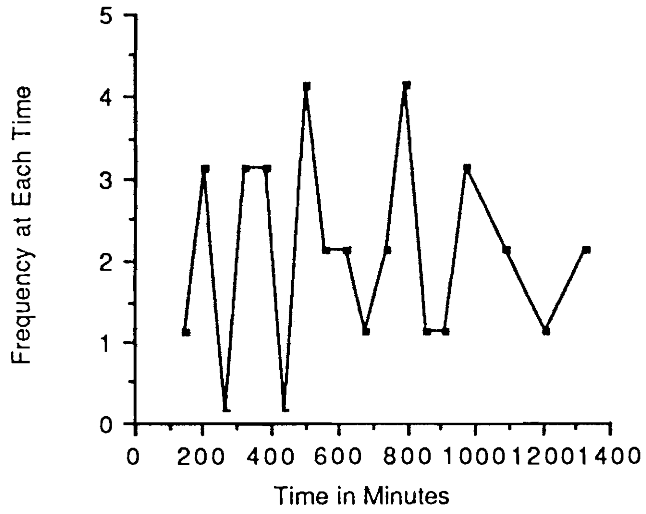

Figure 1. Stage 1 labor times for experimental and control group subjects (N = 35).

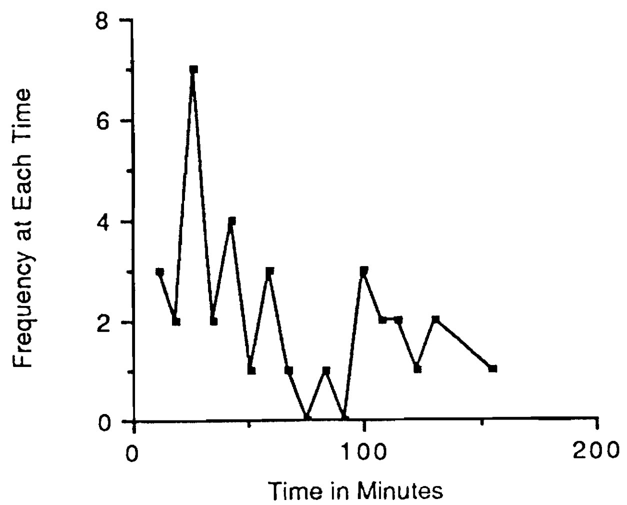

Figure 2. Stage 2 labor times for experimental and control group subjects (N = 35).

experimental group subjects (Table 3).

Research Question Three

Research question three asked,

> What is the incidence of perineal lacerations between primiparas who are fit and those who are not?

In comparing the use of anesthesia and the degree of laceration, no statistical relationships were evidenced. The Fisher's Exact Test also demonstrated no significant relationship between the use of anesthesia and the use of forceps (1-tail t = .58881; 2-tail t = 1.0000).

In further examining perineal lacerations, it was determined that no real tendency existed between the degree of laceration and the use of forceps. There was, however, what appeared to be a clinical trend between the use of forceps and the incidence of episiotomy. Further investigation utilizing Fisher's Exact Test produced no statistically significant relationships (Table 4). In summary, the present findings suggest that the significant differences between the control and experimental groups in this study related to the use of analgesia.

Table 3

Results of Fisher's Exact Test of Anesthesia Use Between Control and Experimental Groups

	n	Anesthesia	No Anesthesia
Control Group	17	16	1
Row %		94.1	5.9
Column %		59.3	12.5
Total %		45.7	2.9
Experimental Group			
Row %	18	11	7
Column %		61.1	38.9
Total %		31.4	20.0
Fisher's Exact Test ($p > .05$)			
One-tail		.02485	
Two-tail		.04075	

Table 4

Results of Fisher's Exact Test of Incidence of

Perineal Lacerations by Group (N = 35)

Lacerations	Fitness					
	Very Low	Low	Fair	Good	Excel-lent	Super-ior
None						
Number	2	5	1	5	2	0
Row %	13.3	33.3	6.7	33.5	13.3	
Col %	40.0	55.6	50.0	38.5	50.0	
Tot %	5.7	14.3	2.9	14.3	5.7	
Mild						
Number	3	3	1	5	1	1
Row %	21.4	21.4	7.1	35.7	7.1	7.1
Col %	60.0	33.3	50.0	38.5	25.0	50.0
Tot %	8.6	8.6	2.9	14.3	2.9	2.9
Moderate/ Severe						
Number	0	1	0	3	1	1
Row %		16.7		50.0	16.7	16.7
Col %		11.1		23.1	25.0	50.0
Tot %		2.9		8.6	2.9	2.9

Note. $p > .13$.

CHAPTER V

DISCUSSION AND IMPLICATIONS

This research study was conducted to determine the effect of maternal aerobic exercise on the length of active labor, the type and amount of analgesia used during active labor, and the incidence and severity of perineal laceration in primiparas. Although much research has been conducted in the area of exercise, comparatively little has specifically addressed the labor benefits that aerobic exercise may provide. Much of the research conducted to date utilized animals, was retrospective, or relied upon anecdotal information.

Conclusions

Findings from this study support previous research (Wallace & Engstrom, 1987) suggesting that moderate exercise in pregnancy does not harm mother or baby and may, in fact, be beneficial to pregnant women.

No statistical relationship was identified between the regular participation in exercise and the length of stage 1 or stage 2 labor in primiparas. Further, there was no statistical evidence that aerobic exercise influenced the incidence or degree of perineal lacerations.

Interestingly, 50% of the women studied using no anesthesia had episiotomies, while greater than 50% of the women utilizing anesthesia had episiotomies.

There was, however, a statistically significant relationship demonstrated between participation in aerobic exercise and use of analgesia. The data indicate that women who perform regular aerobic exercise are less likely than those who do not exercise to utilize medications during labor. This can be supported by information linking increased beta-endorphin levels during pregnancy and labor. In separate studies, Akil, Richardson, and Barchas (1979), Facchinetti et al. (1982), and Thomas, Fletcher, and Hill (1982) discovered that during pregnancy, beta endorphin levels are elevated.

It is also known that beta-endorphin and its precursor, lipoprotein, are released from the anterior pituitary during stress. Carr, Bullen, and Shrinar (1981) reported similar release in response to exercise. It was concluded that primiparas who do not exercise are more likely to use anesthesia than those who do exercise. Mothers in this research study verbalized a desire to have "natural deliveries" (without the use of medications) and yet the incidence of epidural use was relatively high in both groups. It has been postulated that approximately 86% of mothers delivering in one particular hospital (many study participants delivered there) utilize epidural medications, which may reflect institutional or practitioner preferences. In future studies, it would be useful to examine the incidence of epidural use in other states prior to making generalizations about the findings from this study. It would also be interesting to compare epidural use between patients of physicians versus nurse-midwives.

In testing the control and exercise groups, no statistical significance was found between maternal age and length of stage 1 labor. There was also no relationship between stage 2 labor and stage 1 labor. Also, no statistically significant correlation was demonstrated between the lengths of stage 1/stage 2 labors and infant birthweight.

It is likely that internal biases were controlled by utilizing only primiparas who met the participation criteria. By meeting the criteria, fitness levels would not be skewed by variables such as low hematocrit, underlying illnesses that could decrease aerobic capacity, or the use of drugs or cigarettes.

The use of analgesia was controlled for by using participants who were motivated for, and prepared to use, "natural" childbirth methods such as Lamaze or Bradley. It is realized, however, that it was not possible to control factors that may increase the potential for analgesia use such as fatigue, nonprogressive labor, or outside influence toward medication use by health care providers or significant others. The results from this study did not demonstrate a significant difference between the experimental and control groups in reference to stage 1 and 2 labor times.

These data do not support the reports by Wallace and Engstrom (1987) that suggest shorter stage 1 and stage 2 labors in female athletes. Pomerance et al. (1974b) found that fitness had a significant inverse relationship to length of labor in multiparas, but not in nulliparas. Clapp and Dickstein (1984) reported lower incidence of prolonged labor and cephalopelvic disproportion in exercising women.

In contrast, Dale, Mullinax, and Bryan (1982) reported a slightly increased tendency for oxytocin augmentation of labor for nonprogressive labors in women who ran during pregnancy. It is possible that the type of exercise may have a more direct relationship to the length of stage 1 labor, and particularly, the length of stage 2 labor. Activities that increase abdominal muscle strength and provide more control and strength in pelvic musculature may enhance the ability to expel (or push out) the fetus during stage 2 labor.

In examining the incidence of perineal lacerations, it was determined that no real tendency existed between the degree of laceration and the use of forceps, which may indicate that when forceps are used by highly-skilled practitioners, perineal lacerations do not always occur. There was, however, what appeared to be a clinical trend between the use of forceps and the incidence of episiotomy. This may explain the lack of relationship between the use of forceps and the incidence of perineal laceration.

Research Bias and Limitations

As a result of the restricted sample size, the strict criteria for participation in the study, the purposive sample procedure utilized, and the lack of variance in the study population, the application of these results to the general population is extremely limited. Randomization was not possible due to the limited number of individuals meeting the participation criteria. This threat to internal validity may have occurred as a result of selection. Because volunteers were not randomly assigned to groups, it is possible that the groups may have been unequal in some unforeseen manner. Pretreatment differences may have affected the two groups in a manner not obvious to the researcher. It is possible that maturation may also have impacted the results; although the data generated from this study did not bear it out, a difference in gestational age and aerobic fitness may well exist.

It is difficult to control for the variable of "attitude," or a psychological predisposition towards endurance of the discomfort of labor. It is possible that individuals who are disciplined enough to exercise regularly may also be able to endure the discomfort of labor longer than the individual that does not. Additionally, the researcher relied on the participant to provide an accurate exercise history in terms of the number of minutes she exercised each week and how many consecutive weeks the exercise continued. The use of actual fitness test results for assigning women to either the control or experimental group provided a more objective measure of the individual's actual fitness level.

Recommendations

The following recommendations are made for further research:

1. It is recommended that this study be replicated utilizing a larger sample.
2. It is recommended that the parameter of postpartum recovery be studied again comparing antepartum fitness levels with 6-week postpartum fitness levels, and utilizing questionnaires regarding the resumption of physical activities and perceived maternal energy level.
3. It is recommended that in future studies a more comprehensive demographic questionnaire be utilized in an effort to extrapolate more maternal

factors that may have influenced the study results.

Implications for Nursing Practice

Nurses have a unique role as women's health care providers. Nurses can participate in prenatal care as both providers and educators. With prenatal classes being taught primarily by nurses, the opportunity to teach pregnant women about the benefits of exercise exist. Many nurses, nurse practitioners, and nurse midwives provide family planning, antepartum, labor, and postpartum care. Such practice settings can contribute to the provision of holistic care of the woman of childbearing age. Because so many women of childbearing age exercise, it is important to have an understanding of the benefits and limitations of an exercise regime. If benefits can be derived from exercise, it is especially important to educate the public for the purpose of health promotion. As more information regarding the health benefits of exercise throughout the lifespan become known, nurses can provide information that will facilitate patients in making informed choices regarding their own health care. Because exercise can be an important adjunct to prenatal and postnatal care, further nursing research should be performed to identify additional benefits that exercise may afford women and their fetuses.

APPENDIX A

INFORMED CONSENT FORMS

Consent for Participation in an Investigational Study

Information

The purpose of this study is to investigate the relationship between a primipara's aerobic fitness level and the length of active labor (cervical dilation from 3-10 cm), amount of analgesia used, and the incidence of perineal laceration.

Study participants will be selected from existing prenatal aerobic exercise classes in the Salt Lake City area. Participants will be selected by means of response to a voluntary questionnaire requesting participation in the study. Control subjects will be selected from area Lamaze, Bradley, and other childbirth education classes in the Salt Lake City area by response to a questionnaire requesting participation in the study.

Forty subjects will be studied. The control group will consist of 20 primiparas who do not participate in any sustained aerobic activity. The experimental group will consist of 20 primiparas who engage in regular aerobic activity for 20 minutes three times per week.

Both the study and the control groups will be tested for maternal fitness level using submaximal stationary bicycle testing at the Exercise Physiology Laboratory at the University of Utah. Submaximal bicycle testing utilizes stationary bicycling to test an individual's heart response to workload. A cardiac monitor measures the heart rate and each participant is limited to a pulse rate of 140 beats per minute.

All participants will be tested between 32 and 38 weeks gestation. The testing is painless and will be performed at no cost to the participant. The testing lasts less than 10 minutes and is supervised by a trained technician.

Additional time will be required to complete questionnaires and consents. Each participant will receive valuable information and recommendations regarding her current fitness level.

Following the participant's delivery, a hospital chart review will be done to determine the length of active labor, the amount and type of analgesia used, and any incidence of perineal laceration. All information collected will remain confidential.

If you have any questions concerning the research methodology, or your rights as a participant, you may call Audrey Stevenson-Brim at (801) 254-2540. You may also contact Elizabeth Pugh, Ph.D., Chairperson of the Supervisory Committee at the University of Utah College of Nursing (801) 581-7728. If you need to discuss your subject rights or other matters you cannot discuss with the investigator, you may call the Institutional Review Board Office of the University of Utah at 582-3655.

Consent

I understand that participation in this study is voluntary and that my refusal to participate will involve no penalty or loss of benefits to which I would otherwise be entitled and that I may discontinue participation at any time without penalty or loss of benefits to which I would otherwise be entitled.

I understand that my participation in this study is contingent upon my physician's approval. I understand that my participation in this study may be terminated by the investigator without regard to my consent under the following circumstances: (a) if my participation in this study would, in some way, endanger my health or the health of my unborn child, or (b) if my physician has determined that I should not participate in this study. I understand that if I decide to withdraw from this study that arrangements will be made for an orderly termination and I will be informed of any consequences that may occur upon my decision to withdraw. I understand that new findings that develop during the course of the research, which may relate to my willingness to continue participation, will be provided to me.

I understand that the particular treatment or procedure described may involve risks to me that are currently unforeseeable. I understand that the submaximal bicycle testing may cause muscle soreness, fatigue, or fainting. In addition, I understand that the risks of loss of privacy, loss of time, and loss of confidentiality are present.

I understand that trained personnel will be conducting all testing and that these same trained personnel are trained in providing first aid, should it be necessary.

All records will be held in confidence by the investigator and the Institutional Review Board. They may be inspected by the Food and Drug Administration. Any release of information derived from these records to scientific organizations or medical journals will be done only without identification of the subjects.

I have read the foregoing and my questions have been answered. I desire to participate in this study and accept the benefits and risks, which may be serious and substantial. I give permission for information gathered in this study to be released to Audrey M. Stevenson-Brim, R.N.

Date____________ Subject Signature________________________

Date____________ Witness Signature________________________

A copy of this signed document will be given to the participants.

Informed Consent for Graded Exercise Test[1]

1. Explanation of Graded Exercise Test and Cardiovascular Disease Risk Profile

   You will perform a graded exercise test on a bicycle ergometer or motor-driven treadmill. The work will begin at a level you can easily accomplish and will be advanced in 2-minute stages. We may stop the test at any time because of signs of fatigue or you may stop when you wish to because of personal feelings of fatigue or discomfort. We do not wish you to exercise at a level that is abnormally uncomfortable for you.

2. Risks and Discomforts

   The possibility of certain changes occurring during the test exists. They include abnormal blood pressure, fainting, disorders of heart beat, and very rare instances of heart attack. Every effort will be made to minimize them by the preliminary examination and by observations during testing. Emergency equipment and trained personnel are available to deal with unusual situations that may arise.

3. Benefits to be Expected

   The results obtained from the exercise test should assist in evaluating the types of activities you might carry out with no or low hazards and in developing a cardiovascular disease risk profile for yourself.

4. Inquiries

   Any questions about the procedures used in the graded exercise test or in the estimation of functional capacity are welcome. If you have any doubts or questions, please ask us for further explanations.

5. Freedom of Consent

   Permission for you to perform this graded exercise test is voluntary. You are free to deny consent if you so desire.

---

[1] Reprinted with permission of Andrea White, Clinical Coordinator, Peak Academy.

6. <u>Release</u>

I hereby release the University of Utah, College of Health, and all of its officers, agents, and employees from all inability and responsibility for injury, illness, or other similar occurrence, including heart attack or its resultant complications, which might arise out of or result from my participation in the graded exercise test. I understand that any test results of a personal nature will be held confidential. Data used for research purposes may only be used when not identifiable with me.

I have read this form and I understand the test procedures that I will perform and I consent to participate in this test.

________________________________ ____________________
Signature of Participant Date

____
Witness (Program Staff)

APPENDIX B

PEAK MEDICAL HISTORY QUESTIONNAIRE[2]

---

[2] Reprinted with permission of Andrea White, Peak Academy.

Name________________________ SS#_________________________

Name of your physician___________________________________

List the date of your last:

Physical Exam________ Surgery ________ EKG ________

1. Have you been told by a **DOCTOR** that you have, or have had, any of the following (please check each response):

YES	NO	
( )	( )	Rheumatic Fever
( )	( )	An Enlarged Heart
( )	( )	Heart or Vascular Disease
( )	( )	Metabolic Disorders
( )	( )	Heart Murmur
( )	( )	Lung or Pulmonary Disorders
( )	( )	Thrombophlebitis (blood clots)
( )	( )	High Blood Pressure
( )	( )	Abnormal EKG Pattern
( )	( )	Diabetes
( )	( )	Hyperuricemia (high uric acid levels)
( )	( )	Varicose Veins
( )	( )	Stroke
( )	( )	Allergies, specify_________________________
( )	( )	Abnormally high blood lipids (cholesterol or triglycerides level)

2. Please list any drugs, medication, or dietary supplements **prescribed** by a physician that you are currently taking:

Drug______________ for________ Dosage_______________
Reactions____

Drug______________ for________ Dosage_______________
Reactions____

3. Please list any **self-prescribed** drugs, medications, or dietary supplements that you are currently taking.

Drug______________ for________ Dosage_______________
Reactions____

Drug______________ for________ Dosage_______________
Reactions____

4. Is there a history of heart disease, heart attack, elevated cholesterol levels, high blood pressure, or stroke in your immediate family (grandparents, parents, brothers or sisters)?

   ( ) Yes ( ) No Number________________

5. Do you smoke now?

   ( ) Yes ( ) No

   a. If yes, how many cigarettes do you smoke per day?
   ____

   b. If no, have you ever smoked?

   ( ) Yes ( ) No

   If yes, how many cigarettes per day? __________
   How long ago did you quit?______________________

6. Are you currently under a great deal of stress at work, school, or personally?

   ( ) Yes ( ) No

7. Do you actively relieve stress through exercise, meditation, or other methods?

   ( ) Yes ( ) No

8. Are you currently on a regular exercise program?

   ( ) Yes ( ) No

   If yes, please check the following:

   ( ) Walking ( ) Bicycling
   ( ) Aerobics ( ) Swimming
   ( ) Tennis ( ) Racquetball
   ( ) Other____________________________

   Frequency per week:

   ( ) 1-2 times/week
   ( ) 3-4 times/week
   ( ) 5 or more times/week

Duration (each day):

( ) < 15 minutes
( ) 15-30 minutes
( ) 30-45 minutes
( ) > 45 minutes

9. While exercising, do you ever feel limited by (if yes, state type of activity you are performing when this arises):

	Yes	No	
a. Breathing	( )	( )	Activity__________
b. Chest, arm, or neck pain	( )	( )	Activity__________
c. Low back pain	( )	( )	Activity__________
d. Pain in leg, relieved by rest	( )	( )	Activity__________
e. Sideaches	( )	( )	Activity__________
f. Lower leg pain Front-- shin splints Back--achilles	( )	( )	Activity__________
g. Extreme, long-lasting fatigue	( )	( )	Activity__________

I hereby certify that my answers to this questionnaire are true and complete and to the best of my knowledge, I am in good health.

Signed______________________________ Date_________________

Peak Maximal Capacity Test
Data Sheet

Descriptive Information:

Name________________________________ Date________________

Address______________________________ SS#_________________

City_______________ Zip___________ Phone_________________

Physiological Data

Age___ yrs ___ mos. Weight _______ kgs. _______ lbs.

Gender: **M** **F** Height _______ mms. _______ ins.

Time since last meal?____________________________________

Resting blood pressure___________________________________

Predicted maximal heart rate_____________________________

60% predicted maximal heart rate_________________________

70% predicted maximal heart rate_________________________

Bike Test:

Minute	Workload	Heart Rate	Pedal Rate	Workrate

Protocol:____

Administrator(s):____

APPENDIX C

PARTICIPANT QUESTIONNAIRE

Please note that all information will remain confidential.

Participant's name________________________________
last first

Date________________________________

Address________________________________

Age________ Telephone (home)____________ (bus.)____________

In case of emergency, name and number of person to contact:

____

Name/phone number of physician/midwife:____________________

____

Health

1. Is this your first pregnancy?____________________

2. Have you experienced any complications with this pregnancy?____________________

   If yes, please explain____________________

3. Due date for delivery____________________

4. Are you expecting twins?____________________

5. Do you smoke?___________ If yes, how many cigarettes per day?____________________

6. What is your current hematocrit or hemoglobin? ______
   ____
   (you may need to obtain this information from your physician)

7. Do you currently, or have you ever, had any of the following conditions (check all that apply):

   ___ a. heart disease
   ___ b. renal disease
   ___ c. endocrine (gland) disorder
   ___ d. hypertension
   ___ e. seizure disorder
   ___ f. toxemia of pregnancy
   ___ g. respiratory condition (asthma, etc.)
   ___ h. Rh or other blood group sensitization

___ i. drug addiction or use of unprescribed medications
___ j. hematological (blood) disorder
___ k. any other health or obstetrical problems (please explain)________________________
____
___ l. list any prescription or nonprescription medications that you currently use. Please list amount and reason for use:
____
____
____
____

Exercise

1. Do you participate in regular aerobic activity for 20 continuous minutes at least three times per week?

___ yes ___ no

2. How many minutes per week do you spend performing the following activities:

________ a. aerobic exercise
________ b. bicycling
________ c. dancing
________ d. climbing stairs
________ e. swimming
________ f. tennis
________ g. racquetball
________ h. volleyball
________ i. brisk walking
________ j. jogging
________ k. martial arts
________ l. other ________________________

3. How long have you been exercising regularly (three times per week)?________________________

4. ___ I do not participate in any sustained aerobic activity.

Thank you for your participation in this study!!!!

SELECTED BIBLIOGRAPHY

Akil, H., Richardson, D.H., & Barchas, J.D. (1979). Pain controlled by focal brain stimulation in man: Relationship to the enkephalins and endorphins. In R.F. Beers, Jr., & E.G. Bassett (Eds.), Mechanisms of pain and analgesic compounds (pp. 239-248). New York: Raven.

American College of Obstetricians and Gynecologists (1985). Home exercise programs: Exercise during pregnancy and the postnatal period. Washington, DC: Author.

Artal, R., & Wiswell, R.A. (1986). Exercise in pregnancy. Baltimore: Williams and Wilkins.

Astrand, P., & Rodahl, K. (1977). Textbook of work physiology. New York: McGraw-Hill.

Bassey, J., Fentem, P., & Turnbull, N. (1987). Reasons for advising exercise. The Practitioner, 231, 1605-1610.

Carr, D.B., Bullen, B.A., & Skrinar, G.S. (1981). Physical conditioning facilitates the exercise-induced secretion of beta-endorphin and beta-lipotropin in women. New England Journal of Medicine, 305, 560.

Cefalo, R.C., & Hellegers, A.E. (1978). The effects of maternal hyperthermia on maternal and fetal cardiovascular and respiratory function. American Journal of Obstetrics and Gynecology, 131, 687.

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

Clapp, J.F., & Dickstein, S. (1984). Endurance exercise and pregnancy outcome. Medicine, Science, Sports, and Exercise, 16, 556-62.

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, 6, 145.

Curet, L., 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.

Dale, E., Mullinax, K.M., & Bryan, D.H. (1982). Exercise during pregnancy: Effects on the fetus. Canadian Journal of Applied Sport Science, 7, 98-103.

Dressendorfer, R.A. (1978). Physical training during pregnancy and lactation. The Physician and Sportsmedicine, 6, 74.

Edwards, M.J., Penny, R.H.C., & Zevnik, D. (1971). A brain cell deficit in newborn guinea pigs following prenatal hyperthermia. Brain Research, 28, 341-345.

Emmanouilides, G.C., Hobel, C.J., Yashiro, K., & Klyman, G. (1972). Fetal responses to maternal exercise in sheep. American Journal of Obstetrics and Gynecology, 112, 130.

Erkkola, R. (1976). The influence of physical training during pregnancy on physical work capacity and circulatory parameters. Scandinavian Journal of Clinical and Laboratory Investigation, 36, 747-754.

Facchinetti, F., Centini, G., Parrini, D., Petraglia, F., D'Antona, N., Cosmi, E.V., & Genazzani, A.R. (1982). Opioid plasma levels during labor. Gynecologic and Obstetric Investigation, 13, 155-163.

Gauthier, M.M. (1986). Guidelines for exercise during pregnancy: Too little or too much? The Physician and Sportsmedicine, 14, 162-169.

Gilbert, R.D., Cummings, L.A., Juchake, M.R., & Lango, L.D. (1979). Placental diffusing capacity and fetal development in exercising or hypoxic guinea pigs. Journal of Applied Physiology, 46, 828-834.

Glazer, G. (1980). Anxiety levels and concerns among pregnant women. Research in Nursing and Health, 3, 107-113.

Goldberg, L., & Elliot, D.L. (1985). The effect of physical activity on lipid and lipoprotein levels. Medical Clinics of North America, 69, 41-55.

Guyton, A.C. (1981). Medical physiology. Philadelphia: Saunders.

Hale, R.W. (1985, May 15). Women and exercise. In Proceedings of the Twenty-Third Annual Meeting of the American College of Obstetricians and Gynecologists. Washington, DC: American College of Obstetricians and Gynecologists.

Hall, D., & Kaufmann, D.A. (1987). Effect of aerobic and strength conditioning on pregnancy outcomes. American Journal of Obstetrics and Gynecology, 157, 1199-1203.

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 and Gynecology, 142, 545-547.

Hon, F.H., & Wohlegemuth, R. (1961). The electronic evaluation of fetal heart rate. IV. The effect of maternal exercise. American Journal of Obstetrics and Gynecology, 81 361.

Hutchinson, P.L., Cureton, K.J., & Sparling, P.O. (1981). Metabolic and circulatory responses to running during pregnancy. Physician and Sportsmedicine, 9(8), 55-61.

Jopke, T. (1983). Pregnancy: A time to exercise judgment. The Physician and Sportsmedicine, 11 (7), 139-148.

Katz, M., & Sokal, M.M. (1987). Skin perfusion in pregnancy. American Journal of Obstetrics and Gynecology, 137, 30.

Korrok, M. (1981). Pregnant jogger! What a record. Journal of the American Medical ASsociation, 246, 201.

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

Longo, C.D., Hewitt, C.W., Lorijn, R.H., & Gilbert, R.D. (1978). To what extent does maternal exercise affect fetal oxygenation and uterine blood flow? Abstract in Proceedings of the twenty-fifth annual meeting of the Society for Gynecological Investigation (p. 7). Loma Linda, CA: Society for Gynecological Investigation.

Lotgering, K.R., Gilbert, R.D., & Longo, L.D. (1983). Exercise responses in pregnant sheep: Oxygen consumption, uterine blood flow, and blood volume. Journal of Applied Physiology, 155, 834.

Mason, M. (1984). Training for pregnancy. American Baby, 30, 53.

Moore, D.S. (1978). The body image in pregnancy. Journal of Nurse Midwifery, 22(4), 17-27.

Morton, J.J., Paul, M.S., & Metcalfe, J. (1985). Exercise during pregnancy. Medical Clinics of North America, 69, 97-108.

Mullinax, K.M., & Dale, E. (1986). Some considerations of exercise during pregnancy. Clinics in Sports Medicine, 5, 559-570.

Orr, J., Ungerer, T., Will, J., Wernicke, K., & Curet, L.B. (1972). Effect of exercise stress on carotid, uterine and iliac blood flow in pregnant and nonpregnant ewes. American Journal of Obstetrics and Gynecology, 114, 213.

Paisley, J.E., & Mellion, M.B. (1988). Exercise during pregnancy. American Family Physician, 38(5), 143-150.

Pernoll, M.L., Metcalfe, P.A., Kovach, R.W., Wachtel, R., & Dunham, M.J. (1975). Ventilation during rest and exercise in pregnancy and postpartum. Respiratory Physiology, 25, 295-310.

Pernoll, M.L., Metcalfe, J., Schlenker, T.C., Welch, J.E., & Matsumoto, J.A. (1975). Oxygen consumption at rest and during exercise in pregnancy. Respiratory Physiology, 25, 285-293.

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

Pokorny, J,. & Rous, J. (1967). The effect of mother's work on fetal heart sounds. In J. Horsky & Z.K. Stembera (Eds.), Intrapartum dangers to the fetus (pp. 354-357). Amsterdam: Excerpta Medica Foundation.

Pomerance, J.J., Gluck, L., & Lynch, V.A. (1974a). Maternal exercise as a screening test for uteroplacental insufficiency. Obstetrics and Gynecology, 44, 383-387.

Pomerance, J.J., Gluck, L., & Lynch, V.A. (1974b). Physical fitness in pregnancy: Its effect on pregnancy outcome. American Journal of Obstetrics and Gynecology, 119, 877-76.

Rauramo, I., & Forss, M. (1988). Effect of exercise on maternal hemodynamics and placental blood flow in healthy women. Acta Obstetrica Scandinavica, 67, 21-25.

Rovinsky, J.J., & Jaffin, H. (1966). Cardiovascular hemodynamics in pregnancy: III. Cardiac rate, stroke volume, total peripheral resistance, and blood volume in multiple pregnancy. Synthesis of results. American Journal of Obstetrics and Gynecology, 95, 787.

Smith, D.W., Clarren, S.K., & Sedwick-Harvey, M.A. (1978). Hyperthermia as a possible teratogenic agent. Journal of Pediatrics, 92, 878.

Sorenson, K.E., & Borlum, K.G. (1986). Fetal heart function in response to short-term maternal exercise. British Journal of Obstetrics and Gynecology, 93, 310-313.

Souma, J.A., Niejadlik, D.C., Cottrell, S., & Rankel, S. (1973). Comparison of thyroid function in each trimester of pregnancy with the use of tri-iodothyronine uptake, thyroxine iodine, free thy-roxine, and free thyroxite index. American Journal of Obstetrics and Gynecology, 116, 905.

Speroff, L. (1980). Can exercise cause problems in pregnancy and menstruation? Contemporary Obstetrics and Gynecology, 16, 87.

Stembera, Z.K., & Hodr, J. (1967). The "exercise test" as an early diagnostic aid for fetal distress. In J. Horsky & Z.K. Stembera (Eds.), Intrapartum dangers to the fetus (pp. 349-353). Amsterdam: Exerpta Medica Foundation.

Terado, M. (1974). Effect of physical activity before pregnancy on fetuses of mice exercised forcibly during pregnancy. Teratology, 10, 141-144.

Thomas, T.A., Fletcher, J.E., & Hill, R.G. (1982). Influence of medication, pain, and progress in labor on plasma B-endorphin-like immunoreactivity. British Journal of Anesthesia, 54, 401-408.

Veille, J.C., Hohimer, A.R. Burry, K., & Speroff, L. (1985). The effect of exercise on uterine activity in the last 8 weeks of pregnancy. American Journal of Obstetrics and Gynecology, 151, 139-148.

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

Wallace, A.M., Boyer, D.B., Yan, A., & Holm, K. (1986). Aerobic exercise, maternal self-esteem, and physical discomforts during pregnancy. Journal of Nurse-Midwifery, 31, 255-262.

Weinberg, J.S. (1978). Body image disturbance as a factor in the crisis situation of pregnancy. JOGN Nursing, 7(2), 18-20.

Williams, R.S., Logue, E.E., & Lewis, J.G. (1980). Physical conditioning augments the fibrinolytic response to venous occlusion in healthy adults. New England Journal of Medicine, 302, 987-991.

Wilson, N.C., & Gisolfi, C.V. (1980). Effects of exercising rates during pregnancy. Journal of Applied Physiology, 48, 34-40.

Wirth, V., Emmons, P., & Larson, Y. (1978, November). Running through pregnancy. Runners' World, 55-59.

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