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Determining the Level of Knowledge of UND College Women in Their Childbearing Years Regarding Exercise during Pregnancy

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DETERMINING THE LEVEL OF KNOWLEDGE OF UND COLLEGE WOMEN IN THEIR CHILDBEARING YEARS REGARDING EXERCISE DURING PREGNANCY

by

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This Scholarly Project, submitted by Tricia Flohr, Sara Hoerner, and Kari Melby in partial fulfillment of the requirements for the Degree of Master of Physical Therapy from the University of North Dakota, has been read by the Advisor and Chairperson of Physical Therapy under whom the work has been done and is hereby approved.

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(Chairperson, Physical Therapy)

PERMISSION

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Signature(s) Tricia Flohr

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Date 12/19/01

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ABSTRACT

With an increase in the number of pregnant women exercising, there is an increased need for patient education and the distribution of updated guidelines to promote appropriate exercise activities. **PURPOSE:** The purpose of this study was to determine the level of knowledge in English-speaking, college women in their childbearing years attending the University of North Dakota regarding the risks, precautionary measures and recommended modes of exercise during pregnancy. **SUBJECTS & METHODS:** Eighty-four women between the ages of 18 and 40 enrolled in the summer school session completed a thirty-one question survey. The survey was used to gather information about the training needs of college women regarding their understanding of risk factors associated with participating in exercise during pregnancy. **RESULTS:** It was found that the women had a significantly low level of knowledge of the risks, precautionary measures, and modes of exercise during pregnancy. It was also found that the women had a significantly lower amount of knowledge of the risks ($X=32.59 +/ -20.44$, $p<.001$), as compared to the precautionary measures ($X=49.7 +/ -20.90$, $p<.001$) or modes of exercise ($X=45.54 +/-24.75$, $p<.001$). **CONCLUSION:** College women between the ages of 18 and 40 do not have a good understanding concerning the risks of exercise, precautionary measures to be implemented, and recommended modes of exercise associated with pregnancy. **DISCUSSION:** The low scores may be contributed to factors such as no previous experience(s) of pregnancy or the size of city in which the

participants had lived the longest. The information obtained from this study may guide the development of appropriate educational tools and instructional protocols, and may serve as a precursor for future research.

CHAPTER I
INTRODUCTION

Exercise during pregnancy has been occurring since the beginning of time.[1] Historically, the guidelines established for exercise during pregnancy were based on social factors and society's attitude towards women.[1,2] The Romans advocated avoidance of any exercise during the first trimester (1-3 months), moderate activity during the second trimester (3-6 months), and even less activity during the third trimester (6-9 months).[1] In Victorian England, the approach to exercise in pregnancy was very conservative. However, over the years, the way in which exercise during pregnancy has been viewed has changed. Jackson[3] has contributed this change to the increased emphasis on physical fitness in today's society, which has influenced the pregnant woman's attitude and desire to exercise. Exercise has thus become a vital part of many women's lives, pregnant or not.[4,5]

Due to the "fitness boom" of the 1970's, the American College of Obstetricians and Gynecologists (ACOG) developed recommendations for safe exercise during pregnancy.[1,2,4] However, due to a consensus that the guidelines were stringent and too conservative, the ACOG revised their guidelines to a more liberal approach for exercise in pregnancy in 1994. Pivarnik[6] argued that this increased latitude provided by the updated guidelines created an increased responsibility for both the pregnant woman and her health care provider. Therefore, there is an increased need for patient education and the distribution of updated guidelines to promote appropriate exercise activities. Because

education, prevention, and physical fitness have become fundamental components within the physical therapy realm, therapists are often asked about appropriate exercise guidelines during pregnancy. Thus, physical therapists and other health care providers must be aware of ACOG guidelines devised to appropriately educate women on the safety of exercise during pregnancy. In addition, it is crucial for physical therapists and other health care providers to maintain current knowledge of exercise guidelines as research may result in modification of recommendations.

Problem Statement

In spite of all the information available involving exercise during pregnancy, questions as to what are and are not acceptable activities still exist in those who are pregnant or are considering becoming pregnant.[1] In addition, due to the accessibility of information through the media and the internet, women who are pregnant or are considering pregnancy may take what they read as factual without properly considering if the source is credible. As a result, women may be participating in activities that could possibly be harmful to themselves and/or their babies. Alternatively, women may be avoiding certain activities that can be performed safely due to the fear of harming their babies or themselves. Therefore, questions as to whether women in their childbearing years are aware of ACOG guidelines and adhere to these recommendations exist. Zeanah and Schlosser[4] found that a substantial number of women in their childbearing years do not adhere to the ACOG guidelines. Thus, educating women of childbearing years regarding exercise during pregnancy would assist in preventing potential adverse effects from inappropriate exercise practices, and would promote the well-being of both mothers and infants.

Purpose of Study

The purpose of this study is to determine the level of knowledge of non-pregnant, English-speaking, college women in their childbearing years attending the University of North Dakota regarding the risks, precautionary measures, and recommended modes of exercise during pregnancy. The study was accomplished through a survey distributed to those women who met the project's established requirements and attended Psychology, Communication, or Teaching and Learning courses during a summer session at the University of North Dakota. The data resulting from the surveys may provide health care professionals with a guide to utilize in the development of training materials for women of childbearing years concerning the risks of exercise, precautionary measures to be implemented, and recommended modes of exercise associated with pregnancy.

Significance of Study

Because physical therapists play a role in the area of physical fitness and exercise, they are often consulted by clientele for appropriate exercise prescriptions and guidelines.[1] Therefore, this study will provide information for physical therapists and other health care professionals about the knowledge women in their childbearing years have pertaining to the risks, precautionary measures, and modes of exercise during pregnancy. This information may guide the development of appropriate educational tools and instructional protocols, and may promote the safe use of exercise during pregnancy.

Research Questions

What is the level of knowledge women in their childbearing years have regarding the following:

1. The risks associated with exercise during pregnancy.

2. The precautionary measures that are to be implemented while exercising during pregnancy.
3. The modes of exercise deemed appropriate for the pregnant woman.

Further correlations between these research questions and other demographic questions observed in this study will be explained within the discussion chapter of this document.

Hypothesis

The null hypothesis states that non-pregnant, English-speaking, college women between the ages of 18 and 40 are very knowledgeable regarding the risks, precautionary measures, and modes of exercise appropriate during pregnancy. While the alternative hypothesis indicates that non-pregnant, English-speaking, college women between the ages of 18 and 40 are not knowledgeable about exercise during pregnancy. This would result in a need for further client education in what are and are not appropriate forms of exercise during pregnancy.

CHAPTER II
LITERATURE REVIEW

RISKS AND PRECAUTIONARY MEASURES OF EXERCISE

Potential risks to the mother and fetus have mandated precautions for exercising during pregnancy.[7-11] An intent of this study is to outline the potential risks and precautionary measures associated with exercise from conception to the birthing process.

Beginning or Continuing to Exercise

Pivarnik[6] stated that physical therapists are responsible for advising women who may be pregnant to consult a physician before beginning or continuing an exercise program. A physician's recommendation to *not* exercise may be because of underlying medical concerns or early evidence of immature fetal growth in the current pregnancy.[7] Stephenson and O'Connor[8] concluded that women must be screened for conditions that would limit medical, cardiovascular, musculoskeletal, or pregnancy-related complications.

Musculoskeletal Issues and Injuries

During pregnancy, the body undergoes hormonal and anatomical changes that may result in musculoskeletal complaints.[2,9-11] The hormones relaxin and progesterone produce increased joint laxity throughout pregnancy, and most significantly during the third trimester. Such an increase in joint mobility is a significant risk factor for weight-

bearing activities.[2,12] Joints most at risk are those not protected by overlying muscles, such as the knees and elbows. To protect these joints, Noble[13] recommended that women keep their "knees at ease and elbows soft" during physical activities.

Along with hormonal changes, the increasing abdominal cavity displaces the center of gravity, resulting in a progressive lumbar lordosis and rotation of the pelvis and femurs.[14] The enlarging breasts also contribute to the shift in center of gravity. This shift may interfere with a woman's balance and ability to perform physical tasks. These morphologic changes are relative contraindication to any type of exercise in which balance is a factor, especially during the third trimester (i.e., inline skating, water skiing, ice-skating, downhill skiing, surfing, or horseback riding).[9,14-17] To minimize the risk of injuries, Artal[14] suggested that women exercise on easy-to-control machines, such as treadmills or automated stair-climbing machines. Exercise involving the potential for even mild abdominal trauma should be avoided.[11,17]

The Supine Position

Artal[14] reported that lying flat on the back causes "supine hypotension" as a result of the uterus compressing the inferior vena cava and/or the abdominal aorta, reducing the return of blood flow to the heart.[12,14] The resulting diminished cardiac output is considered to be potentially dangerous to the fetus. There are discrepancies in the literature regarding guidelines for pregnant women lying supine. The American College of Obstetricians and Gynecologists (ACOG)[16] suggested that women avoid exercise in the supine position after the fourth month of pregnancy. Artal[14] stated that supine exercise should not be performed under any circumstance. In contrast, Noble[13] stated that most pregnant women have no problem lying on their backs, and only a few women

experience symptoms of hypotension in the end stages of pregnancy. Noble did suggest, however, that pregnant females limit exercise on their backs to less than five minutes. It has also been recommended that women intersperse exercise positions (supine with side-lying) to avoid potential adverse effects.[1,13]

Intensity of Exercise

The intensity of exercise varies the effects of exercise on the fetus.[11,16] Physiologically, lung volume is affected during pregnancy, with resting maternal oxygen consumption increasing as gestational age progresses.[11] This process results in an increased need of oxygen during rest and a decrease in the amount of oxygen available for exercise. Therefore, guidelines published by the ACOG[16] recommended that women exercising during pregnancy must adjust their exercise intensity.

Women may derive health benefits from even mild-to-moderate exercise (at least three times a week).[1,11] Brown[15] suggested that women exercise at 50-60% of Maximum Heart Rate (MHR) for 20-30 minutes, three times per week. Heckman and Sassard[9] recommended 60-70% of MHR at least three times a week, increasing to four-to-six times per week. Clapp[18] documented no adverse effects of women exercising up to 85% MHR. The ACOG[16] recommended that women exercise at a target heart rate of 140 bpm for no longer than 20 minutes, three times per week. The American College of Sports Medicine (ACSM) suggested that a woman used her perception of exertion (Borg's scale), to quantify subjective exercise intensity, where 60-70% MHR correlates with "somewhat hard" or "hard."

Among the above guidelines, Yeo[19] stated that none account for gestational age in determining maximum exercise intensities. Current guidelines may be based on

assumptions rather than on scientific knowledge since little data has been systematically collected from studies of pregnant women. The available guidelines may be too conservative or too aggressive depending on a woman's age, aerobic fitness level, or type of exercise. The ACOG[16] recommended that individuals modify their intensity of exercise according to maternal symptoms.

Fetal Heart Rate

It has been speculated that the underlying stimulus for fetal heart rate (FHR) is a decrease in placental perfusion, resulting in a small decrease in fetal PO_2.[20] The decrease in fetal PO_2 may lead to fetal distress (such as bradycardia) or a change in fetal behavioral patterns.[21] Clapp, Little, and Capeless[20] noted that FHR after maximum or near-maximum exercise in untrained women has been associated with post-exercise fetal bradycardia in pregnancies complicated by hypertension and growth retardation. In contrast, the researchers found that exercise in *healthy, well-conditioned* women at or above a baseline conditioning level in mid and late pregnancy is normally associated with an increase in FHR. Wilhelmina,[21] however, showed that moderately strenuous exercise in healthy pregnant women at term does not change FHR. These discrepancies suggest that there are many confounding variables influencing the FHR response, including the mother's fitness level, gestational age, intensity, type, and duration of exercise.[20]

Fetal Growth

During short-term exercise, cardiac output is directed toward the working muscles and away from the splanchnic organs.[2,10,12,14,22,23] During pregnancy this may result in an increased risk of fetal hypoxia and possible fetal growth retardation.[19,22,24] Clapp and Dickstein[24] stated that women participating in strenuous aerobic exercise have reported

an adverse effect on fetal growth. Campbell and Mottola[7] found that structured maternal exercise at a frequency of more than five times per week in the third trimester was strongly associated with an increased incidence of low birth weight babies. It was also noted that an exercise frequency of less than two times per week was only modestly associated with an increase in low birth weights. Clapp and Rizk[25] found that fit women who continued their regular routine of weight-bearing exercise throughout pregnancy delivered babies who were lighter and leaner than those born to physically active women in the control group, owing to a decrease in fetal fat mass.

In contrast, Clapp et al.[26] found that beginning a program of regular, moderate-intensity, weight-bearing exercise at eight or nine weeks' gestation enhanced fetoplacental growth (infants had a higher birth weight). Kardel and Kase[27] also found that well-trained women with uncomplicated pregnancies were able to safely continue aerobic exercise at high levels without compromising fetal growth and development. Kardel and Kase further found a tendency of high placental weights in the high-intensity exercise group as compared to a moderate-intensity exercise group.

The contrasting findings may suggest that the type of exercise and the time during pregnancy when exercise is initiated may be important determinants of low birth weights.[26] Also, the prior fitness level of the mother, intensity of exercise, and low or high-risk pregnancies appear to play a role in infant birth weight.

Schramm, Stockbauer, and Hoffman[28] found that mothers of very low birth weight infants were much less likely to exercise during pregnancy than mothers having babies of normal birth weight. This finding may lead physicians to encourage mothers

with a history of having low birth weight babies to restrict activity. However, exercise may also be part of the *treatment* for mothers of potential low birth weight infants.[26]

Pre-Term Labor and Spontaneous Abortion

It was once believed that exercise in the first weeks of pregnancy increased the risk of miscarriage or pre-term labor.[28] Clapp[20] reported that the incidence of spontaneous abortion is not increased in runners who continue to run during early pregnancy. Many authors[2,5,17,29] stated that there is limited evidence to suggest that moderate exercise in a healthy pregnancy will stimulate uterine contractions causing premature delivery, alter development of the fetus, or put a pregnant woman at higher risk for premature labor. As a precaution, however, it has been recommended that women who have previously delivered a baby before 36 weeks of pregnancy be very cautious in participating in an exercise program during the second and third trimesters of their current pregnancy.[10] It has further been recommended that women with preterm contractions should avoid exercise that increases uterine contractions, whether painful or painless.

Thermoregulation

Thermoregulation in pregnancy is a factor to consider, as maternal hyperthermia may increase the risk of CNS abnormalities in the fetus.[30] McMurray and Katz concluded that this is a more significant concern during the first trimester of pregnancy. Because of ethical issues, most studies have been based on the animal models, with human studies being retrospective in nature. Consequently, data concerning temperature effects on human fetal development are not definitive. However, McMurray and Katz referenced data indicating that hyperthermia may cause teratogenic effects to the fetus

and indicated that fetal distress may result when exercise is prolonged, performed in a hot, humid environment, or performed when the mother is dehydrated. Continuous activities, such as long distance running, have been reported to impose the greatest heat stress. McMurray and Katz stated that exercises involving more anaerobic work, such as weight training, do not impose as much thermal stress.

Because the fetus cannot cool off through perspiration or respiration, Butler[17] indicated that women must be cautious when exercising. Strenuous exercise should stop short of increasing core body temperature. Smith and Fisher[31] recommended that maternal core temperature should not be elevated greater than approximately 3°F (1.5°C). Butler[17] stated that the critical maternal core temperature is an excess of 100.4°F (38°C) and any temperature above this could de detrimental to the fetus and mother. Heckman and Sassard[9] noted that when strenuous exercise or activities result in persistent elevated body temperatures during the first eight weeks of gestation, when neural tube closure and organogenesis occur, increased risk of birth defects may result.

Kristal-Boneh[32] said that adequate fluid intake will help to prevent a rise in maternal core temperature. The researchers suggested that pregnant women should ingest fluids prior to and during exercise at 10-15 minute intervals. Another important consideration is clothing, which acts as an insulator causing heat retention. McMurray and Katz[30] recommended that during exercise, short sleeved, loose-fitting and light-colored clothing is best. The authors also recommended removing excess clothing during rest periods to expose the skin to the environment. To reduce thermal stress during exercise, McMurray and Katz stated that pregnant women include rest periods during

their normal workouts. Butler[17] further advised pregnant women to avoid saunas and hot tubs (including hot baths).

MODES OF EXERCISE

Modes of exercise that will be discussed are for healthy pregnant females. Exercise prescriptions for women with pregnancies that may be or are compromised are beyond the scope of this study and are not addressed.

Best Suited for Pregnancy

Sady and Carpenter[33] recommended that the pregnant exerciser use more generalized rhythmical exercises involving large muscle groups. Hartmann and Bung,[12] along with other authors,[1,8] indicated that swimming, walking, and stationary bike riding are also recommended forms of activity during pregnancy. Hartmann and Bung[12] also stated that acceptable types of activity while pregnant include participating in aerobics, running, and snorkeling. Brown[15] indicated that stretching, Frisbee, golf, and tennis may be performed while pregnant. However, authors[8,12,15] have stated that from all the various modes of exercise that may be performed while pregnant, walking or swimming are the best. Specific modes of exercise are further explained within this section of the report.

Exercises to Avoid

Any mode of exercise that places the expectant mother and her baby at increased risk should not be performed.[1,5,15] As stated by the ACOG[16], exercise that results in exhaustion should be avoided by women who are pregnant. Jarski and Trippett[34] explained that exercise resulting in exhaustion may lead to decreased blood flow to the uterus, possibly causing inadequate oxygen supply to the fetus. In addition, Brown[15]

stated that exercises emphasizing balance skills, as well as strenuous activities that may traumatize the uterus or abdominal region, are not recommended modes for pregnant females. These precautions eliminate water skiing, scuba diving, surfing, inline skating, ice skating, downhill skiing, horseback riding, endurance events, field hockey and other contact sports due to possible detrimental effects to the expectant mother and fetus.[1,9,15,35,36] Numerous authors[1,2,9,33] stated that scuba diving will have a harmful effect on the fetus due to the breathing of pressurized gases.

A summary of recommended guidelines regarding modes of exercise to be avoided during pregnancy is provided in Table 1.[8]

Table 1. Recommended Guidelines Regarding Modes of Exercise Women Should Avoid During Pregnancy.

1. Exercises that require women to lie supine for longer than 3 minutes after 4 months of gestation to prevent compression on the inferior vena cava.
2. Exercises that promote straining of the pelvic floor or abdominal muscles.
3. Exercises that excessively stretch hip adductors and possibly cause strain and trauma to the symphysis pubis.
4. Exercises involving sharp twists, rapid or uncontrolled swinging or bouncing movements.
5. Exercises that utilize positions in which the buttocks are higher than the head, as in bridging, supine bicycling motions, or modified quadruped position due to the potential for an air embolus to be introduced through the vagina.
6. Inversion activities.
7. Utilization of deep heat modalities or electrical stimulation.

Sapsford R, Bullick-Saxton J, Markwell S. *Women's Health A textbook for Physiotherapists.* Philadelphia, PA: WB Saunders Company Ltd;1998.

Running and Jogging

Hartmann and Bung[12] noted that jogging during pregnancy has been found to be safe provided that moderate levels of intensity and duration are implemented prior to conception. Artal and Buckenmeyer[35] and Sapsford et al.[1] indicated that runners, who

participated in these activities prior to becoming pregnant, should be able to continue the same program when pregnant if aware of the potential risks and warning signs that will signal them to stop or contact a physician. Warning signs will be discussed in the section explaining exercise guidelines.

Authors[1,35,36] stated that when running or jogging during pregnancy, current levels of fitness must be considered. Running distance, speed, and intensity will depend on whether women were able to exercise at beginner, intermediate, or advanced levels before becoming pregnant.[39] Artal and Buckenmeyer,[35] and other authors,[1,37] recommended that prior to beginning an exercise program while pregnant, women should get a general physical assessment by a physician.

According to Nordahl, Kerr, and Peterson,[37] when just beginning a running program, it is imperative to initiate the program with walking activities. If new to exercise prior to becoming pregnant and in the first trimester (0-3 months), the authors recommended that women start with a simple walking program such as walking for 30 minutes 2-3 times per week, with a day of rest in between. During the second trimester (3-6 months), walking intensity may increase. Nordahl, Kerr, and Peterson additionally stated that women should warm up by walking briskly for 5-10 minutes and then pick up the pace and power walk (walk at a fast pace, pumping the arms) for 25 minutes. Women should then cool down by walking slowly for 5 minutes. A walking and running program designed by Karen Nordahl, M.D., personal trainer Susi Kerr and physical therapist Carl Peterson is provided in Appendix A.

Walking and Biking

Stephenson and O'Connor,[8] Artal and Buckenmeyer,[35] as well as Sapsford et al.,[1] stated that walking is an excellent form of aerobic conditioning during any stage of pregnancy. To achieve a higher level of exercise, the authors indicated that brisk walking may be used. Brisk walking while pregnant should first be performed for 5-10 minutes at a time, and then increased to 20-30 minutes 3-4 times per week.[38] Artal and Buckenmeyer[35] indicated that women may continue walking at pre-pregnancy levels with medical clearance.

According to Stephenson and O'Connor,[8] bicycling is also a very good form of exercise to do while pregnant. Because it is a non-weight-bearing activity, bicycling will decrease the amount of stress on the joints, ligaments, and muscular structures. Stephenson and O'Connor also indicated biking should be performed in a cool place to decrease the risk of heat stress to the expectant mother and/or baby. Using a stationary bike over a non-stationary bike is recommended by Artal and Buckenmeyer[35] to decrease the chance of falls. Although biking is a safe form of exercise while pregnant, Artal and Buckenmeyer stated that some women find mobile cycling difficult after 4 ½ months due to the altering center of gravity and changing balance.

Aquatics

Swimming has been found to be one of the most beneficial forms of exercise for all to perform according to Hartmann and Bung.[12] Sapsford et al.[1] and Hartmann and Bung[12] stated that because of water's inherent properties, such as its buoyancy, performing exercise in water decreases the degree of stress on the body's joints. These researchers also noted aquatic exercise to be beneficial due to its relaxing effect on the

entire body, and stated that it is generally more comfortable than other forms of exercise, especially those activities involving weight-bearing.

Sapsford et al.[1] reported that aquatic activities are excellent modes of exercise for the pregnant female to perform. Exercising in water was also reported as physiologically advantageous to the mother and fetus. In addition to relieving stress to the joints, the hydrostatic pressure of the water may help alleviate unwanted edema and fluid build-up, common side effects of pregnancy. McMurray and Katz,[30] Hartmann and Bung,[12] and Sapsford et al.[1] reported that water between 28°C and 30°C may serve as a thermoregulatory buffer, protecting the fetus from the negative effects of overheating.

Hartmann and Bung[12] reported that stroke volume during exercise in water is increased as compared to on land. Sapsford[1] found that exercise in water at 70% of VO_2 max was well tolerated and offered several physiological advantages for the pregnant woman when compared to land based exercise. Hartmann and Bung[12] also reported that heart rate is reduced in water and metabolic rate is increased due to the warmth of the environment.

Aerobics

Authors[1,14,22,34,40-43] have stated that aerobic exercise of moderate intensity and duration is safe for both the mother and fetus. Sapsford et al.[1] and Jarski and Trippett[34] recommended low-impact cardiovascular activities. However, these authors noted that prior levels of function may allow the participants to perform aerobic conditioning of higher intensity if done so safely. Stephenson and O'Connor[8] asserted that to achieve maximal benefit while pregnant, conditioning should strengthen the cardiopulmonary system with 20 to 30 minute periods of aerobic activity. Stephenson and O'Connor also

declared that the participant's heart rate should fall within the designated target zone. How to determine a target heart rate is explained in the portion of this document discussing exercise prescription.

If the pregnant female wishes to participate in circuit training classes, Sapsford et al.[1] stated that the training pace be individualized for participants. Participating in 'New Body' classes (low-impact activities) was found to be safer for the pregnant female; however, these classes may still be too fast and require sudden changes of direction. According to Sapsford et al., step classes are not recommended due to the increased risk of falling and the potential aggravation of the symphisis pubis joint, an area already at stress due to the musculoskeletal changes associated with pregnancy.

Lastly, Hartman and Bung[12] concluded that aerobic exercise executed at a moderate intensity on a regular basis and performed outdoors is the best choice of activity during pregnancy. The researchers stated that exercise performed continually vs. intermittently is more beneficial. Hartmann and Bung[12] and Sapsford et al.[1] stressed that to truly achieve the most desirable and safe effects of aerobic exercise (class participation), women should begin aerobic classes before planning to get pregnant.

Weight Training

According to Sapsford et al.,[1] weight lifting can assist in facilitating a very productive and healthy pregnancy. These authors also proposed that strengthening will tone and build muscular strength in the upper extremities and lower extremities, which are used more during pregnancy. Targeting muscle groups, such as the quadriceps and the gluteals, will aide the mother in performing lifting activities. Strengthening the rhomboids and the quadriceps will aide the expectant mother in many active labor

positions by increasing the stability of the mother's position. It was also proposed that shoulder girdle strengthening, in addition to targeting the biceps and triceps, will aide the mother during activities of daily living, such as lifting a child or doing laundry. Sapsford et al. recommended using high repetitions with light weight. In addition, the authors stated that small hand weights (0.5 to 1 kg) are useful to strengthen the upper extremities and recommended that movement patterns should be monitored closely by both a therapist and the participant to ensure smooth controlled movements. Both Sapsford et al.[1] and Hartmann and Bung[12] recommended that weight training be limited to 2 to 5 kg weights or low resistance on machines to avoid the use of the Valsalva maneuver. These authors stated that addressing this topic with the pregnant exerciser is extremely important since Valsalva maneuvers may result in decreased venous return to the heart, increased arterial pressure and increased cardiac work. In addition, Sapsford et al.[1] indicated that free weights are not recommended since there is a chance of injury if they are dropped. However, according to Stipe,[44] free weights are permitted and may be beneficial exercise if handled by an experienced weight trainer in an appropriate and safe manner.

Although Sapsford et al.[1] recommended limiting weight to 2 to 5 kg, Sussman and Douglas[45] proposed that if women have been lifting prior to pregnancy, current regimens may continue through the first and second trimesters. However, these authors advised the pregnant female not to lift more than 30 to 35 lbs during the third trimester due to the increased risk to the fetus, resulting from the increased pressure within the abdomen, which may decrease the amount of blood flow to the fetus.

Sussman and Douglas[45] noted that body positioning is important in the expectant mother's strengthening regimen. It is recommended by the ACOG that pregnant females avoid exercising on their backs after the first three months of pregnancy. Reasons for this are explained within the risks and precautionary section of this document. Sussman and Douglas recommended using sitting upright (bicep curls) or standing (squats) positions. However, it is crucial that the expectant mother understand that any exercise that causes pain in the pelvic, spinal, or abdominal regions be avoided.

According to Sussman and Douglas,[45] the pregnant exercisers must be aware of the potential for injury when using free weights or machines. In addition to the danger of dropping a free weight on the abdomen, joint laxity due to hormonal changes may increase the risk for injury. The authors also recommended that women not use sudden, jerky motions or force lifting weights that are too heavy to manage safely to avoid damaging joints, muscles and ligaments. Finally, Sussman and Douglas recommended that women follow basic precautions of exercise when weight lifting, including avoiding dehydration, excessive core body temperatures and exhaustion. For individualized recommendations, women may contact their attending physicians. Additional precautionary information is provided in later segments of this document.

Stretching/Toning

According to Sapsford et al.,[1] the importance of gentle stretching and muscle lengthening after performing exercise is amplified in pregnant individuals. It is proposed that incorporating stretching activities will gently lengthen muscle groups that possibly shortened during pregnancy. Muscles reported to most commonly be affected include the piriformis, hip flexors, gastrocnemius-soleus, and pectorals. Sapsford et al. indicated it is

important that breathing techniques be incorporated with these exercises to enable safe participation by avoiding the Valsalva maneuver.

Sundin[46] reported that two recommended forms of stretching or toning activities pregnant women may perform are tai chi and yoga. It is believed that the combination of breath awareness, movement, mental control and stretching may increase overall body awareness. It is recommended that pregnant participants check with a physician, physical therapist and/or other health care professional to see if tai chi and/or yoga activities are appropriate prior to initiated activities.

Bochaton[47] advocated that postural skills are crucial during pregnancy. Yoga-like exercises, which require a constant awareness of body mechanics, may enhance the expectant mother's awareness of her posture, thus decreasing the adverse effects of poor posture. Bochaton remarked that the cat and camel exercise is a typical exercise that may help postural awareness and spinal mobility. This exercise requires the participant to be on hands and knees, flexing the entire spine and then reversing the movement with gentle extensions, from the sacrum to the cervical spine. Another beneficial exercise is the "Muslim Prayer." With this exercise, the mother is on hands and knees, trying to sit slowly on the heels, while stretching the lumbar spine. Additional exercises the mother may perform are shown in Appendix B.

Abdominal Strengthening

According to Sapsford et al.,[1] there has been controversy regarding the effectiveness, as well the objectiveness, of training the abdominal region during pregnancy. Because of the abdominals' role in trunk stability, postural skills, and labor (expulsion of the baby during second stage labor), physical therapists have been

interested in the function of the abdominal muscles. Sapsford et al. stated that during the stages of pregnancy, the rectus abdominus becomes lengthened due to the growth of the fetus and subsequent enlargement of the abdominal region, which decreases the mechanical advantage of the muscle. Thus, when considering performing abdominal exercise while pregnant, strengthening exercises are not very practical during the later stages of gestation. Pre-natal classes have focused on concentric abdominal exercise through modified sit-ups or mini-curls. However, Sapsford et al. proposed that the transversus abdominus and internal obliques be the muscles targeted during the pre-natal classes for two reasons. First, the rectus is at a mechanical disadvantage due to the lengthened state while pregnant. Second, stability is of prime importance while pregnant due to the increased load on the spine, postural changes, and decreased rectus abdominus strength secondary to the growing fetus. Because of these two reasons, the rationale of concentric trunk flexion (i.e., lying flat on one's back and raising shoulders and chest to ceiling), is questionable according to Wohlfahhrt et al.[48] The role of stabilization should be of prime concern when designing an abdominal exercise prescription.

As previously stated, Sapsford et al.[1] recommended that the pregnant female target the transversus abdominus. This may be accomplished by having the expectant mother in a quadruped position (on all fours; knees and forearms) to perform exercise. While in this position, women should relax the abdomen and then lift the baby up towards the spine. The weight of the baby and abdomen provide a stretch facilitation for the targeted transversus abdominus, with the baby providing additional resistance. Bochaton[48] further stressed the importance of sustaining proper pelvic tilt while performing the exercise. Lastly, Sapsford et al.[1] stated that the abdominal muscles'

actual function during pregnancy and the implications for proper exercise prescriptions are still areas in need of further research.

PHYSICAL CHANGES DURING PREGNANCY

Pulmonary

Wang and Apgar[5] reported there are pulmonary adaptations in the pregnant female during both early and late pregnancy. Hartmann and Bung[12] stated that early in pregnancy, progesterone primarily controls the pulmonary adaptations before ventilation is mechanically restricted by the uterus. Hartmann and Bung[12] and Artal[14] stated that in later pregnancy the expansion of the uterus leads to an elevation of the diameter and a widened transverse chest diameter, resulting in a decreased functional residual capacity and expiratory reserve volume. Despite these changes, however, the vital capacity remains normal. The most significant pulmonary adaptations noted by Hartmann and Bung and Artal included a mild increase in tidal volume and oxygen consumption secondary to the increased oxygen requirement of the fetus. Hartmann and Bung[12] found that because of the greater oxygen demand of the fetus, the pregnant female's respiratory frequency and oxygen consumption was increased from that of a non-pregnant female while exercising verses at rest. Artal[14] reported that the mother's increase in ventilation may reduce the arterial PCO_2. This increase in ventilation would then result in a mild maternal alkalosis, which would facilitate placental gas exchange and prevent fetal acidosis. However, as exercise increases to moderate and maximal levels, Artal[14] proposed that pregnant women demonstrate decreased respiratory frequency and lower tidal volume. Hartmann and Bung[12] indicated that as exercise intensity increases,

maximal oxygen consumption is attained. Both studies[12,14] stated that a modest increase in VO_2 max is achieved in pregnancy at much lower exercise levels.

Cardiovascular

Hakeem[50] noted that during pregnancy, cardiovascular changes occur due to the greater cardiac output produced by standard exercises versus that of non-pregnant females. Hartmann and Bung[12] and Hakeem[50] stated that total blood volume and cardiac output gradually begin to increase from the sixth to eighth weeks of gestation and peak at the end of the second trimester with an increase of 40-50%. This increase in blood volume is due to a greater increase in plasma cells verses red blood cells. In contrast, Hartmann and Bung[12] reported a reduction in hematocrit by 35%. The authors stated that the reduction in red blood volume does not imply a decreased oxygen supply to the muscles.

Hakeem[50] indicated that the pregnant female's left ventricle is rotated forward and the heart's walls are thickened. Because of the hypertrophy and increased blood volume, the pregnant female's cardiac capacity is increased by 70-80 ml. Artal[14] stated that maternal heart rate is increased by approximately 7 beats per minute (bpm) in the first weeks of gestation, with a gradual increase up to 15 bpm later in pregnancy. Hakeem[50] stated that progesterone is produced as a result of pregnancy, which causes mild relaxation in the blood vessel walls, resulting in good circulation.

Musculoskeletal

Hakeem[50] stated there are numerous changes in the musculoskeletal system during pregnancy. Authors[1,5,12,14] have documented that an increase in joint laxity may result in an increased range of motion at the joints (possibly leading to a higher risk of

strains or sprains). Because of this increase in laxity, the overall structure of the skeletal alignment may assume an abnormal posture. Sternfeld[2] and other authors[5,12,14] indicated that there is increased lordosis of the lumbar spine due to the growing fetus and resultant abdominal region. The female's breasts become enlarged,[5,14] shoulders become rounded, and a forward head may result.[12] Artal[14] and other authors[5,12,51-53] stated that these changes alter the center of gravity and cause necessary adaptations in the woman's posture. Artal[14] noted that the exaggerations of the adaptations may significantly interfere with the ability to exercise. However, Hakeem[50] believed that the ways in which adaptations occur are person specific and based on factors such as muscle strength, role models, level of fatigue, and prior level of condition or function.

Metabolism

Authors[5,51] have indicated that metabolic functions are increased during pregnancy. Therefore, pregnant females use carbohydrates at a greater rate than non-pregnant females while exercising. In addition, fasting blood glucose levels are lower in the pregnant population. Therefore, hypoglycemia is more likely to happen both during rest and exercise in pregnancy. Because of these factors, the caloric intake and nutritional status of pregnant individuals is important. According to Artal[14] and Hakeem,[50] approximately 300 extra kilocalories per day are mandated to meet the metabolic needs of pregnancy. Caloric requirements are increased even further in those females who are exercising regularly during their pregnancies. Artal[14] affirmed that a diet rich in high complex carbohydrates is preferred since carbohydrates best replace muscle glycogen that is lost during exercise, minimizing the threat of ketosis, which could harm the fetus.

BENEFITS OF EXERCISE

Hartmann & Bung[12] and other authors[1,2,8,9] indicated that exercising during pregnancy may assist in the prevention of excessive maternal weight gain, back pain, and thrombosis and/or varicous vein formation.[12] One maternal advantage is the ability to maintain fitness levels, which may lead to a speedier recovery from labor during delivery[8,22,56] and a reduced stress on the cardiovascular system. Exercising pregnant women have also reported subjective feelings of enhanced psychological wellness,[12] such as increased self confidence, joy/satisfaction during exercise, and a more stable character.[2,12,18]

One benefit to maternal exercise is that it may increase the rate of placental growth, which assists in later pregnancy to create a more functional capacity for the fetus. When exercising, the mother's body makes adaptions and gains tolerance to an array of physiological stresses as a direct result of the differences in automonic responses and increases in blood volumes.

The benefits of exercise continue through delivery, possibly assisting in fewer complications during a difficult delivery.[18] Clapp[49] stated that there is evidence the fetus may become accustomed to dealing with increases in body temperature, diminished oxygen and energy supplies, and intensified uterine contraction brought on by the mother's catecholamines secondary to an exercise regimen.[2,55] For each of the previous potential physiological problems, Sternfeld[2] stated that adaptions of compensatory mechanisms may serve to protect the fetus. The adaptations made by the fetus are thought to be tolerated well over short periods of stress.[49]

Clapp[49] reported that, "Regular maternal exercise during pregnancy produces these benefits because the physiological adaptions to regular exercise and those of pregnancy either magnify one another or cancel one another. The physiologic end result is a very robust alteration in maternal function that protects both mother and fetus from many of the usual problems associated with pregnancy."

Posture

Sternfeld[2] recommended that the goals of muscular conditioning during pregnancy should be to maintain/improve posture, provide added support for the enlarging breasts, strengthen muscles that are used during labor, and also prevent urinary incontinence (through kegal exercises, modified abdominal curls, shoulder shrugs, and pelvic tilts). Sternfeld[2] and Andrews and O'Neil[56] stated that pelvic tilts have been useful in alleviating round ligament pain that is due to its stretching during pregnancy. Sternfeld[2] stated that learning good posture for body mechanics is also of great importance. Rather than bending at the waist to reach toward the ground, squatting to the floor helps to maintain joint mobility, and keep joints stable and in a position of limited strain.

Noble[13] stated that the human spine has curves designed to counteract the compressive forces of gravity that affect posture when in an upright standing position. These curves will become increasingly pronounced during pregnancy as the mother's weight increases, causing the center of gravity to shift forward. Noble also stated that the addition of new weight tends to tip the pelvis forward if there is inadequate muscular support, causing greater stress and resulting in poor posture. Artal[14] added that the pelvic shift commonly leads to fatigue and a backache due to strain on the muscles and

ligaments of the vertebral column. As a result, the muscles become more strained as the S-shape of the spine increases with a forward shifting pelvis. Hartmann and Bung[12] stated that this shift moves the center of gravity higher, causing additional strain on the muscles and ligaments in the back, increasing the chance of low back pain. These authors indicated that for this reason, the abdominal muscles become increasingly important during pregnancy. The abdominal muscles take on the task of supporting the added weight of the developing fetus, and therefore must have more strength and elasticity than that of non-pregnant women. Strong abdominal muscles will then assist in supporting the spine as the fetus continues to grow. Exercises for the abdominals, buttocks and pelvic floor muscles may help in maintaining support of the pelvis (because of their attachments to the pelvis) and its contents.

Hartmann and Bung[12] stated that stretching the tight muscles of the back and strengthening the weak muscles of the abdominals improve body alignment. A correct posture will help protect the joints from strain, conserve muscle energy, and assist in preventing discomfort, backaches, and fatigue.

Labor

Zeanah and Schlosser[4] stated that exercise may play a positive role during the entire labor experience, from decreasing length of labor time to the type (vaginal or cesearian) of actual delivery. Hall and Kaufman[57] and other authors[5,12] have documented that higher fitness and activity levels are associated with shorter periods of active labor. Clapp[49] reported that 80% of women who maintained a training level greater than 55% of maximal capacity during a regular, sustained, weightbearing exercise program delivered before their due date, but after their term was complete

(beginning of the thirty-eight week). Also, there was an inverse relationship between the number of caesarian deliveries performed and the amount of exercise during pregnancy. Hartmann and Bung[12] stated that the probability of a vaginal delivery (verses caesarian section) was more likely to occur in women with strengthened abdominals and pelvic muscles. Clapp's[49] research found that those women who continued their exercise programs through their entire pregnancies had labors with an active phase that was one-third shorter and one-third the rate of surgical delivery. Zeanah and Schlosser[4] and other researchers[5,12] reported that performing physical activity during pregnancy had no effect on the gestational length, maternal weight, or length of delivery. Sternfeld et al.[58] found that there was no relationship between the level of maternal exercise and birthweight or gestational age.

Noble[13] stated that exercise may benefit the pregnant female's labor process. Noble also stated that a physically fit pregnant female is better enabled to cope with both the mental and physical components of labor. During the first stage of labor when the participant's role is passive (uterus is working by itself), being of good physical condition will facilitate her relaxation and cooperation. Maintaining a good fitness level allows for effective bearing-down during the second stage of labor when the role of the female is more active in assisting the expulsion of the baby through contractions of the uterus.

Authors [2,4,5,9,12,23,24,59-62] have reported additional benefits associated with exercise during pregnancy as listed in Table 2.

- Shorter gestation
- Less gestational weight gain
- Higher Apgar scores
- Less toxemia
- Decreased risk of gestational hypertension
- Pre-eclampsia
- Fewer symptoms common during pregnancy (i.e. nausea, fatigue, leg cramps, round ligament pain, backache)
- Less frequency of complications during labor and delivery
- Decrease in perceived exertion during labor
- Fewer signs of fetal compromise
- Less need for obstetric intervention
- Decresed maternal weigth gain and fat deposition

Table 2. Benefits of Prenatal Exercise

Psyche

Hartmann & Bung[12] indicated that throughout pregnancy, mothers often become psychologically dissatisfied with body images and changes, which are commonly triggered by the long term carrying of the fetus. These psychological and anatomical changes play into the mothers' and fetus' overall well-being. Incorporating a routine physical exercise program may assist in relieving mental and/or emotional stress, and improving self-confidence, self-esteem, appetite and sleep.[2,12,45,54,63]

Research by Wang and Apgar[5] found that exercising continues to produce favorable effects even as the pregnancy progresses to full term. Sternfeld[2] and Hartmann and Bung[12] reported that a variety of activites may be perceived as gratifying and fun, and may also provide an opportunity for heightened kinesthetic perception and increased physical awareness. Zeanah and Schlosser[4] reported an increase in maternal subjective symptoms that were preceeded by a decrease in exercise. Wang and Apgar[5] tracked women who exercised throughout full term pregnancy, concluding that those

who exercised prior to being pregnant (3 months before) reported feeling better during the first trimester than non-exercisers. In addition, exercising throughout the second and third trimesters also correlated with more positive feelings into the third trimester. Many of these benefits might be explained by the biological mechanisms (hormonal and metabolic adaptions) that are associated with alterations in catecholarnines, an increase in endogenous opiates, and an improved cardiovascular system function.[2]

Gestational Diabetes

Gestional diabetes occurs in 4% to 7% of obstetric patients as stated by Artal.[14] Artal[14] and other researchers[64-66] found that physcial exercise and associated physiological and psychological benefits are not only encouraged for healthy women, but are also valuable as an adjunct therapy for women who experienced gestational diabetes during pregnancy. Hartmann and Bung[12] defined gestational diabetes as a state of intolerance to carbohydrates. If gestational diabetes occurs, the onset is normally in late pregnancy secondary to placentar hormones interfereing with insulin production. During late pregnancy, exercise actually decreases blood glucose levels.[15,67] This alteration may be due to the increase in fetoplacental demands. Similarily, Artal[14] stated that "reduced insulin sensitivity may be reversed most efficiently with exercise." Bung, Bung, Artal et al.[65] and Bung, Artal, Khodignian et al.[68] showed that by exercising large muscles, an increased amount of glucose will be used, which simultaneously leads to an increase in insulin sensitivity. This exercise induced sensitivity to insulin then counteracts the diabetogenic metabolism.[2]

Studies by Artal,[69] Jovanic-Peterson,[70] and Bung, Artal, Khodignian et al.[68] tested several exercise programs for pregnant diabetics. The results demonstrated that

exercise programs are feasible in women with gestational diabetes and may also be used as an optional therapeutic approach. Artal[69] and Jovanic-Peterson[70] recommended that pregnant diabetic women, even if previously sedentary, begin an exercise program. As recommended with any previously sedentary pregnant woman who wanted to start an exercise program, she should wait until the twelfth week of the pregnancy to begin.[49]

Energy Reserve

Sternfeld[2] stated that performing a regular exercise program while pregnant will assist in maintaining $V0_2$ max and may even improve it, especially in women who were previously sedentary. Studies by Hartmann and Bung[12] suggested that trained women who continue to exercise throughout their pregnancy will maintain and may increase their aerobic capacity. Clapp and Capeless[71] tested women before and after pregnancy, accessing $V0_2$ max while participating in a treadmill exercise. These results indicated that $V0_2$ max levels were significantly higher in women 12-24 weeks and 24-36 weeks postpartum.

Preventative Measures

Clapp[49] reported that there was a three-fold reduction in subjective physical complaints and a decreased rate of exercise-induced injuries during pregnancy. Clapp indicated that the explanation of these results was unclear, but suggested that women who stayed physically active during pregnancy had better posture and muscle tone, responded with more attention to an exercise setting, and minimized factors that could lead to an injury. Noble[13] used an example to explain why exercise should be a vital role before, during and after pregnancy, "Just as you would equip your car with snow tires if you

expected heavy winter condition, so should you ensure that your body has extra help in its physical development at this time."

EXERCISE GUIDELINES

American College of Obstetricians and Gynecologists (ACOG)

The ACOG has developed a pamphlet entitled 'Exercise and Pregnancy' that incorporates general guidelines for exercising in the childbearing year.[1] Sapsford et al. recommended that physical therapists read all documents regarding exercise during pregnancy very carefully as they could be used as accepted standards of exercise guidelines with their pregnant clients.

Artal[14] and Sternfeld[2] noted that the most recent updated ACOG guidelines as revised in 1996 are the following:

1. Consult with medical caregiver before commencing exercise.
2. Gradually increase exercise if previously sedentary.
3. Exercise regularly, 3X/week. Regular frequency of exercise is preferable to sporadic physical activity.
4. Maximum heart rate should not exceed 140-150 bpm or a limit set in consultation with a doctor.
5. Moderate exercise should not exceed 20 minutes.
6. Avoid overheating and exercising in hot conditions. Adequate hydration and wearing proper clothing is recommended, especially in the first trimester .
7. Maintain adequate fluid intake to avoid dehydration.
8. Do not exercise with a febrile illness.
9. Ensure adequate warm-up and cool-down periods.
10. Avoid exercising in supine after the end of the fourth month.
11. Avoid contact sports after 16 weeks gestation.
12. Avoid ballistic bounces with stretches and do not stretch to extreme ranges of movement.
13. Low-impact exercise is preferable.
14. Full flexion or hyperextension of joints should be avoided.
15. Activity involving Valsalva maneuvers should be avoided.
16. Increase caloric intake to account for exercise needs.
17. Exercises requiring balance should be avoided, particularly in the third trimester.

18. Intensity of exercise should be monitored according to symptoms; and, exhaustive exercise should be avoided.

American College of Sports Medicine (ACSM)

Sapsford et al.[1] and Balady et al.[72] indicated that the ACSM exercise guidelines are similar to those of the ACOG, yet do show some variation in what is considered to be a safe frequency, intensity, and duration while training. According to the ACSM, the pregnant female may participate in exercise for 15 minutes at a peak heart rate of 140 bpm; whereas, according to the ACOG, the pregnant female should decrease the exercise intensity by 25-30%. In accordance with the ACSM, the pregnant female may partake in a total of 30-45 minutes of exercise per session, whereas the ACOG limits strenuous exercise to 15-20 minutes. Finally, Sapsford et al.[1] indicated that the ACSM stated pregnant athletes could exercise at a level less than 75% of the maximum heart rate.

Contraindications

There are specific contraindications for exercise during pregnancy unique to each health care professional; however, the following to be discussed are general contraindications to exercise during pregnancy according to Sapsford et al.[1] Sapsford et al.[1] and other authors[8,12] stated that the pregnant client should not exercise if high blood pressure or toxemia is present. With increased blood pressure beyond normal boundaries, further complications with stroke volume, cardiac output, and oxygen carrying capacity will occur, which will adversely affect both the mother and her fetus. Authors[1,12] also stated that placenta previa or vaginal bleeding are signs to not exercise. According to Hartmann and Bung,[12] it is exceedingly important that the expectant mother planning on exercising while pregnant consult a physician to determine if the placenta is still attached.

If it is not attached, the already hindered supply (nutrients, etc.) will be further compromised, resulting in potential severing of the necessary nutrients to the fetus.

Authors[1,12] stated that developing preterm labor or having a history of preterm labor would be a contraindication to exercising while pregnant due to the possibility of delivering the baby prior to proper development and nourishment. Wang and Apgar[5] concluded that Intrauterine Growth Retardation (IUGR) is also a contraindication to exercise since exercise shifts a portion of the blood supply away from the placenta. Wang and Apgar[5] and Sapsford et al.[1] noted that if the pregnant female has a cardiac pathology, exercising alone is contraindicated. Participation in exercise may only occur under supervision of a cardiologist and the maternal physician. Sapsford et al.[1] and Hartmann and Bung[12] indicated that pregnancies with multiple fetuses, such as twin pregnancies, are contraindicated. Because blood flow, oxygen, and nutrients are decreased in a pregnancy that consists of only one fetus, adding additional fetuses would further decrease the availability of those necessary components to each fetus.

Red Flags to Stop Exercise

As stated by Sapsford et al.,[1] all of the following are reported as **red flags to stop exercise and contact a physician**: pain, bloody discharge, gush of fluid, sudden swelling, signs of DVT, severe headaches or fainting spells, increased pulse and/or blood pressure after exercise beyond normal, persistent contractions, unexplained abdominal pain, insufficient weight gain (1 kg per month is normal), pubic pain, shortness of breath, difficulty walking, and abnormal dizziness. In general, anything that appears to be along the lines of giving birth would necessitate the stopping of exercise. Lastly, Sapsford et al.

stated that it is important for the pregnant female to know these signs and symptoms if exercising without supervision at home or elsewhere like a gym.

EXERCISE PRESCRIPTIONS

Components

Studies conducted by Ireland and Ott[11] and Zeanah and Schlosser[4] have found that it is always necessary to assess a pregnant woman's previous level of physical fitness and activity when creating a prenatal exercise program. Authors[2,4,5,8] have stated that a basic program design for prenatal exercise should be customized for the individual and account for the mother's health status, exposure/experience with exercise (duration and intensity prior to pregnancy), and interests and goals of exercising. Heckman and Sassard[9] stated that exercises selected for pregnant women correspond to the changes in both body weight and balance to decrease the risk of injury.

Sternfeld[2] indicated that the mother's specific symptoms and comfort level will often dictate an alteration in the mode of exercise performed, as well as a reduction in the duration, frequency, and intensity of exercise. The determined intensity, duration, and frequency of exercise should begin at a level that will not result in pain, shortness of breath, or excessive fatigue.[5] Wang and Apgar used the FIT model (frequency, intensity, time/duration) along with mode, to help define each component of an exercise prescription. Hartmann and Bung[12] and other authors[1,15,47] recommended that aerobic prenatal exercise be performed on a regular basis for 20-30 minutes a day, at a frequency of at least 3 times per week, and at an exercise intensity of 50-60% of Maximum Heart Rate (MHR), using a mode of exercise that is familiar and enjoyable to the expectant mother. The main components of a prenatal exercise program should include: warm-up,

flexibility, aerobic conditioning, muscular strengthening, endurance, cool-down and relaxation.[2] Zeanah and Schlosser[4] indicated that there should be prenatal instruction regarding contraindications to exercise and warning signs of overexertion.

General Guidelines

Clapp[18,22] stated that all prenatal exercise regimens be individualized and balanced to each mother's fitness level and may be altered various times throughout her pregnancy. Clapp[22] recommended that a flexible, individualized approach to exercise would need to incorporate five main areas: 1) education, 2) training, 3) monitoring, 4) setting attainable goals, and 5) safety. To assist in planning a prenatal workout program, pregnant women should be encouraged to monitor their condition and well-being both during and following exercise. Brown[15] and other authors[5,14] recommended monitoring heart rate during exercise. Brown[15] indicated that the intensity of exercise is often monitored by taking one's pulse and calculating how many times the heart beats in one minute. If the pregnant woman's goal was to exercise at 50% of MHR, estimation of MHR could be attained by subtracting age from 220, then multiplying by 0.5 or 50% (i.e. a 24 year old wanting to exercise at 50% of MHR→take (220 – 24) X 0.5 = 98 beats/minute). Brown reported that this formula may be unreliable for women during pregnancy, as these women tend to have a higher heart rate. It was instead recommended by Zeanah and Schlosser[4] to use a Rate of Perceived Exertion scale (RPE) to monitor intensity during exercise.

Wang and Apgar[5] and Clapp[18,22] observed that some basic information which could be periodically monitored include the amount of hydration, caloric intake and mix, exercise/rest cycles, maternal temperature, and musculoskeletal comfort. Assessment of

this information should be done at least once a week. Heckman and Sassard[9] stated that it is now considered safe for pregnant women to increase their exercise regimen under the condition that it is a gradual increase with medical supervision. Wang and Apgar[5] revealed that maintaining adequate hydration was important to emphasize, and recommended that pregnant women consume up to one pint of liquid before exercising, and one cup every 20 minutes during exercise to maintain sufficient hydration. Concerning caloric intake and mix, it is known that exercise combined with pregnancy demands a higher need for energy. Wang and Apgar also stated that an increased intake of 150 calories per day is suggested in the first two trimesters and an increased 300 calories per day is required in the third trimester. It was also stated that women could minimize thermal stress by performing exercise early in the morning or later at night to improve the mother's ability to dissipate heat. Pregnant women should also be informed that decreases in exercise performance are common, especially into late pregnancy.

Some general guidelines indicated by Ireland and Ott[11] and other authors[14] that all prenatal exercise programs should follow include:

1. Regular exercise (defined as at least 3x/week) is recommended over intermittent exercise.
2. Vigorous exercise should be preceded by a 5 minute warm up phase of the muscles that will be exercised. This may include slow walking, stationary cycling, and /or gentle stretching.
3. Vigorous exercise should be followed by a 5 minute cool down phase of gradual decline in activity and gentle stretching.
4. Maternal heart rate should be measured at times of peak exercise intensity.
5. When rising from the floor, be cautious to avoid orthostatic hypotention.
6. Educate client that pregnancy reduces the amount of oxygen available for aerobic exercise.
7. Ensure that mother is consuming an adequate diet while exercising. This is particularly important due to the fact that pregnancy itself requires an additional 300kcal/day to maintain a metabolic homeostasis.
8. Encourage adequate hydration (before, during and after), proper exercise clothing (loose, breathable), and optimal exercise environment to assist

with the mother's heat dissipation, which is especially important throughout the first trimester.

9. Exercise should be stopped and the physician consulted if any unusual symptoms occur.

Weight Training

Raskin[73] stated that weight training during pregnancy should be performed at a frequency of 2-3 times per week, allowing a day to rest between each workout session. Raskin also recommended that when beginning to use weight training as part of an exercise routine, pregnant women should set a goal of 2-3 sets of 8-12 repetitions for each lift. The goal is not to exercise to the point of muscular fatigue. Instead, a weight range should be determined that will challenge the expectant mother without reaching the point of exhaustion or result in a loss of proper lifting form/technique. Sussman and Douglas[45] stated that if pregnant women were weight training prior to pregnancy, current weight lifting regimens may be continued through the first and second trimesters. However, lifting weights heavier than 30-35 lbs. should not be performed during the third trimester. This weight limitation was to reduce the occurrence of causing an increase in abdominal pressure. According to the ACOG,[74] breath should not be held during lifting exercises; and, that exhalation should take place during the exertion phase of each lift. Also, the ACOG noted that strengthening exercises of the same muscle groups should not be preformed on consecutive days. As indicated by Raskin,[73] a pregnant woman's goal should not be to get increasingly stronger, but to hopefully continue to exercise throughout pregnancy. Authors[74] stated that when the strength of one group of muscles was disproportionate to its antagonist(s) muscles, the weaker muscle should be strengthened to restore balance around the joint. In accordance with the ACOG, a decrease in the amount of weight being lifted or a reduction in the number of sets during

each workout session should occur. It should be noted that however the change was modified, a minimum of 8 repetitions for each lift should be maintained. According to the ACOG guidelines, "Muscle strengthening be preceded and followed by stretching exercises that are specific for the muscles that are made to work against resistance."

Aerobic Conditioning

Sternfeld[2] recommended that during aerobic conditioning, decisions concerning exercise mode, frequency, duration, and intensity be guided by maternal comfort and common sense. As stated earlier in the FIT model, aerobic exercise should occur on a regular basis of 20-30 minutes a day, at least 3 times per week, at an exercise intensity of 50-60% of MHR.[1,12,15,47] Brown[15] stated that brief bouts of exercise at 70% of MHR are acceptable. Studies by Hartmann and Bung[12] revealed that non-weightbearing activities are considered more favorable for prenatal exercise due to the fact that they are easier on the joints and require reduced energy expenditures. Swimming and stationary cycling are two modes of non-weight bearing exercise that are commonly preferred. Bochaton[47] stated that exercise regimens should focus on gentle breathing exercises to maintain good diaphragmatic mobility and incorporate pelvic tilts.

Stretching and Toning

Sapsford et al.[1] stated that muscular lengthening becomes increasingly important when exercising during pregnancy. Performing stretching exercises may be done as often as desired, preferably at least once a day.[74] Sapsford et al.[1] indicated that safe stretching techniques need to be followed, especially when considering the pregnant woman's increase in hormones that relax ligaments and collagen in preparation for physiologic body changes. The authors stated that pregnant women may then be at a higher risk of

overstretching soft tissues. The pregnant woman's ability to gain mobility while stretching is increased. According to the ACOG,[74] muscles should be stretched only to the point of tension, and any pain be regarded as a signal that the stretch has gone too far. The amount of time a stretch can be held may vary from 6-20 seconds, depending on the individual. The stretch should be held long enough for relaxation to occur, allowing maximum benefit. According to the ACOG, a general warm-up should be completed before the muscles are stretched.

PREVIOUS STUDIES

Rodriguez et al. [75] evaluated the usefulness of a Maternity Education Program (MEP), a program designed to improve pregnant women's knowledge of pregnancy, hygiene and dietary habits, birth, and caring for the newborn. The mean overall knowledge increased by 4.97 points, and those partaking in physical exercise went up from 22.4% to 57.6%. Rautava[76] and Higgins and Woods[77] discussed the phenomenon that low levels of childbirth knowledge are associated with risks in health-connected behavior.

Despite the lack of literature concerning women's knowledge of exercise during pregnancy, all authors advocated the importance of prenatal education for the health of the mother and the fetus.[75-83] In a study[80] to analyze the results of maternal mortality rate, Ding and Zhang found that 73% were avoidable deaths; 44.5% of those were caused by the lack of health knowledge of the pregnant woman and her family. In interviews with more than 1,800 adults, only 28% of them reported being advised by their doctor to increase their level of physical activity. Huggins[83] reported that only 4 in 10 patients who were advised to exercise more stated that they received help in developing an exercise

plan, follow-up support or counseling. Churchill[82] recommended that women should be provided with adequate information to enable decision-making regarding care and that continuity of care is essential for the communication between professionals and their patients.

CHAPTER III
METHODOLOGY

Subjects

Non-pregnant, English speaking, college women between the ages of 18 and 40 who attended Psychology, Communication, or Teaching and Learning courses during the summer session at the University of North Dakota had the opportunity to voluntarily participate in the study. The women were chosen based on their age, gender, and English speaking ability. Women who were pregnant at the time of survey distribution were not able to participate in the study. Because participation in the study was voluntary, the participant's consent was assumed when the survey was completed and returned to the researcher. Dependent on individual instructors wishes, some participants were compensated with additional course credit in that specific course upon completion of the survey.

Instrumentation

The survey was developed by Tricia Flohr, Sara Hoerner, and Kari Melby, all Physical Therapy students attending the University of North Dakota (UND). With the assistance of Dr. Peggy Mohr and Dr. Renee Mabey, both Associate Professors of Physical Therapy at the University of North Dakota, the survey was revised and formatted into its final configuration. In addition, it was reviewed by Associate Professor Beverly Johnson, UND Physical Therapy, faculty with expertise in the area of Women's

Health. Finally, the study protocol was approved by the Institutional Review Board, Office of Research and Program Development at the University of North Dakota. A sample of the approved IRB form can be found in Appendix C.

The women who participated in the study were given a cover letter and three-page, 30-item survey to complete. The survey contained six demographic questions requesting information of the participant's age, ethnic orientation, the approximate size of the city in which she had lived the longest, number of pregnancies experienced, and if she had experienced pregnancy, where she received most of her prenatal information. The remainder of the survey consisted of 24 true/false/unsure questions regarding the risks, precautionary measures, and modes of exercise during pregnancy. A sample of the survey and cover letter utilized in the study can be found in Appendix C.

The cover letter accompanying each survey contained an explanation of the risks, benefits, criteria to participate, protection for confidentiality and individuals the participants could contact if any questions arose. In addition, the cover letter included a statement that all women completing the survey not consider the questions as factual since some of them may actually be false statements. The women were encouraged to contact their physician prior to engaging in an exercise program and obtain specific instructions regarding guidelines to follow for exercising during pregnancy.

Procedure

With permission of the course instructors from the selected Psychology, Communication, and Teaching and Learning summer session courses at the University of North Dakota, the survey and cover letter were distributed by a researcher to women who fit the selected criteria willing to voluntarily participate. One researcher was present to

explain the project and all necessary information contained within the cover letter and of importance to the study. The researcher instructed all participants not to place their names on the survey to ensure confidentiality. She then stressed the importance of reading the cover letter prior to completing the survey; and, she stated that all participants should not take the questions as factual since some of the questions may be false. All participants were additionally told to keep the attached cover letter for their own personal reference once they had completed the survey. Contact persons and phone numbers that were within the cover letter were also pointed out to all participants if any questions regarding the survey itself or content of the study should arise. Lastly, all willing participants were told only to answer the questions as true or false if they were 100% sure of the answer, and to select unsure if they were not 100% confident in their answer(s).

After the researcher's explanation of the project, the survey and cover letter were given to those women willing to participate. The survey took approximately eight to ten minutes to complete. Upon completion, the participants placed the surveys in an envelope that was provided by the attending researcher. Once all surveys were collected and the envelope sealed, the researcher stored all the data in the Physical Therapy Department at the University of North Dakota in a locked cabinet. Distribution and collection of the surveys occurred between June 11, 2001 and July 31, 2001. Following the completion of the project, all the data collected will be retained for three years at the UND Physical Therapy Department, after which time it will be appropriately destroyed.

Data Analysis

Traditional descriptive statistics were used to profile the subjects (UND college women of their childbearing years) and identify the mean scores of their knowledge

concerning each main research question (risks of exercise, precautionary measures to be implemented, and modes of exercise during pregnancy), in addition to their overall total scores. Univariate Analysis of Variance was also utilized to compare the subjects' scores regarding each research question. For those sample sizes greater than thirty, parametric tests were performed; nonparametric tests were used on those sample sizes smaller than thirty.

When comparing and assessing data collected from the demographic questions in relation to their effects on the participants' levels of knowledge concerning exercise during pregnancy, t-tests and individual samples t-tests were used. Subsequent tests, such as the Levene's test for equality of variances and the t-test for equality of means, were performed to compare demographic questions to the percent scores of each individual research question, as well as the total percent score. An ANOVA was used when analyzing the number of pregnancies experienced in relation to the participants' levels of knowledge. When making multiple comparisons, such as with the demographic question involving the participants' city size concerning their longest place of residency, Post Hoc Tests (Scheffe and Bonferroni) were performed.

Due to the small number of respondents, some demographic questions, such as the participant's age and where she received most of her prenatal information, were collapsed. Because of the small sample sizes of these demographic questions, the Kruskal-Wallis test was used to compare and assess the participants' levels of knowledge regarding their overall total scores and those scores attained from each individual research question. These tests, as well as others, will be discussed within the results

chapter of this report. An alpha level of less than or equal to .05 was set by the researchers to determine the outcomes of all statistical tests utilized within the study.

CHAPTER IV
RESULTS

Eighty-four surveys that met the established criteria were filled out and returned to the researchers. Statistical analysis of Repeated Measures ANOVA using Two-Way calculations and IV of subjects and questions (risks, precautionary measures, and modes) revealed that there was a significant difference in scores between risk questions, precaution questions, and mode questions ($F(2, 166) = 25.966$, $p<.001$). Further analysis by Scheffe's post hoc analysis demonstrated a significant difference between risk scores ($X=32.59 \pm 20.44$) and precaution scores ($X= 49.7 \pm 20.90$) with $p<.001$. There was also a significant difference between risk scores ($X=32.59 \pm 20.44$) and mode scores (45.54 ± 24.75) with $p<.001$. To obtain a quick overview of individual survey questions and results, refer to Table 3 which describes Risks, Table 4 which describes Precautionary Measures, and Table 5 which describes Modes of exercise.

RISK QUESTIONS	Correct response	Women responding correctly	
		%	n
It is safe for all women to exercise during their entire pregnancy?	False	45.2%	38 / 84
The incidence of spontaneous abortion increases with runners who continue to run during early pregnancy (0-3 months)?	False	22.6%	19 / 84
During normal healthy pregnancies, beginning a regular exercise program in the 2nd trimester (4-6 months) or continuing one's current exercise program harms the baby?	False	52.4%	44 / 84
Heat stress from intense exercise lasting longer than 30-45 minutes may be harmful to the baby?	True	28.6%	24 / 84
The risk of harm to the baby increases as exercise intensity increases (from moderate to vigorous exercise)?	False	10.7%	9 / 84
Performing strenuous exercise in an overly warm environment during the 1st trimester (0-3 months) of pregnancy may harm the baby?	True	13.1%	11 / 84
During the 2nd and 3rd trimesters (4-9 months) pregnant women should perform exercise lying flat on their backs?	False	25.0%	21 / 84
A pregnant woman can sit in a hot tub to resolve muscle soreness after exercise?	False	63.1%	53 / 84

Table 3. The number and percentage of women responding correctly to risk questions.

The survey results found that 10.7% (or 9 out of 84) of the respondents incorrectly answered all eight questions regarding risks and only 1.2% (or 1 out of 84) answered all eight risk questions correctly. On average, the respondents scored a 32.5% (or 2.6/8) in their knowledge of risks for pregnant women during exercise.

PRECAUTION QUESTIONS	Correct response	Women responding correctly	
		%	n
Taking a deep breath and holding it during any exercise should be avoided?	True	33.3%	28 / 84
A woman can exercise at 60%-70% of her maximum heart rate?	True	13.1%	11 / 84
A woman can perform exercises that involve sharp twists of the body, rapid or uncontrolled swinging or bouncing?	False	63.1%	53 / 84
Women can begin exercising during pregnancy a without consulting a doctor?	False	70.2%	59 / 84
Maternal body temperature should remain below 100.4°-102.2° F (38°-39° C) for the well being of both mother and baby?	True	34.5%	29 / 84
Following a cool-down of 5 minutes after exercise, it women should lie down for 5-10 minutes to avoid lightheadedness, dizziness, and/or fainting?	True	17.9%	15 / 84
A pregnant woman should perform a warm-up period of 5 minutes before exercise and a cool-down period of 5 minutes after exercise?	True	75.0%	63 / 84
During pregnancy, adequate water intake, appropriate clothing, and by avoiding direct heat while exercising can assist in maintaining normal body temperature?	True	90.5%	76 / 84

Table 4. The number and percentage of women responding correctly to precaution questions.

The survey results found that 1.2% (or 1out of 84) of the respondents incorrectly answered all eight questions regarding precautions and only 1.2% (or 1 out of 84) answered all eight precaution questions correctly. On average, the respondents scored a 49.7% (or 3.9/8) in their knowledge of precautions for pregnant women during exercise.

MODE QUESTIONS	Correct response	Women responding correctly	
		%	n
A moderate level of participation in yoga is a safe form of exercise during any stage of pregnancy?	True	50.0%	42 / 84
Types of endurance activities best suited are walking and/or swimming?	True	75.0%	63 / 84
Exercise requiring balance (i.e. skiing or skating) should be avoided, particularly in the 3rd trimester (6-9 months) of pregnancy?	True	61.9%	52 / 84
A woman can do sit-ups (lying on the back with knees bent and lifting the upper body towards the knees) during any stage of pregnancy?	False	33.3%	28 / 84
Brisk walking and/or bicycling at moderate to very high rates in mid-late (4-9 months) pregnancy lead to pre-term labor?	False	7.1%	6 / 84
Swimming and/or biking are better than running and/or high intensity aerobics?	True	56.0%	47 / 84
Women can use free weights and/or weight machines when strength training?	True	33.3%	28 / 84
Women should use heavy resistance when doing strength training for their arms and legs?	False	47.6%	40 / 84

Table 5. The number and percentage of women responding correctly to mode questions.

The survey results found that 6.0% (or 5 out of 84) of the respondents incorrectly answered all eight questions regarding modes and only 3.6% (or 3 out of 84) answered all eight mode questions correctly. On average, the respondents scored a 45.5% (or 3.6/8) in their knowledge of modes for pregnant women during exercise.

The following was obtained from the demographic questions portrayed on the survey. Women who completed the survey ranged in age from 18 to 40 years with an average age of 23.7 ± 4.7. Forty-eight percent of the respondents were 21 or younger, and 92% were Caucasian. When looking at the size of the city in which the participants lived the longest, 35% lived in a city with a population of 5000 or less. Additionally, most of the respondents had never been pregnant (78%). For those who had previously been pregnant, 39% experienced one pregnancy, 33% experienced two pregnancies, 17% experienced three pregnancies, and 11% experienced four or more pregnancies. Lastly, the majority of women (71%) received most of their prenatal information from their physician, while the remaining 29% obtained their information from other sources. These included family, friends, or coworkers; books, magazines, or the internet; educational sources. Refer to the following page for a complete subject demographic profile.

Complete Subject Demographic Profile

Age	**N**	**%**
21 or younger	40/84	48
22 or older	44/84	52
Ethnicity		
Caucasian	76/84	92
Other: African American	7/84	8
Native American		
Hispanic		
City Size		
5,000 or less	29/83	35
5,001 – 10,000	4/83	5
10,001 – 25,000	7/83	8
25,001 – 50,000	21/83	25
50,001 or more	22/83	27
Have you been pregnant		
No	65/83	78
Yes	18/83	22
Number of prior pregnancies		
1	7/18	39
2	6/18	33
3	3/18	17
4 +	2/18	11

Age

When groups were analyzed using an independent samples t-test to compare the age groups 21 years or younger and 22 years or older, there was no significant difference found in knowledge scores of risks ($t(82) = -.838$; $p>.05$), precautionary measures ($t(82) = -.136$; $p>.05$), and modes of exercise ($t(82) = -.961$; $p>.05$).

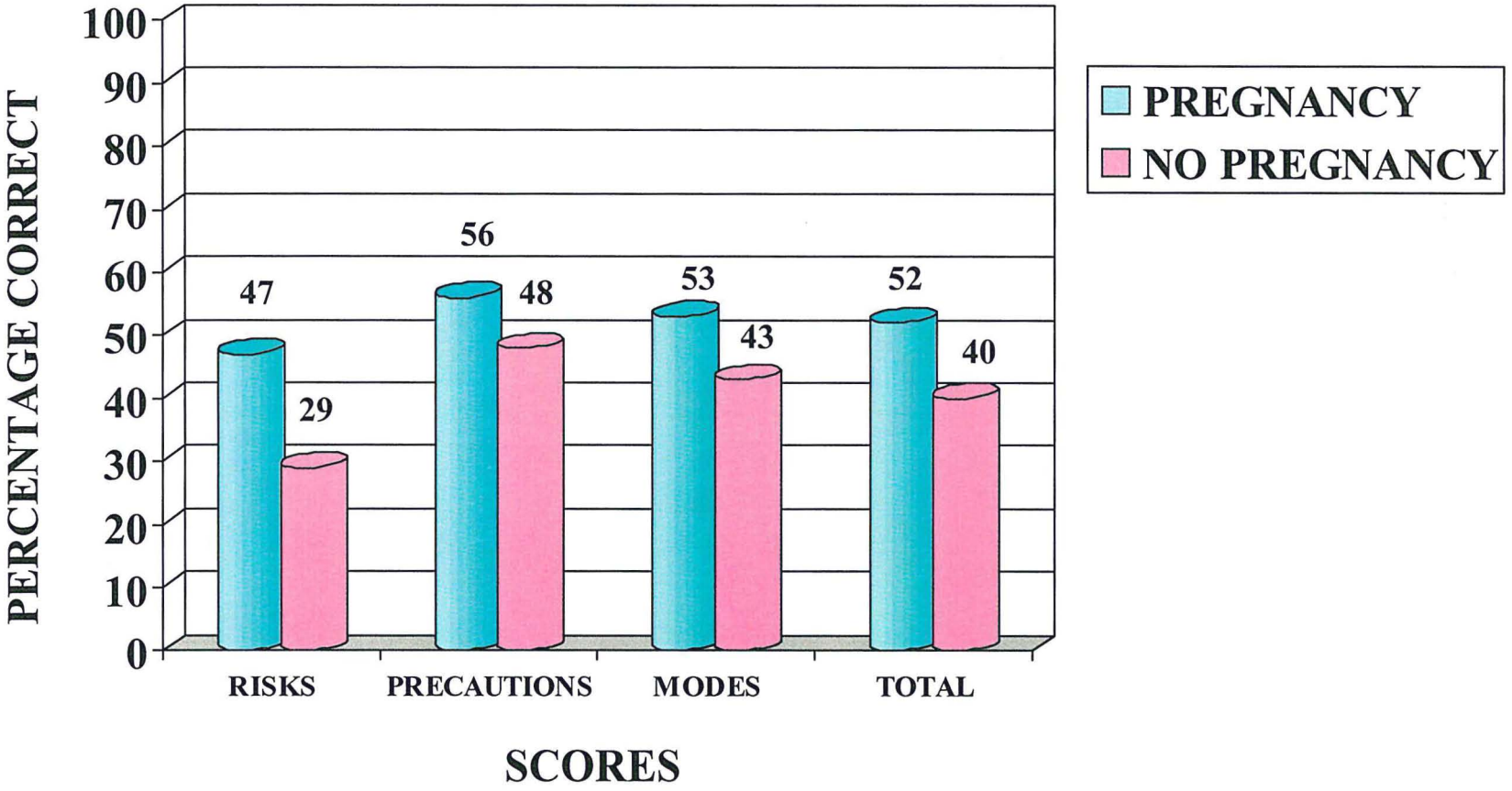
Pregnancy

When comparing women who had not previously been pregnant and women who had experienced a prior pregnancy, results of an independent samples t-test found no significant difference in knowledge scores of precautionary measures ($t(81) = -1.462$; $p>.05$) and modes ($t(81) = -1.587$; $p>.05$) of exercise. However, when comparing women who had previously been pregnant to those who had not, there was a significant difference in knowledge scores of risks ($t(81) = -3.611$; $p=.001$), with women who had previously experienced one or more pregnancies having a greater knowledge of risks associated with exercise during pregnancy. Further comparison between women who had previously been pregnant and those who had not revealed that there was a significant difference in the total knowledge scores ($t(81) = -2.636$; $p=.01$) concerning the risks, precautionary measures, and modes of exercise, with those women who had previously been pregnant having a greater total knowledge about exercise during pregnancy.

A One-Way ANOVA was used to determine knowledge scores between groups of women who had previously had one, two, three, or four or more pregnancies. The results revealed that there was no significant difference among the groups when analyzing risk scores ($F(3,14) = .643$;$p>.05$), precautionary measures scores ($F(3,14) = 1.310$; $p>.05$), mode scores ($F(3,14) = .198$; $p>.05$), or total scores ($F(3,14) = .618$;$p>.05$). For

an analysis of the knowledge scores between women who have been pregnant and women who have not been pregnant, see Graph 1.

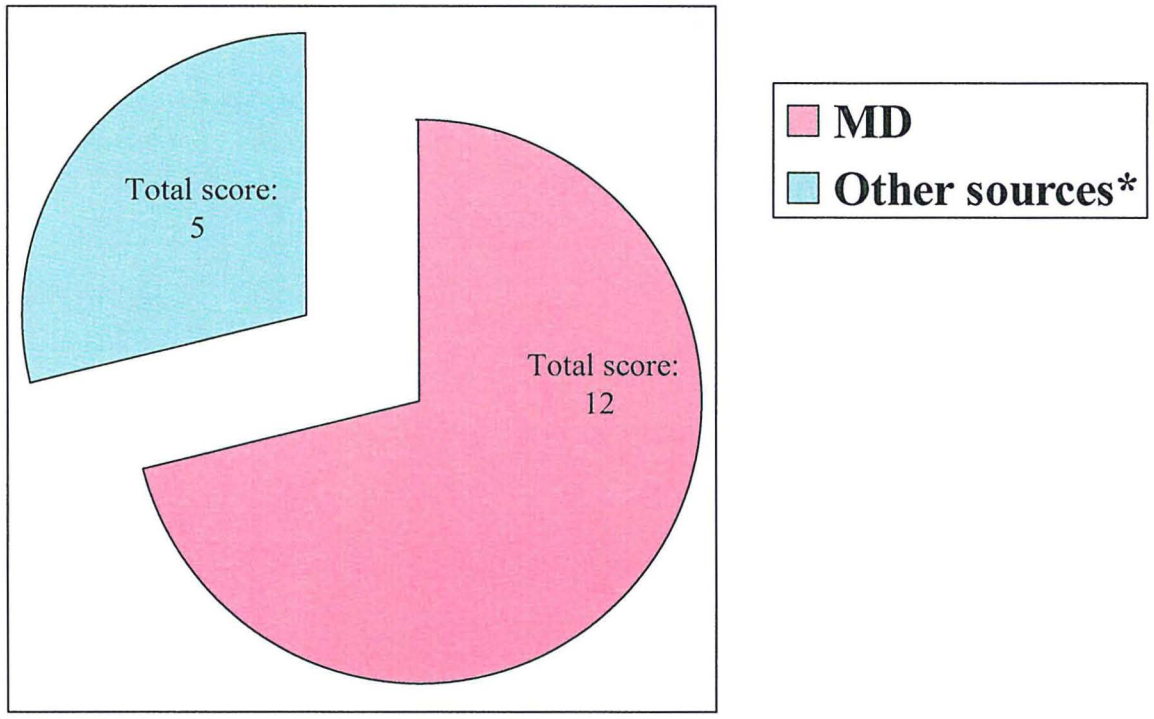
Graph 1. Mean percentage scores on knowledge of risks, precautionary measures, modes of exercise and total scores between women who have and have not been pregnant.



Prenatal Information

Twelve of the eighteen respondents (71%) who had at least one pregnancy prior to completing the survey answered the question concerning where they received their primary source of prenatal information. When comparing the group of women receiving information from physicians to the group getting their information elsewhere, statistical analysis found that there was no significant difference in knowledge scores on risks ($t(15) = 1.049; p = .311$), precautionary measures ($t(15) = -.882; p = .391$), modes ($t(15) = .175; p = .863$), or overall total score ($t(15) = .116; p = .909$). See Graph 2 for the breakdown of obtained sources of information.

Graph 2. Mean percentage scores on where pregnant had received their primary sources of information concerning exercise during pregnancy.

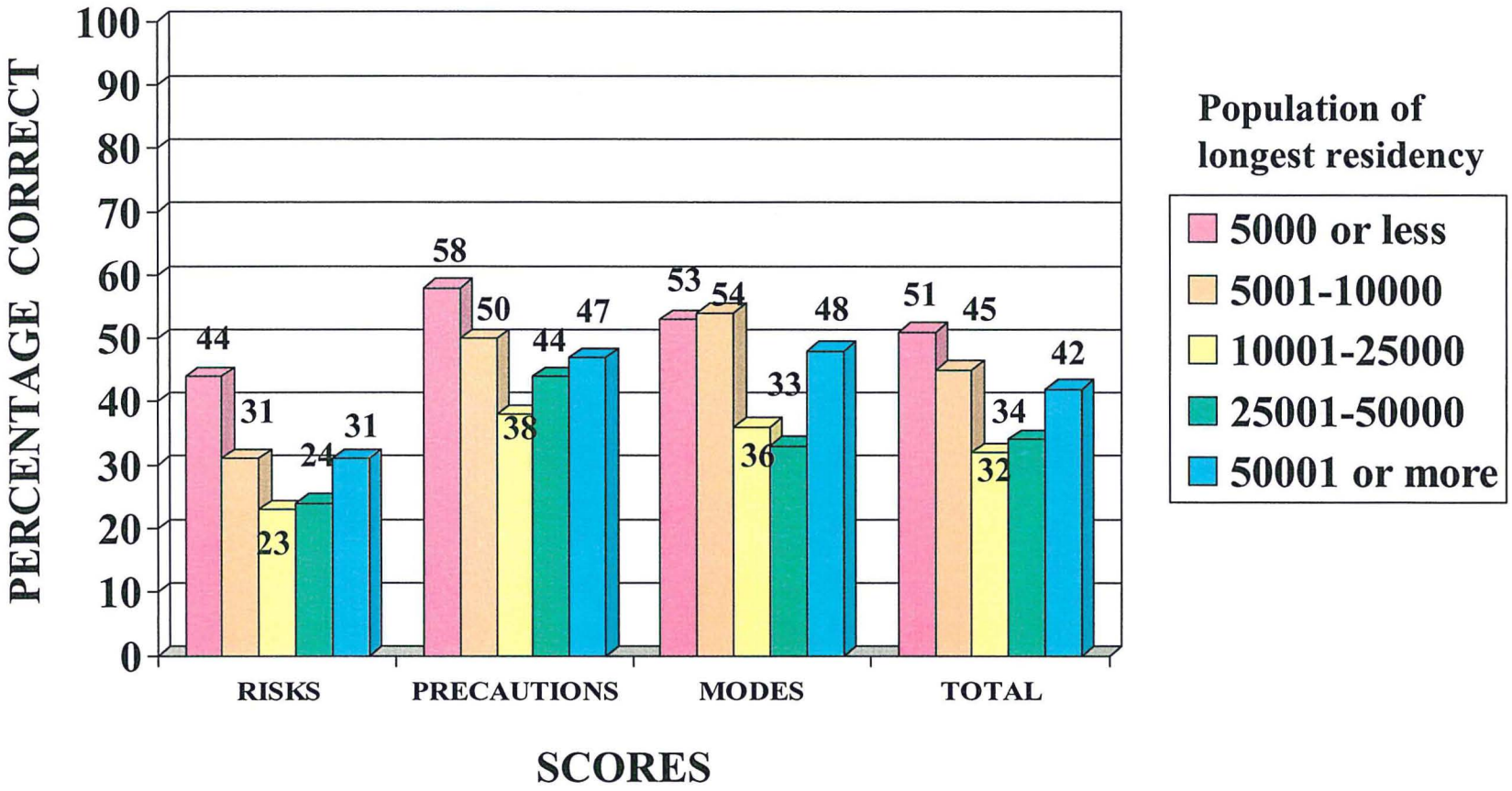


* Other sources – family, friends, co-workers, books, magazines, internet, educational courses

City Size

When looking at the each respondent's longest place of residency, an ANOVA test was administered to determine if there were any similarities or differences in their knowledge of exercise during pregnancy pertaining to the established research questions. The respondents' knowledge concerning precautionary measures of exercise during pregnancy revealed no significance, no matter the size of the city in which they lived the longest. However, when comparing women living in cities with a population of 5000 or less and those living in cities with a population of 25,001 to 50,000, the ANOVA found that there was a significant difference in risk scores ($F(4,78) = 4.017; p = .005$) and total scores ($F(4,78) = 4.244; p = .004$). After computing the ANOVA analysis, the mode scores did not meet the criteria to be considered significantly different, yet its result ($p = .053$) was close to the set alpha level of $p = .05$. Due to the results close proximity to the established alpha level, further post hoc analysis was computed to determine if the modes scores, in fact, did show a significant difference. Therefore, two conservative post hoc analyses, Scheffe and Bonferroni, were computed, finding there to be no confirmation of any significant difference in mode scores when comparing women living in cities with a population of 5000 or less to those living in cities with a population of 25,001 to 50,000. For further analysis of the knowledge level of women according to size of city in which they resided the longest see Graph 3.

Graph 3. Mean percentage scores on knowledge of risks, precautionary measures, modes of exercise and total scores of women who are from differing populations of city sizes.



CHAPTER V
DISCUSSION

Exercise during pregnancy has been a source of changing thought regarding its safety regulations, risks, and benefits. In the past, exercise was viewed as harmful to the mother and fetus, and women were cautioned to limit any type of physical activity or labor to avoid potential harm to their baby. Up until 1994, the American College of Obstetricians and Gynecologists (ACOG) gave strict guidelines for women who wished to exercise during their pregnancy, limiting their exercise intensity to 140 bpm and their time to 15 minutes.

The ACOG then lightened these restrictions for healthy women in low-risk pregnancies, simply stating that pregnant women should not exercise to exhaustion. Many physicians today remain overly cautious, however, concerned that strenuous exercise will harm the fetus.[84] This concern has an effect on what physicians do or do not recommend to their patients. Huggins[83] found that through interviews with more than 1800 adults, only 28% of them reported being advised by their doctor to increase their level of physical activity. Further, only four in ten patients who were advised to increase their amount of exercise said that they received help in developing an exercise plan, follow-up support or counseling. While this study's population was not specifically devoted to pregnant women, it was assumed that they were included. If physicians rarely advise exercise in healthy adults, as in this study, one could speculate that they would be more apprehensive with pregnant women.

Our study was conducted to determine the level of knowledge in women concerning the risks, precautionary measures and modes of exercise during pregnancy. The questions were derived from current ACOG guidelines and literature regarding exercise during pregnancy. According to the survey, 91% of the respondents were Caucasian women attending college at UND for undergraduate study in communication, psychology, and education. The study found that 50% of the respondents scored a 10/24 or below (42%) on overall knowledge of risks, precautionary measures, and modes of exercise during pregnancy. The least amount of knowledge was known concerning the risks of exercising when pregnant.

We as researchers are most concerned that the level of knowledge concerning the risks of exercise during pregnancy was the lowest (as compared to precautionary measures and modes of exercise). If a woman is not knowledgeable about the risks of exercise and/or she partakes in risky behavior(s), she may cause potential harm to her baby and to herself. A good understanding of risks is essential if the pregnant woman is to ensure optimum health for both her and her fetus.

The low scores of overall knowledge may be attributed to a multitude of factors. The participants may have simply guessed on the answers, may have been in a hurry while taking the survey, or they may have participated only to receive extra class credit from the instructor.

The participants may have had disapproving attitudes if the individuals had perceived or had been taught that exercise was harmful for a pregnant woman and the fetus. What the participants had observed or witnessed within their own families may have influenced their knowledge levels and attitudes on this particular subject. If a

family member, such as a mother, grandmother, or sister was not physically active during pregnancy, the individuals would probably choose likewise.

The results may also be a reflection of society's views on pregnancy and exercise. Women are exercising more now than in the past and are carrying this over to pregnancy. However, society's mores continue to rule some women's thoughts and behaviors concerning the matter. As Parker and Parvey[85] have shown, women today are still receiving most of their prenatal information from physicians. If physicians are not pro-active in educating themselves or their clients in current literature, past ideas such as exercise harming the baby may continue to prevail. The scores may further be linked to the demographics of the participants, including age, ethnicity, city size, information source, past pregnancy, and number of past pregnancies (if applicable). These demographics are described below.

Age

In our study, 48% of the respondents were 21 years of age or younger, and 52% were 22 years or older. There was no significant difference in the level of knowledge between these two groups. Our results do not correlate with previous research[75,76,86] which found that age was a factor in the level of knowledge and exercise levels in women. Older women had a higher level of prenatal and childbirth knowledge, and were more likely to exercise prior to pregnancy.

Ethnicity

Ninety-two percent of the respondents in our study reported Caucasian descent, while only eight percent reported ethnic origin of African American, Native American, or Hispanic. There was no significant difference in knowledge scores when comparing the

ethnicity of respondents. Because survey distribution was conducted in the Midwest, with predominantly Caucasian ethnicity, we feel our results may represent a bias. A future study may incorporate a variety of cultures in order to ensure a better representation of ethnicities.

City Size

It was found that the city size of the participants' longest residence was a determinant in their level of knowledge. Women who resided the longest in cities with a population of 5,000 or less had significantly more knowledge of the risks associated with exercise during pregnancy than those women who were from cities of a population having 25,001-50,000. The women of cities with 5,000 or less also had significantly higher overall scores than those women from cities with a population of 25,001-50,000.

These results were contrary to what we had initially anticipated due to the fact that women in larger cities should have more access to educational materials and professional personnel (MDs, nurses, PTs, personal trainers, etc.) concerning pregnancy and appropriate exercise information. It appeared through our results, however, that women in smaller communities possessed more knowledge concerning risks of exercise during pregnancy than those in larger communities. Melnikow and Alemagno[81] conducted a study of Midwestern inner-city postpartum women, with a median age of 23 and a median parity of 2, and reported that inadequate prenatal care was independently associated with being ashamed or afraid of the pregnancy or physician, transportation problems, being black, and/or being homeless. In smaller communities, these factors may not be as big a concern.

Due to the smaller population in more rural areas, pregnant women may have a more comfortable, personal relationship with the community's health care professionals, which would ease discussion of topics concerning their pregnancy. This phenomenon may also be due to a more active-based learning in smaller communities, where family and friends provide information to the expecting mother. Future research may compare knowledge of women living in remote/rural areas (population of 500 or less) to women living in large cities (population of 100,000 or more).

Information Source

The data concerning the sources where pregnant women receive their information may be skewed in our results because only 18 of 84 women (those who had previously been pregnant) answered this question. The results initially reported other sources where pregnant women received their prenatal information, including books, magazines, and internet; family, friends, co-workers; and educational course(s). Secondary to the low number of responses (18), however, the data was condensed into a title of "Other Sources." Nevertheless, we do feel that this is an accurate representation, as most women still primarily receive their prenatal information from their physician.[85]

We did not include community health workers (CHWs) as one of the choices for a source of prenatal information. In hindsight, we feel they should have been included, as Zuvekas[87] has shown that CHWs enhance patients' knowledge about health topics and help them alter their behavior. This includes prenatal care, and specifically the reduction of high-risk behaviors. Future research may include CHWs due to their accessibility to a wider base of subject pool, such as age and ethnicity.

Pregnancy

Seventy-eight percent of the participants in our study had never previously been pregnant, whereas twenty-two percent had. There was a significant difference in overall knowledge scores on the risks, precautionary measures, and modes of exercise between these two groups, with women who had previously been pregnant achieving higher scores. This corresponds to a study by Rodriguez,[75] who showed that those who had previously experienced pregnancy had higher levels of knowledge in prenatal care.

Number of Pregnancies

There was no significant difference between groups with different numbers of pregnancies (1, 2, 3, 4+). This is contrary to what we initially thought we would find. We estimated that women who experienced a greater number of pregnancies would have greater knowledge than those who had had fewer pregnancies, with experience as the sole criteria for increased knowledge. Our assumption considered the entire realm of prenatal care, however, and did not just limit it to knowledge of exercise, as our survey analyzed.

The reader should consider that our study has limitations and may therefore not fully represent the general population. Some limitations to consider include:

1) Survey participants included mostly college-age, Caucasian females in a Midwest geographical location. Pregnancy affects women of every race, every region of the world, and represents more ages than the women reported in our study. Different results may have been obtained had the survey been distributed to include a broader population.
2) Our survey was of college-age women (the mean age was 23), with most reporting no previous pregnancies. If more women who had been pregnant before completed the survey, the results may have indicated a higher level of knowledge,

because our results showed that women who had prior pregnancies had significantly higher scores than those who had none.

3) Participants' highest level of education was not addressed. Survey distribution included women in undergraduate classes only; upper level, graduate classes were not included. Melnikow,[81] Rautava,[76] and Hinton[86] reported that women who were well educated had greater prenatal care, childbirth knowledge, and were more likely to exercise prior to pregnancy than those who were less well educated. Therefore, had women with more education completed the survey, the results may have been different.
4) The survey questions did not address the participants' level of exercise. If women exercise before they are pregnant, they are more likely than their sedentary counterparts to continue their exercise regime when they are pregnant.[76,81,86] If this question would have been asked, we could have compared women's knowledge of exercise during pregnancy with their level of (exercise) activity.
5) The sample size was relatively small. Though the population we surveyed was adequate enough to obtain valid statistical results, a bigger sample size would have better represented the population and would have increased the power of this study. To increase the sample size and variety of participants, it is a suggestion to future researchers to extend the survey to groups of women outside of the educational environment. Some different areas to incorporate would include various work places, church groups, high schools, homeless shelters, and/or community health program participants. Another proposal would be to distribute

the survey to other geographical locations to better represent the ethnicity of the population.

A follow-up study might determine if additional factors, such as income or level of education (as indicated above) influence women's knowledge of the risks, precautionary measures and modes of exercise during pregnancy. Both upper income level and higher education have been associated with the greater likelihood of women exercising prior to pregnancy,[86] greater prenatal care,[81] and childbirth knowledge.[76] Another suggestion for further investigation would be a fill-in-the-blank survey to determine women's knowledge. This would eliminate the chance of guessing, and would give the researcher(s) more insight on how much knowledge the respondent's truly possess.

Summary and Conclusion

Female subjects participating in this study were not very knowledgeable concerning the risks, precautionary measures and modes of exercise associated with pregnancy. The possible reasons for this are widespread and the conclusions drawn from these researchers represent only a few of the many potential explanations. Future research may include a more diverse population in terms of age, ethnicity, education, and income level. In addition, further studies may distribute the survey to various work places, church groups, high schools, homeless shelters, and/or community health programs.

In conclusion, in order for women to reap the benefits of exercise and enjoy a safe pregnancy, it is imperative that they know the risks and associated precautionary

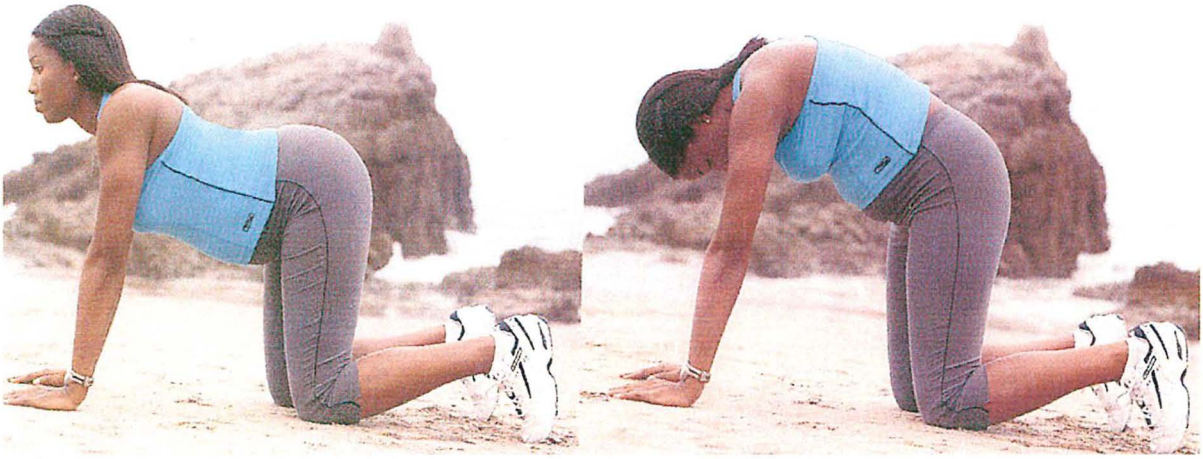
guidelines. It is therefore of utmost importance that health care professionals are aware of current guidelines and are willing resources, ready to share information with their clients.

Appendix A

	1st Trimester (0-3 Months)	2nd Trimester (3-6 Months)	3rd Trimester (6-9 Months)
Beginner	You were new to exercise prior to your pregnancy. Start slowly with a simple walking program: Walk for 30 minutes 2-3 times per week, with a day of rest in between.	You can begin to increase the intensity of your walk. Warm up by walking briskly for 5-10 minutes, then pick up the pace and power walk (walk at a fast pace, pumping your arms) for 25 minutes. Cool down by walking slowly for 5 minutes.	You should be able to power walk for at least 30 minutes. If you aren't up to it, ride a recumbent bike, use a stair climber or walk on a treadmill. Your hips may not feel as stable as in the second trimester, so stick to level terrain. Continue to exercise at least twice a week and do the strength-training exercises
Intermediate	You were walking or running consistently for at least 3 months prior to your pregnancy for 10-15 total miles per week. You can continue the same routine 3-4 times a week, with a day of rest in between.	If everything went well in your first trimester and you are feeling up to it, you can continue at the same pace.	Continue your routine if you are still comfortable, but stick to flat terrain. Decrease your mileage if running becomes difficult; walk or cross train to maintain your fitness level.
Advanced	You were running 15-20 miles a week consistently for 6 months or more prior to pregnancy and occasionally competed in races. You can continue this routine except for the racing. If you feel as if you are overexerting yourself, walk or discontinue the routine until you feel stronger.	You can run as many as 5 days a week if you feel comfortable. Work out in a pool on days when you are feeling tired or are not up for a run.	You surely are feeling the extra weight you are carrying. If you still feel good and want to continue running, then do so. You may find that you don't feel comfortable running as long or for as many days a week as you did in the first two trimesters. If you feel unstable, walk or continue your runs in a pool.

****Walking/Running Program** developed by Karen Nordahl, M.D., personal trainer Susi Kerr and physical therapist Carl Peterson.[39]

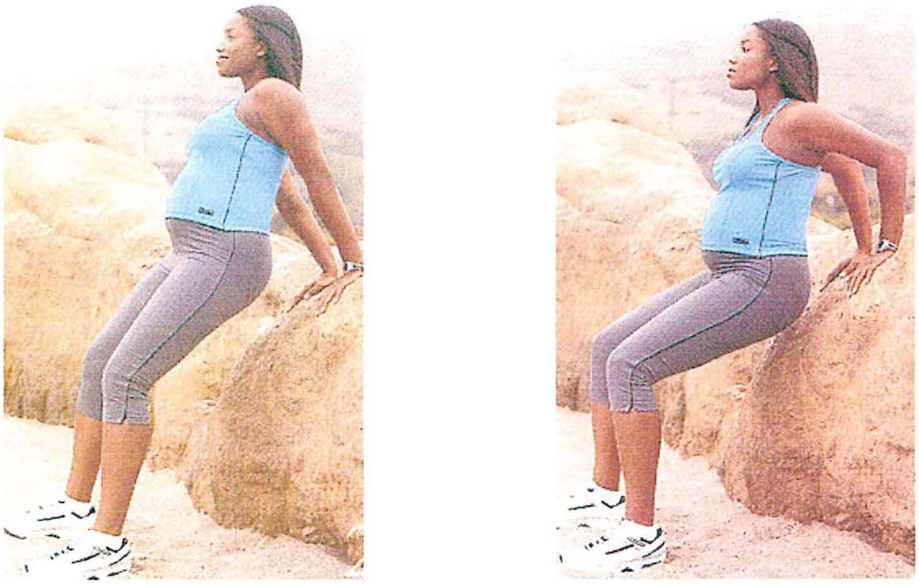
Appendix B



A B

Figure 1[37]: CAT & CAMEL EXERCISE

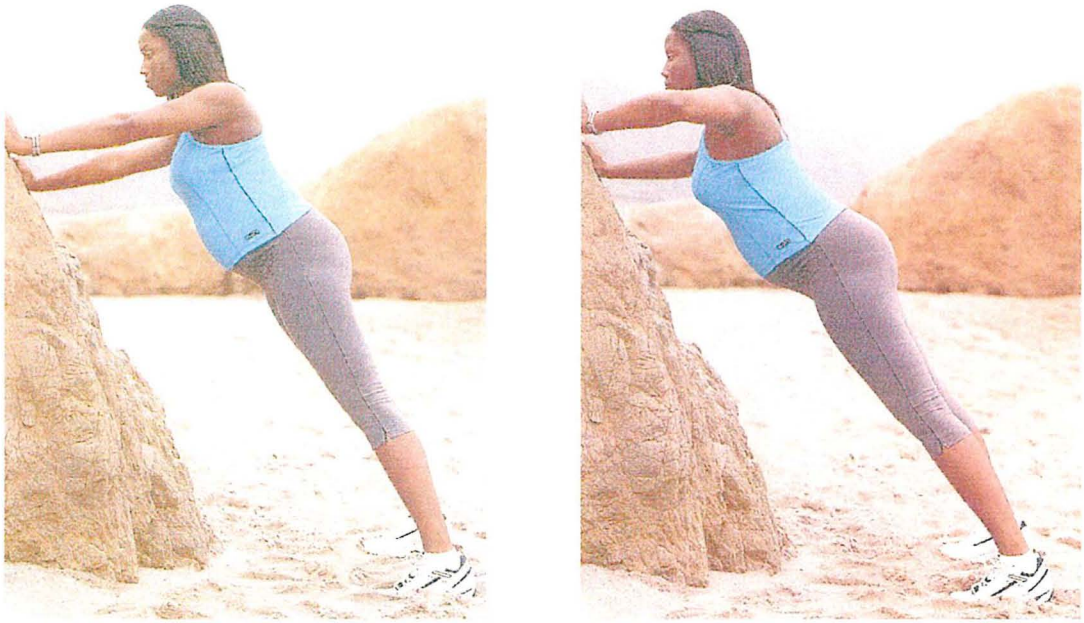
Kneel on the ground with the wrists just in front of the shoulders and knees in line with the hips. Keeping the arms straight, inhale, lifting up the head and tailbone (A). Using the abdominals, exhale, letting the head relax and round the spine like a cat (B). Continue for repetitions in a rhythmic pattern.[k]



A B

Figure 2[37]: TRICEPS-DIP

Stand with the back to a ledge offering horizontal support, knees bent, feet flat on the ground. Place the hands on the edge of the support close to the buttocks using the arms; squeeze the shoulder blades down and together (A). Without changing position, bend the elbows, lowering the torso until the elbows are about in line with the shoulders (B). Straighten the arms without locking and repeat.



A B

Figure 3[37]: PUSH-UPS

Women should face a support, feet are hip-width apart, hands are slightly wider than the shoulders, and arms are straight (A). Bend at the elbows and lean chest toward the support until the elbows are in line with the shoulders (B). Push back to the starting position and repeat.

Trimester Tip: Traditional push-ups, with the hands on the ground, may be done during the first trimester. Do push-ups while kneeling with hands on a bench during the second trimester.

A B

Figure 4[44]: SQUATS

Stand with the legs hip-width apart, hands on the hips. Stand tall by pulling the navel toward the spine with tailbone pointing down to the floor. Squeeze the shoulder blades down and back (A). Bend the knees, keeping weight equally over the heels, and lower the body as if going to sit in a chair. Do not let the knees extend over the toes (B). Straighten the legs to starting position, squeezing the buttocks at the top of the lift to bring the hips under the shoulders. Do 2 sets of 15 repetitions.

Trimester Tip: Hold on to the back of the chair during the third trimester for balance.

A B

Figure 5[44]: STANDING HIP LIFT

Stand with the right side to a chair. For support, hold on to the back and place the left hand on the hip. Shift weight to the right leg without leaning; lift the left foot off the floor and slightly in front of the midline of the body (A). Keeping the hips and shoulders square, without rotating the hips or shoulders, sweep the left leg up and out to the left (B). Return to the starting position and repeat. Do 2 sets of 15 repetitions/side.

A B C

Figure 6[44]: BALLET LEGS

Stand with the right side to a chair. Hold on to the back for support and place the left hand on the hip. Bend the left knee to rest the left foot against the right calf (A). Extend the left leg out in front of the body (B), then return to A. Without leaning forward, extend the left leg behind the body (C), squeezing the buttocks; then return to A. Do 2 sets of 15 repetitions on each leg.

Figure 7[44]: BICEPS CURL

Sit on the edge of a chair with feet flat on the floor. Hold a dumbbell in each hand with arms and elbows by the sides of the body. The palms face forward with wrists straight. Pull the navel toward the spine to help sit-up tall, avoiding arching the back. Pull the shoulder blades down and back. bend one arm, keeping the elbows stationary, curling the dumbbell toward the shoulder. Lower; then bend the other arm for one repetition (One rep equals a curl with both arms).
Trimester Tip: The participant may want to sit farther back in the chair and place a pillow behind the back for support as the pregnancy progresses.

A B

Figure 8[44]: LATERAL RAISE

Stand with the feet hip-width apart and knees slightly bent. Hold a dumbbell in each hand, palms facing the body, and let the arms hang by the sides (A). Pull the navel up toward the spine to help stand tall. Squeeze the shoulder blades down and back. Keeping a slight arc to the arms, lift the arms out and up to shoulder height (B). Slowly lower and repeat. Do 1-2 sets of 10 repetitions, resting 1 minute between sets.
Trimester Tip: Sit in a chair and place a pillow behind the back for support during the second and third trimesters.

Figure 9[8]: Illustrates a suggested exercise series for an early pregnancy class.

7 SHOULDER, ARM AND UPPER BACK STRETCH

Purpose: To increase range of motion and flexibility in shoulders, arms and upper back muscles.

Position: Sitting with back against wall, legs out straight. Start with straight arms, palms up at shoulder level. Drag arms slowly up wall maintaining contact with wall. Hold at point where arms want to push away from wall, (hold for 10 sec.), lower slowly. ***Amount:*** 3x

8 CAT EXERCISE

Purpose: To relieve back pain and increase flexibility in low back muscles.

Position: On hands and knees, arch the back up and drop head down. Reverse the action, to head up and back raised to flat position. ***Amount:*** 10x

9 BUDDHA

Purpose: To stretch upper back, arms, wrists, and low back muscles.

Position: Sitting on heels with knees a comfortable distance apart, place hands on thighs. Keeping knees bent slide hands forward (on floor) until arms and back are stretched forward, breathe out, stretch. (hold position, breathing easily, for 10 sec.)

Amount: 5x

10 SQUATTING

Purpose: To stretch hip muscles and increase endurance in the squatting position.

Position: Feet shoulder-width apart and knees pointed out to side, heels on ground, squat holding onto partner or table for support, (hold for 10 sec.), stand, repeat. ***Amount:*** 4x

11 HIP STRETCH

Purpose: To stretch front of thigh and increase flexibility in legs.

Position: Squat on floor. Place one leg behind and shift weight to bent leg keeping hands on floor. Pull self forward until knee of bent leg is directly over ankle, (hold for 10 sec.). Switch and stretch.

Amount: Alternate 3x each leg

12 SIDE BENDS

Purpose: To stretch arms and trunk.

Position: Feet shoulder width apart. Hold elbow of right arm with left hand. Gently pull right elbow behind head as you bend to the left, (hold 10 sec.). Switch to left. Hold left elbow with right hand.

Amount: 3x each side

13 CALF STRETCH

Purpose: To stretch calf muscles and front of thighs.

Position: Hands on wall, straighten left leg behind. Feet pointing straight forward, lean into wall until stretching is felt in calf muscles (hold 10 sec.). Same position, bend the back knee (hold 10 sec.). Switch and stretch opposite leg. ***Amount:*** 3x each leg

Figure 10[8]: Illustrates a suggested exercise series for an early pregnancy class.

Appendix C

_X_ EXPEDITED REVIEW REQUESTED UNDER ITEM _3, 9_ (NUMBER[S]) OF HHS REGULATIONS
___ EXEMPT REVIEW REQUESTED UNDER ITEM ____ (NUMBER[S]) OF HHS REGULATIONS

UNIVERSITY OF NORTH DAKOTA HUMAN SUBJECTS REVIEW FORM FOR NEW PROJECTS OR PROCEDURAL REVISIONS TO APPROVED PROJECTS INVOLVING HUMAN SUBJECTS

Please include ALL information and check ALL blanks that apply.

PRINCIPAL INVESTIGATOR: Sara Hoerner / Kari Melby / Tricia Pederson **TELEPHONE:** 701-335-2455 218-874-7785 **DATE:**

ADDRESS TO WHICH NOTICE OF APPROVAL SHOULD BE SENT: 264 E Carroll Ave, Newfolden, MN 56738

SCHOOL/COLLEGE: Medicine and Health Sciences (E.g., A&S, Medicine, EHD, etc.) **DEPARTMENT:** Physical Therapy **PROPOSED PROJECT DATES:** 06/' (Mont

PROJECT TITLE: "Determining the Level of Knowledge of UND College Women in Their Childbearing Years Regarding Exercise During

FUNDING AGENCIES (IF APPLICABLE): ____

TYPE OF PROJECT (Check ALL that apply):

_X_ NEW PROJECT ___ CONTINUATION ___ RENEWAL ___ DISSERTATION OR THESIS RESEARCH _X_ STUDENT RESEA

___ CHANGE IN PROCEDURE FOR A PREVIOUSLY APPROVED PROJECT

DISSERTATION/THESIS ADVISER, OR STUDENT ADVISER: Dr. Peg Mohr, Associate Professor of Physical Therapy

PROPOSED PROJECT: ___ INVOLVES NEW DRUGS (IND) ___ INVOLVES NON-APPROVED USE OF DRUG ___ INVOVLES A C INSTITUTION

IF ANY OF YOUR SUBJECTS FALL IN ANY OF THE FOLLOWING CLASSIFICATION, PLEASE INDICATE THE CLASSIFICATION(S):

☐ MINORS (<18 YEARS) ☐ PREGNANT WOMEN ☐ MENTALLY DISABLED ☐ FETUSES ☐ PERSON MENTAL

☐ PRISONERS ☐ ABORTUSES ☒ UND STUDENTS (>18 YEARS)

IF YOUR PROJECT INVOLVES ANY HUMAN TISSUE, BODY FLUIDS, PATHOLOGICAL SPECIMENS, DONATED ORG MATERIAL, OR PLACENTAL MATERIALS, CHECK HERE ____

IF YOUR PROJECT HAS BEEN\WILL BE SUBMITTED TO ANOTHER INSTITUTIONAL REVIEW BOARD(S), PLEASE L OF BOARD(S): ____

Status: ____ Submitted; Date ____ ____ Approved; Date ____

1. ABSTRACT: (LIMIT TO 200 WORDS OR LESS AND INCLUDE JUSTIFICATION OR NECESSITY FOR USING HUMAN SUBJECTS.)

Education and prevention have become vital components within the Physical Therapy realm. One area that has become more prevalent today is that of physical fitness and exercise during pregnancy. With an increase in the number of pregnant women exercising, there is an increased need for patient education and the distribution of updated guidelines to promote appropriate exercise activities. Because of their role in physical fitness and exercise, physical therapists are often asked about appropriate exercise guidelines during pregnancy; however, with new and updated information from the American College of Obstetricians and Gynecologists (ACOG) and the American College of Sports Medicine (ACSM), more current, appropriate guidelines for exercise during pregnancy are needed to give to women who are pregnant or are considering pregnancy.

The purpose of this study is to review survey data to determine the level of knowledge of non-pregnant English speaking, college women between the ages of 18 and 40, regarding the risks, precautionary measures, and modes of exercise during pregnancy. The results of this study may provide health care professionals with an informational guide to utilize in the development of training materials for women of childbearing years in regards to the risks, precautionary measures, and modes of exercise associated with pregnancy.

PLEASE NOTE: Only information pertinent to your request to utilize human subjects in your project or activity should be included on this form. Where appropriate attach sections from your proposal (if seeking outside funding).

2. PROTOCOL: (Describe procedures to which humans will be subjected. Use additional pages if necessary. Attach any surveys, tests, questionnaires, interview questions, examples of interview questions (if qualitative research), etc., the subjects will be asked to complete.)

Sample Population:
Anticipated cooperation of approximately fifty to sixty women who are between the ages of 18 and 40, who will be undergraduate students attending Psychology, Sociology, Communication, or Teaching and Learning courses during the summer session at the University of North Dakota. Subjects will be chosen based on their age, gender, and English speaking ability. Women who are pregnant will be excluded from the study.

Procedures:
With permission from the course instructors, a short 30-item survey will be distributed by a researcher to willing participants attending undergraduate Psychology, Sociology, Communication, or Teaching and Learning classes during the summer session at the University of North Dakota. Distribution and collection of the survey will occur between 06/11/01 and 07/31/01. One of the researchers will be present to explain the project. A cover letter explaining the risks, benefits, criteria to participate, protection for confidentiality and contact individuals will accompany the survey. The survey will take approximately eight to ten minutes to complete. Upon completion, the participants will place the surveys in an envelope that will be provided by the researcher. Data will be stored in the Physical Therapy Department at the University of North Dakota in a locked cabinet. Following the completion of our project, data will be retained for three years and then be destroyed. Traditional descriptive and analytical statistics will be used, and an alpha level for all statistical tests will be set at .05.

3. BENEFITS: (Describe the benefits to the individual or society.)
Both health care professionals and the participants will benefit from data collected through this study. The benefit to the participant will be the experience of being involved in a scientific study, and knowing that she will be contributing to the body of knowledge in exercise physiology and physical therapy. Society may benefit from this study by acquiring increased information regarding the training needs of women between the ages of 18 and 40 regarding exercise during pregnancy. Participants may also be compensated by receiving class credit as determined by their individual instructors.

Data collected from the study may provide the basis for developing an appropriate informational brochure that will provide exercise guidelines for women who are pregnant. It is anticipated that this information will help to promote the health and wellness of both women and babies.

4. RISKS: (Describe the risks to the subject and precautions that will be taken to minimize them. The concept of risk goes beyond physical risk and includes risks to the subject's dignity and self-respect, as well as psychological, emotional or behavioral risk. If data are collected which could prove harmful or embarrassing to the subject if associated with him or her, then describe the methods to be used to protect the confidentiality of data obtained, debriefing procedures, storage of data, how long date will be stored (must be a minimum of three years), final disposition of data, etc.)

The risks involved in this research project are minimal. There is a minimal risk that subjects may take information displayed on the survey as factual and incorporate it into their lifestyles. To minimize this risk, a cover letter will accompany the survey, and will state that participants should not take the survey content as factual. It will also provide a recommendation that participants, who may become pregnant, should contact their primary physician about any concerns regarding exercise during pregnancy. In addition, women who are pregnant will be excluded from the sample population.

In the cover letter, four contact persons and phone numbers will be provided and the participant will be encouraged to contact those individuals if she has any questions regarding this project. To protect confidentiality, the participants will be instructed not to put their names on the survey. Since surveys will be numerically marked, the actual subject will be unrecognizable.

5. **CONSENT FORM:** Attach a copy of the **CONSENT FORM** to be signed by the subject (if applicable) and/or any stateme to the subject should be attached to this form. If no **CONSENT FORM** is to be used, document the p be used to assure that infringement upon the subject's rights will not occur.

Describe where signed consent forms will be kept and for how long (must be a minimum of 3 years), plans for final disposition or destruction.

Participation in this project is voluntary and completion of the survey will indicate consent to participate. Subjects may withdra penalty at any time until data collection is complete. Withdrawal from this study will not affect the participant's relationship with Therapy Department, the University of North Dakota, or the educational department in which the surveys are distributed. In re data, no identifying information will be used in any reports. Data will be retained for a period of three years and stored in a loc the Department of Physical Therapy. After this time, all data will be destroyed.

Office of Research & Program Development
University of North Dakota
Grand Forks, North Dakota 58202-7134

On campus, mail to: Office of Research & Program Development, Box 7134, or drop it off at Room 105 Twamley Hall.

The policies and procedures on Use of Human Subjects of the University of North Dakota apply to all activities involving use Subjects performed by personnel conducting such activities under the auspices of the University. No activities are to be initia prior review and approval as prescribed by the University's policies and procedures governing the use of human subjects.

SIGNATURES:

Principal Investigator	D
Project Director or Student Adviser	D
Training or Center Grant Director	D

Please do NOT place your name on this survey. Complete this survey ONLY if you are FEMALE. Please answer the following questions by circling the answer you feel is most appropriate:

What is your current age in years? _____

What is your primary ethnic orientation?

African American/Black

Asian

Caucasian/White

Hispanic

Native American

Other_____

What is the approximate size of the city in which you have lived the longest?

5000 & below

5001 - 10,000

10,001 - 25,000

25,001 - 50,000

50,001 +

Have you been pregnant? YES NO

If so, how many times have you been pregnant? 1 2 3 4 +

If you have been pregnant, from whom did you get **MOST** of your prenatal information?

a) Completed a prenatal educational course
b) Received information from physician
c) Received information from health care provider other than physician (i.e. physical therapist, occupational therapist, physician's assistant, nurse)
d) Received information from friends/family/co-workers
e) Received information from books/magazines/internet
f) Did not receive any prenatal information
g) Other_____

Please answer the following questions in relation to the time period of pregnancy from conception to delivery. Circle the answer you feel is most appropriate:

TRUE	FALSE	UNSURE	It is safe for all women to exercise during their entire pregnancy.
TRUE	FALSE	UNSURE	Taking a deep breath and holding it during any exercise should be avoided.
TRUE	FALSE	UNSURE	A woman can exercise at 60% - 70% of her maximum heart rate.
TRUE	FALSE	UNSURE	A moderate level of participation in yoga is a safe form of exercise during any stage of pregnancy.
TRUE	FALSE	UNSURE	A woman can perform exercises that involve sharp twists of the body, rapid or uncontrolled swinging or bouncing.
TRUE	FALSE	UNSURE	Women can begin exercising during pregnancy without consulting a doctor.
TRUE	FALSE	UNSURE	Types of endurance activities best suited are walking and/or swimming.
TRUE	FALSE	UNSURE	Exercise requiring balance (i.e. skiing or skating) should be avoided, particularly in the 3rd trimester (6 - 9 months) of pregnancy.
TRUE	FALSE	UNSURE	A woman can do sit-ups (lying on the back with knees bent and lifting the upper body towards the knees) during any stage of pregnancy.
TRUE	FALSE	UNSURE	The incidence of spontaneous abortion increases with runners who continue to run during early pregnancy (0 - 3 months).
TRUE	FALSE	UNSURE	Brisk walking and/or bicycling at moderate to very high rates in mid-late (4 - 9 months) pregnancy lead to pre-term labor.
TRUE	FALSE	UNSURE	During normal healthy pregnancies, beginning a regular exercise program in the 2nd trimester (4 - 6 months) or continuing one's current exercise program harms the baby.
TRUE	FALSE	UNSURE	Heat stress from intense exercise lasting longer than 30 - 45 minutes may be harmful to the baby.

Please answer the following questions in relation to the time period of pregnancy from conception to delivery. Circle the answer you feel is most appropriate:

TRUE	FALSE	UNSURE	The risk of harm to the baby increases as exercise intensity increases (from moderate to vigorous).
TRUE	FALSE	UNSURE	Performing strenuous exercise in an overly warm environment during the 1st trimester (0 - 3 months) of pregnancy may harm the baby.
TRUE	FALSE	UNSURE	Maternal body temperature should remain below 100.4° - 102.2° F (38° - 39° C) for the well being of both mother and baby.
TRUE	FALSE	UNSURE	Following a cool-down of 5 minutes after exercise, women should lie down for 5 - 10 minutes to avoid lightheadedness, dizziness, and/or fainting.
TRUE	FALSE	UNSURE	During the 2nd and 3rd trimesters (4 - 9 months) pregnant women should perform exercise lying flat on their backs.
TRUE	FALSE	UNSURE	A pregnant woman can sit in a hot tub to resolve muscle soreness after exercise.
TRUE	FALSE	UNSURE	A pregnant woman should perform a warm-up period of 5 minutes before exercise and a cool-down period of 5 minutes after exercise.
TRUE	FALSE	UNSURE	Swimming and/or biking are better than running and/or high intensity aerobics.
TRUE	FALSE	UNSURE	Women can use free weights and/or weight machines when strength training.
TRUE	FALSE	UNSURE	Women should use heavy resistance when doing strength training for their arms and legs.
TRUE	FALSE	UNSURE	During pregnancy, adequate water intake, appropriate clothing, and avoiding direct heat while exercising can assist in maintaining normal body temperature.

THANK YOU FOR TAKING YOUR TIME TO COMPLETE THIS SURVEY.

Dear Participant:

Our names are Sara Hoerner, Kari Melby and Tricia Pederson and we are graduate students from the Physical Therapy Program at the University of North Dakota. This letter is to invite you to participate in a research study regarding women's understanding of risks, precautionary measures and recommended modes of exercise during pregnancy. We are completing this study as a scholarly project requirement for our Master's degrees.

The purpose of this study is to gather information about the training needs of college women (ages 18-40) regarding their understanding of risk factors associated with participating in exercise during pregnancy. Results from this survey process may serve as a guideline for the development of educational materials outlining recommended practices for exercise during pregnancy.

Approximately fifty to sixty English-speaking, non-pregnant female, college students, between the ages of 18 and 40, will be recruited to complete a 30-item survey. It will take approximately eight to ten minutes to complete the survey (attached to this letter). Participants will be recruited from various Psychology, Sociology, Communication, and Teaching and Learning classes during the summer session courses. People excluded from the study include males, pregnant or non-English speaking women, those under age 18 or over the age of 40, and those not enrolled in the selected Psychology, Sociology, Communication or Teaching and Learning summer session courses. Your completion of the survey will indicate your consent to participate. You may choose to withdraw from this study at any time until you return the survey to the researcher. Your withdrawal will not harm your relationships with the Physical Therapy Department, the University of North Dakota, or the educational department in which this survey is being completed. When you are finished with the survey, you may return it to the researcher by placing it in the envelope provided at the front of the room. **Do not write your name on the survey.**

The risks to you as a participant in this study are minimal. The survey content provides a short true and false quiz regarding risk factors and precautionary measures that may or may not apply to exercise during pregnancy. **The questions should not be considered factual, as some answers will be false.** The researchers recommend that all participants and women who are pregnant contact their physician prior to engaging in an exercise program and obtain specific instructions regarding guidelines during pregnancy. No identifying information will be recorded or attached to the survey data. All data will be stored in a locked cabinet for three years after the completion of the study and then shredded. Only the researchers and their advisors will have access to the data. Results will be reported in aggregate form without any information that may link the participant with the data results.

You, as a participant in this study, may benefit from the experience of being in a research study, and/or may gain additional knowledge about your personal understanding of risk factors associated with exercise during pregnancy. Society may benefit from the study by acquiring increased information regarding the training needs of women of childbearing years. The results of this study may provide a guideline for the development of educational materials. You, as a participant, may also be compensated by receiving class credit as determined by your individual instructor.

If you have any questions about this study, please feel free to discuss your questions with the researchers: Sara Hoerner (612) 959-9499, Kari Melby (701) 335-2455, Tricia Pederson (218) 874-7785, or you may contact our advisor, Peg Mohr at (701) 777-3689. Should you have any additional concerns about the study, you may contact the Office of Research and Program Development at (701) 777-4279.

Thank you for your time in completing this survey. A copy of this letter has been provided for your personal reference.

Sincerely,

Sara Hoerner Kari Melby Tricia Pederson

Peg Mohr, Advisor

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