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Exercise and Pregnancy: A Guide for Health Care Professionals

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EXERCISE AND PREGNANCY:
A Guide for Health Care Professionals

by

Stacy Lee Ripplinger
Bachelor of Science in Physical Therapy
University of North Dakota, 1997

An Independent Study

Submitted to the Graduate Faculty of the

Department of Physical Therapy

School of Medicine

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in partial fulfillment of the requirements

for the degree of

Master of Physical Therapy


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May
1998



This Independent Study, submitted by Stacy Lee Ripplinger 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 Faculty Preceptor, Advisor, and Chairperson of Physical Therapy under whom the work has been done and is hereby approved.


(Faculty Preceptor)


(Graduate School Advisor)


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Title EXERCISE AND PREGNANCY: A Guide for Health Care
 Professionals

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Date 12/16/97

TABLE OF CONTENTS

List of Figures.....	v
Acknowledgements.....	vi
Abstract.....	vii
I. Introduction.....	1
II. Maternal Body Changes.....	9
Physiological Changes.....	9
Cardiovascular Changes.....	9
Respiratory Changes.....	11
Metabolic System.....	12
Endocrine System.....	13
Fetal Responses.....	14
Musculoskeletal Changes.....	15
Posture.....	15
Low Back.....	17
Abdominals.....	17
Pelvic Floor.....	19
III. Components of an Exercise Program.....	21
Exercise.....	21
Diet and Nutrition.....	28
Emotions and Mental Attitude.....	32
IV. Exercise Suggestions.....	33
Warm-up/Cool Down Routines.....	33
Stretching.....	34
Postural Training.....	39
Abdominals.....	42
Pelvic Floor.....	47
Recreational and Sports Activities.....	50
V. Conclusion.....	56
Appendices.....	60
References.....	67

LIST OF FIGURES

Figure	Page
1.1 Percentage of Women Who Exercised During Pregnancy, by Activity.....	6
3.1 Contraindications for Exercise During Pregnancy.....	23
3.2 Precautions for Exercise During Pregnancy.....	24
3.3 Warning Signs and Symptoms for Exercise During Pregnancy.....	25

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ABSTRACT

Health and fitness has become nationwide trends resulting in people of all ages making wiser choices regarding nutrition and exercise. Pregnant women are also participating in this fitness revolution to help ease the discomforts of pregnancy, maintain fitness levels, and regain their shape after delivery. These women often turn to health care providers, including physical therapists, for guidance. The purpose of this independent study, accomplished by a review of the literature, is to provide physical therapists and general health care practitioners an overview of maternal body changes, nutritional requirements, and emotional changes that occur during pregnancy, and how these factors contribute to exercise tolerance and safety. The components of a well-rounded fitness regime, with specific exercise suggestions that can be incorporated into an individualized exercise program will be described. This will enable health care providers to make logical and educated decisions regarding health and fitness for the pregnant woman.

CHAPTER I

INTRODUCTION

Health and fitness has become a nation-wide trend resulting in people of all ages making wiser choices regarding nutrition and exercise. It is estimated that 85 million Americans are involved in some type of fitness program, and 25 million Americans jog regularly.¹ Cardiovascular fitness, weight control, and mental relaxation are only a few of the many benefits individuals gain from exercising on a regular basis. Both men and women have expanded their knowledge on the value of exercise; consequently, there has been an increasing number of women participating in athletic activities during the past decade.

Not only has there been an increase in the number of women performing in sports and fitness activities, but pregnant women are also participating in this fitness revolution. Women in their childbearing years not only wish to maintain their own healthy lifestyle, but ensure that exercise will be beneficial to their unborn child.

Exercise during pregnancy is a controversial subject and has remained this way throughout much of history. Historical journals, dating back to the time of Lewis and Clark, describe Sacajawea, a Shoshone Indian woman who transported baggage for the expedition from the Bitter Root Stream at the time of her pregnancy. She had a long, difficult labor and was only able to deliver her child after drinking oxytocic tea brewed

from powdered rattlesnake rattles. Despite the fact that Sacajawea's protracted labor may have been related to her excessive exercise, the general belief was that pregnancy and delivery was easy among Indian women because they worked hard. Although, deliveries may have been easier because women ate less, resulting in smaller babies. It was believed at that time that women must remain active to ensure that the newborn would not be a weakling.²

From the biblical times of the Hebrews and Egyptians to the present, women have exercised during pregnancy, and moderation has continually been suggested.¹ No guidelines for exercising while pregnant were written prior to the 1980's; incidentally, pregnant women were advised by their physicians to avoid heavy exertion and get plenty of rest.³

The American College of Obstetricians and Gynecologists (ACOG), in 1985, established general guidelines for health care providers to follow when recommending exercise programs to pregnant women. These guidelines proved to be very broad and restricting to the physically fit woman. For example, the guidelines suggested that maternal heart rate should not be greater than 140 beats per minute and low impact aerobic exercise should not exceed 15 to 20 minutes. A well-conditioned female athlete would barely break a sweat with these stipulations. In 1994, ACOG modified these guidelines and omitted the specificity; a personalized approach to designing an exercise program is now possible (Appendix A and Appendix B).^{3,4} This program should be based on a woman's current fitness status and the success of her pregnancy.

Depken and Zelasko⁵ report that the safety of exercise during pregnancy is obtained by considering all of the benefits and risks that may affect a mother and her

child. As of yet, no research indicates that moderate, regular exercise is associated with adverse maternal or fetal outcomes; although, the topic of exercise during pregnancy has raised considerable controversy.

Numerous studies have found no differences in fetal birth weight when compared to maternal activity levels.⁶⁻⁹ Rose et al¹⁰ used a self-rating of physical activity model to classify pregnant women into exertional categories. No overall differences in birth weights were found between the groups upon delivery; although, there was a decrease in mean birth weight as activity level increased, but the difference was not statistically significant.

In contrast, Hatch et al¹¹ performed a study assessing the impact of maternal exercise on fetal growth during pregnancy. It was found that low to moderate levels of exercise during pregnancy had no adverse affects on fetal growth; babies of the exercising mothers were actually heavier than the non-exercising group. Vigorous exercise was also associated with increases in fetal growth. Schramm et al⁴ analyzed data from the Missouri Maternal and Infant Health Survey to determine the relationship between exercise, employment, and other activities during pregnancy. The major finding of the study was that women who had very low birth weight infants were much less likely to exercise compared to women with other pregnancy outcomes.

Clapp and Rizk⁷ have reported that regular exercise increases mid-trimester placental growth rate and volume between fourteen and twenty-six weeks gestation. The increase in functional area is thought to improve blood flow and offer protective benefits to the fetus.⁵ In contrast, Clapp¹² actually found a reduced birth weight in women who continued a regular exercise regime throughout late pregnancy. The low birth weight was

attributed to a reduction in fetal fat mass, which may be a cardiovascular advantage in later life.

Not only is the fetus affected by maternal exercise, but mothers may experience many benefits themselves from exercising during pregnancy. By exercising, pregnant women may reduce the presence of urinary incontinence, low back pain, and the pain associated with labor. Other benefits include a decrease in the length of labor, delivery of a healthy child, and recovery from childbirth as soon as possible.⁵ Beckmann and Beckmann⁸ found that women who exercised moderately had shorter labors, increased likelihood of vaginal delivery, decreased use of anesthesia, and decreased incidence of oxytocin labor augmentation. Clapp¹² reported that active labor was 30 percent shorter on average in women who exercised versus non-exercising women. In addition, studies have also found no increase in uterine activity following exercise,¹³ decreased chance of breech presentation,¹⁴ less risk of pre-labor rupture of membranes, and a lower threat of pre-term labor and birth.^{12,14} Spontaneous abortions were also found to occur less frequently in pregnant women who exercise.^{11,15}

Pregnant women may also find that exercise alleviates many of the discomforts and symptoms they experience during this great time of change. Women who performed aerobic activity at a level great enough to produce or maintain a training effect reported, according to Tanji,⁶ fewer pregnancy related discomforts. Similarly, Horns et al⁹ compared pregnancy outcomes between sedentary and active women. Women in the sedentary group were found to have more discomforts, such as vaginal discharge, fatigue, leg cramps, heartburn, shortness of breath, and constipation, than the active group.

Many women reduce the intensity and duration of exercise or stop completely during pregnancy. Hatch et al¹¹ reported that a decrease in women who exercised during pregnancy occurred from 14.9 percent in the first trimester to 9.5 percent in the third trimester, and the type of exercise shifted from high-intensity weight-bearing activities, such as aerobics, to gentler activities, such as swimming and walking.

Zhang and Savitz¹⁶ conducted a survey to describe the prevalence and pattern of U.S. women who exercised during pregnancy. They found that 42 percent of all reporting women exercised during pregnancy; 45 percent did not exercise at least three times a week either before or during pregnancy, 13 percent exercised before pregnancy but stopped after they found out they were pregnant, 7 percent did not exercise before pregnancy but did exercise during pregnancy, and 35 percent exercised before and during pregnancy. It was also found that the Southeast Central part of the U.S. had the highest percentage (48 percent) of exercising pregnant women, Asians were less active than whites, and women in fishing and farming occupations were more active than managerial or professional women. Activity level decreased with increasing maternal age, in women with previous children, and in women who were overweight, had a previous abortion or stillbirth, or multiple births.

Pregnant women who wish to remain physically fit may participate in a variety of activities; however, several studies have shown that walking seems to be the most popular.^{4,16} Horns et al⁹ reported that brisk walking was preferred by 47 percent of a total group of pregnant women who exercised one or more days per week. Other popular activities include swimming, aerobics, biking, etc. (Fig. 1.1).¹⁶

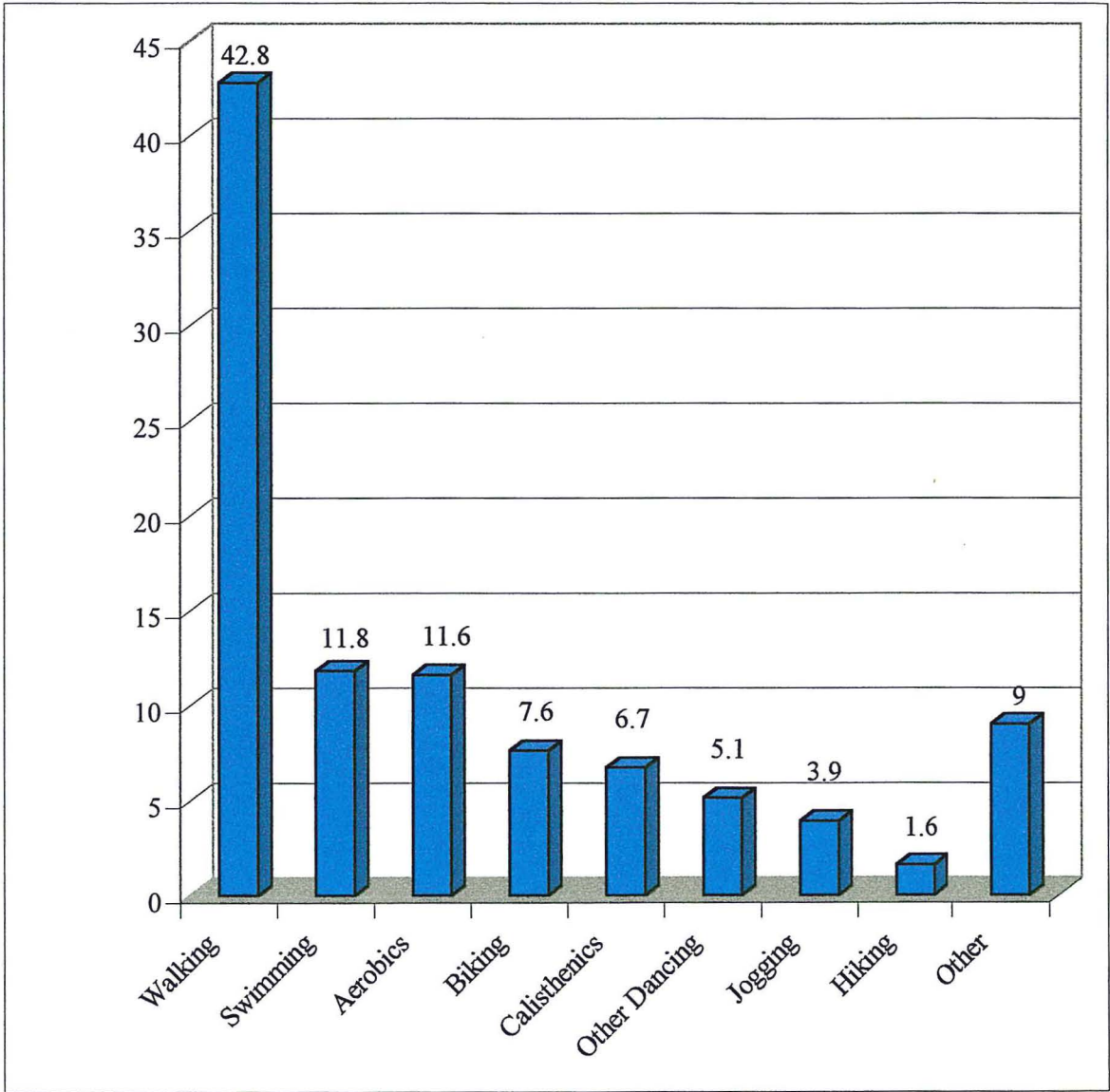


Figure 1.1 Percentage of Women Who Exercised During Pregnancy, by Activity

Regardless of the activities pregnant women wish to participate in to remain physically fit, guidelines must be followed to ensure the safety of the mother and her child. Pregnant women must monitor their exercise programs carefully; although, no evidence has indicated that exercise jeopardizes maternal or fetal health.¹⁴ Moderate exercise is safe and provides benefits for many pregnant women;¹⁸ therefore, mothers-to-be are searching for answers to their numerous questions regarding exercise. Health care professionals, including physical therapists, must be prepared to assume roles as designers, advisors, and teachers to help these pregnant women make healthy choices for themselves and their children.

Because of the recent trend in physical fitness, many women who become pregnant are looking for ways to remain fit and healthy. They most often turn to health care providers, including physical therapists, for guidance; therefore, professionals must be knowledgeable on the current literature and research regarding exercise during pregnancy. This topic has raised many questions among researchers and health care professionals regarding benefits, necessity, safety, types, and amount, just to name a few, but no definite answers have been given thus far. Much research and exploration must be completed in order to provide professionals and mothers-to-be with the appropriate advice and recommendations for remaining fit during pregnancy.

The purpose of this independent study, accomplished by a review of the literature, is to provide physical therapists and general health care practitioners an overview of the changes occurring in a female's body during pregnancy. It will describe the components of a well-rounded fitness regimen, with specific exercise suggestions that can be incorporated into an individualized exercise program. This will enable health care

providers to make logical and educated decisions regarding health and fitness for the pregnant woman.

Physical therapists play a significant role in designing and teaching individualized exercise programs to pregnant women who wish to remain physically fit. The proper guidelines, developed by the American College of Obstetricians and Gynecologists (ACOG), must be followed, and therapists should have a general knowledge of the stages and changes a woman experiences during pregnancy.

General health care practitioners should also be knowledgeable in the area of exercise and pregnancy because pregnant women generally visit practitioners initially, seeking advice and asking questions. Insightful health care practitioners will be able to provide women with helpful, safe advice and most likely refer pregnant females to specific providers, depending on their needs.

Most importantly, pregnant women who are inquiring about exercise during this time of great change are already motivated and willing to learn the safest and most effective ways to remain physically fit. They have apparently experienced the benefits of exercise in the past and are looking to continue leading a healthy lifestyle. They are also looking to decrease or eliminate some of the preventable problems, such as urinary incontinence and low back pain, experienced during pregnancy.

By being an informed and knowledgeable health care provider, pregnant women will have the option to strive for physical fitness during pregnancy and an overall healthier lifestyle.

CHAPTER II

MATERNAL BODY CHANGES

Pregnancy is a time of enormous change. The female body is going through a state of many physiologic and musculoskeletal changes, which are all working together to produce a new life in forty weeks. The main goal of exercise is to promote a new energy level by improving the efficiency of the different systems of the body. Pregnancy alone actually increases this efficiency and takes the body into a new state of activity geared towards the growth and development of the baby.¹⁹

Physiologic Changes

Cardiovascular System

The cardiovascular system is responsible for pumping blood throughout the body and is under considerable stress throughout pregnancy. Blood volume, the amount of blood circulating in the body, progressively increases approximately 30-50% (1 to 2 liters) throughout pregnancy²⁰⁻²⁴ and returns to normal 6-8 weeks postpartum.²² This increase is mainly due to two hormonal factors, aldosterone and estrogen, which are both increased during pregnancy. These hormones promote increased fluid retention by the kidneys.²⁵ In addition, red blood cells are also produced in excess of 20% by the bone marrow, and plasma is produced in excess of 50%, both contributing to the increased blood volume.²¹

Because of the increased blood volume, the heart must work harder. Since it is a muscle, the walls become stronger and thicker. This causes the heart to increase in size, especially the left ventricle.^{21,22,24} Not only does the heart become bigger, it actually is slightly displaced. The pressure of the expanding uterus on the diaphragm causes the heart to be displaced superiorly and to the left.^{22,24}

Heart rate, or the number of ventricular contractions, is also affected during pregnancy. Maternal heart rate is elevated during rest and progressively increases throughout gestation.^{20,26} Resting heart rate increases approximately 7 beats per minute (bpm) in the first trimester,¹⁹ and peaks at approximately 20% or 10-15 bpm above pre-pregnancy rate at full term.^{19,22,24} It will return to a normal level 6 weeks following gestation.²²

The combined effects of increased blood volume, cardiac enlargement, and heart rate significantly increases cardiac output during pregnancy. Cardiac output is magnified approximately 30-60% above pre-pregnancy levels.^{21-23,25-27} The greatest increase occurs when the female is left side-lying because the uterus is placing the least amount of pressure on the aorta.²² Other static positions may also influence blood flow. When supine, women may develop a drop in blood pressure, causing them to become dizzy and lightheaded. This occurs because the growing uterus places pressure on the vena cava, which can also decrease blood flow to the uterus. Prolonged standing without moving may cause venous pooling in the legs, and women may experience similar symptoms.³

Although cardiac output increases, blood pressure decreases due to venous distensibility. Blood pressure begins to decline early in the first trimester and becomes the lowest in mid-pregnancy; pre-pregnancy levels are reached 6 weeks before delivery.²²

There is only a slight decrease in systolic blood pressure, but diastolic pressure is reduced approximately 10% below non-pregnant values.²¹

All of the cardiovascular changes that occur during pregnancy make it necessary for the heart to work harder. This means there is less cardiac reserve available for performance of increasing demands, such as exercise; therefore, exercising at the same pre-pregnant intensity may be unrealistic.

Respiratory System

Changes in maternal respiration stem from anatomical and functional alterations. Hormonal changes early in pregnancy may cause edema and tissue congestion of the upper respiratory tract, which creates nasal stuffiness, runny noses, and occasional nosebleeds.^{22,24}

Anatomically, pressure from the enlarging uterus will not allow the diaphragm to be drawn down as far as usual during inspiration giving the woman a feeling of not being able to inhale deeply. Prior to this crowding, hormones stimulated the female's ribs to flare up and out. This causes 4 centimeters (1.5 inches) of passive elevation of the diaphragm. Consequently, the subcostal angle increases from approximately 68 degrees in early pregnancy to 103 degrees in late pregnancy.²¹ Total chest circumference increases by 5 to 7 centimeters (2-3 inches), and occasionally, this increased circumference is maintained following childbirth.²²

Functionally, total lung capacity is unchanged or slightly decreased, but tidal volume is increased up to 40% (from 500 ml in the non-pregnant state to 700 ml in late pregnancy). Because there is an increase in tidal volume but not a significant change in total lung capacity, it was discovered that the functional residual capacity was decreased

by 500 ml. This means that at the end of quiet expiration, there is a smaller oxygen reserve in the lungs and a reduced ability to withstand periods of apnea.²¹ Minute ventilation is also increased by 40% (from 7.5 liters/minute to 10.5 liters/minute). This helps to enhance the resting oxygen consumption by approximately 20-30%.^{19,21,22,24,26}

A natural state of hyperventilation exists throughout pregnancy because of the increased oxygen demands required. Uterine pressure on the diaphragm plus the natural state of hyperventilation associated with pregnancy may elicit some women to experience frequent breathlessness hyperventilation. They may feel dizzy, lightheaded, or nauseated, and need to be reminded to breathe slowly and evenly, take deep inhalations, and lengthen exhalations. Exercise that may cause labored breathing or dyspneas should be avoided; although, pregnant women who exercise moderately can improve their aerobic capacity.²⁴

Metabolic System

Metabolism refers to the sum of all physical and chemical changes that take place within an organism. This involves two fundamental processes: anabolism (assimilation or building-up process) and catabolism (disintegration or tearing-down process).²⁸

Anabolism relates to the process by which nutrients are made available for the body. Metabolic functions release energy from nutrients and transform it into usable structures for the body. Most of these functions increase during pregnancy; the energy cost of a pregnant female is approximately an additional 300 calories per day. Excellent nutrition and nutritional supplements are a must for a healthy pregnancy.²⁴ This will be discussed further in Chapter III.

The increased metabolism, which occurs during pregnancy, creates heat as a by-product referred to as catabolism. This results in an elevated maternal body temperature of 0.5 degrees Celsius (0.9 degrees Fahrenheit); normal body temperature for a non-pregnant female is 37 degrees Celsius (98.6 degrees Fahrenheit). Temperature will return to normal following childbirth.²⁹ Prolonged or strenuous exercise may raise the female's internal core temperature, which also raises the fetus's temperature. Since the fetus depends on the mother for heat dissipation, an increase in maternal temperature can seriously harm her child. Research has suggested that hyperthermia of the fetus may lead to neural tube defects.^{21,24}

Women who are physically fit seem capable of keeping cooler while exercising. Clapp^{5, 30,31} followed 18 conditioned athletes before and during pregnancy and found that peak rectal temperatures actually decreased during pregnancy. He believes that the physiological changes that occur during pregnancy actually increase women's tolerance to heat and resets their thermoregulatory system. Although, even if the risk is minimal, women should avoid overheating, dehydration, hot tubs, saunas, and whirlpools. Also, pregnant women should not exercise in hot, humid climates or if they are experiencing a fever. All of these factors will reduce the amount of heat that can be eliminated from the female's body.⁵

Endocrine System

Three main hormones, relaxin, progesterone, and estrogen, may affect a woman's ability to exercise while pregnant. Relaxin, produced by the ovaries during pregnancy, is thought to soften ligaments, and relax and stretch fibrocartilage in preparation for delivery.²¹ Progesterone, originating mostly from the placenta, is responsible for feelings

of fatigue, enriching and thickening the fertilized egg, and helping to develop the lobules of the breasts. It may also cause a rise in temperature and respiratory rate. Estrogen, produced by the ovaries, placenta, and corpus luteum, may contribute to morning sickness, stimulate the growth of the uterus, and enlarge and prepare the breasts for lactation.²⁴

Fetal Response

Many concerns have been raised regarding the safety of the fetus during maternal exercise. These concerns include questions regarding adequate blood flow to the fetus, fetal heart rate, and temperature regulation.

When a woman exercises during pregnancy, there is a shift of blood flow from the internal organs, including the uterus, to the working muscles. Blood flow to the uterus is a function of intensity and duration; therefore, exercise is safest and most valuable at moderate levels.³

Fetal heart rate is used by many researchers to determine exercise effects on the fetus. Studies have shown that fetal heart rate increases approximately 5-30 bpm during maternal exercise, and returns to baseline within 15 minutes following exercise.^{3, 13, 32} So far, it has been thought that the increase of fetal heart rate is the fetus's physiological response, and it is not associated with any adverse effects.³

Temperature regulation, which was discussed previously, is another concern when considering exercise during pregnancy. The fetus rids its heat through blood flow to the placenta, which is then dependent on maternal blood flow and temperature. Women should keep their body temperatures below 38.9 degrees Celsius (102 degrees Fahrenheit)

to prevent hyperthermia from occurring, which may cause central nervous system damage and birth defects, decreased birth weights, and early uterine contractions.¹⁹

More research is needed to better understand the physiological effects of exercise on maternal and fetal systems, and the outcomes associated with labor, delivery, and postpartum recovery.

Musculoskeletal Changes

The musculoskeletal system is composed of bones, ligaments, muscles, tendons, and cartilage. This is the body's support system, but during pregnancy this system must respond to the ever changing hormones, weight gain, body alignment, and an altered center of gravity.²⁴

During the first trimester, the hormone relaxin is released, and it begins softening ligaments, loosening joints, and stretching muscles and tendons to prepare the woman's body for childbirth. Estrogen also contributes to making the musculoskeletal system vulnerable to injury, especially in the weight-bearing joints of the back, pelvis, and lower extremities. This ligamentous laxity reduces joint stability, which increases the chance of injuries. Loosened joints may eventually become hypermobile.¹⁹

Posture

Muscular imbalances also create problems for pregnant women and usually result from poor postural alignment. Common muscular imbalances in pregnancy are as follows: the "tight" muscles include the scapular protractors, levator scapula, back extensors, hip flexors, tensor fascia lata, piriformis, hamstrings, adductors, and the gastrocnemius; the "weak" muscles include the scapular retractors, lower lumbar paravertebrals, gluteus maximus and medius, abdominals, and quadriceps. By working

on relaxation and stretching of the tight muscles and strengthening of the weak muscles, the reduced muscle imbalances will help reduce the postural deviations.¹⁹

As pregnant women begin to gain weight and hormones begin influencing body structures, proper postural alignment becomes a challenge. The female's shoulders become rounded with scapular protraction and upper extremity internal rotation due to the enlarging breasts, which creates a kyphotic curve in the thoracic spine. Cervical lordosis increases in the upper cervical spine and a forward head is evident to compensate for the kyphotic thoracic region. As the uterus becomes heavier, the female's skeletal structure begins to tilt anteriorly, which results in an anterior pelvic tilt and increased lumbar lordosis. This also will cause a hyperextension of the knees.^{5, 19,22,33}

These deviations in posture may lead to further problems. The body's center of gravity shifts superiorly and anteriorly due to the growing weight of the uterus. This causes the woman to weight shift further back on her heels to bring the center of gravity posterior or perform an even more exaggerated anterior pelvic tilt.³⁴ Some women also compensate by widening their stance to create a wider base of support for standing and ambulating, which produces the "pregnancy waddle". This is acceptable as long as the woman is not excessively pronating or supinating, which may alter the biomechanics of her hips, knees, and feet.¹⁹ Because of the shift in gravity and increased base of support, quick changes in direction, level, or speed of movement are contraindicated during pregnancy. To limit these biomechanical related problems, women should wear comfortable and supportive shoes, seek firm footing, and minimize activities which might lead to falls.

Changes in posture are not corrected spontaneously after childbirth; pregnant posture may become learned. Improper handling and carrying of the newborn can also hinder return to optimal posture;²² therefore, practicing proper posture techniques is an important and mandatory procedure. Practicing proper posture will be covered in Chapter IV.

Low Back

Approximately 50% of pregnant women complain of low back pain.^{19,21} The incidence of back pain seems to stem from faulty postural alignment due to increased expansion of the uterus, increased weight gain, decreased abdominal function, and the laxity of ligamentous structures. Back pain may also be a sign of overuse or excessive and improper bending and lifting. The symptoms of low back pain usually become worse with muscular fatigue, static postures, or as the day progresses; rest or change of position relieves these symptoms.²² Proper posture and body mechanic instructions, abdominal strengthening, and stretching of back, shoulder, and neck muscles may benefit the majority of women during pregnancy and postpartum.

Abdominals

The abdominal wall consists of four paired primary muscles, the internal and external obliques, the rectus abdominis, and the transversus abdominis. The muscles have skeletal attachments on the thoracic cage and pelvis and via broad aponeuroses to both the thorocolumbar fascia and the rectus sheath. As the uterus expands, the abdominal muscles become stretched and an increase in muscle length is produced.³⁵

The function of the abdominals during pregnancy include trunk movement, pelvic stabilization, and restraining the abdominal and pelvic organs.^{3,35} Because the

abdominals do perform an important role during pregnancy, it is important to have strong abdominal muscles prior to pregnancy and continue to exercise them throughout. A study conducted by Gilleard and Brown³⁵ found a decrease in abdominal muscle function, a decrease in the ability to stabilize the pelvis against resistance, and an increase in rectus abdominis separation width, length, and angles of insertion as pregnancy progressed.

This increased separation of the rectus abdominis is referred to as Diastasis recti. Diastasis recti occurs either above, below, or at the level of the umbilicus and at the midline of the linea alba, which is a tendinous fiber that merges the abdominal muscles with the fascia and extends from the xiphoid process to the symphysis pubis. This condition may result from the maternal hormones causing a softening of structures, mechanical stress within the abdomen, and weak maternal abdominal muscles. Other contributing factors include heredity, obesity, multiple-birth pregnancy, a large baby, excess uterine fluid, and an already lax abdominal wall from previous pregnancies.¹⁹

The occurrence of diastasis recti is more common as pregnancy progresses and peaks in the third trimester. It also may continue past the 6-week postpartum period. This condition usually causes complaints of low back pain because of decreased control of the pelvis and lumbar spine. With severe separations, the anterior abdominal wall consists of only skin, fascia, subcutaneous fat, and peritoneum, and may eventually lead to actual herniation. This also provides less protection for the fetus.²²

Women must monitor this separation of the rectus abdominis, especially before performing abdominal exercises. The diastasis recti test must be performed to assess the

degree of separation of the muscles before any abdominal exercises are initiated.³⁴ This test and specific abdominal exercises will be discussed further in Chapter IV.

Pelvic Floor

The pelvic floor is a multi-layered sheet of muscle that stretches from the sacrum and coccyx to the ishium and symphysis pubis. The levator ani is a pair of muscles that form a sling to support the uterus, vagina, rectum, urethra, and bladder. These muscles are divided into two layers; the peroneal, or outer layer, and the pelvic diaphragm, or inner layer.²⁴

The pubococcygeal, the most dynamic muscle that acts as a sling for the vagina and provides support to the rectum, and the iliococcygeal, which is a support layer, help make up a portion of the levator ani musculature. The perineum, a diamond-shaped space below the pelvic floor, forms two triangles: the urogenital triangle, pierced by the urethra and vagina, and the anal triangle, pierced by the anus. The region where the triangles join is called the perineal body.²⁴ A healthy pelvic floor is essential for women to perform daily activities with confidence and control.

The function of the pelvic floor is to provide sphincter control of the bladder and bowels, support the pelvic organs and their contents, withstand increases in abdominal and pelvic pressure, enhance sexual responses, and help the baby's head emerge during birth.^{22,34}

During and following pregnancy, a female's pelvic floor may become dysfunctional due to the many stresses placed upon the pelvic floor musculature. Because of the muscle and soft tissue laxity that occurs during pregnancy, the pelvic organs may drop and possibly prolapse due to the decreased support. Urinary stress

incontinence, which is an involuntary loss of urine due to an increase in abdominal pressure, is quite common. The stress of the actual childbirth may also inhibit pelvic floor function, such as an episiotomy (incision to enlarge the vaginal opening to allow for a faster delivery), tears, or lacerations. Hypertonicity, an increase in muscle tension or facial tightness, may result from improper postpartum healing.²²

To prevent dysfunctions of the pelvic floor from occurring and to allow a fast return to its original pre-pregnant condition, pelvic floor exercises should be performed on a regular basis. As early as 1948, Dr. Kegel emphasized the value and importance of pelvic floor exercises.³⁶ These exercises should be performed prenatally, during pregnancy, and postpartum. A study conducted by Morkved and Bo³⁶ compared two groups of postnatal women, one group attended an eight week pelvic floor muscle exercise course and the other, the control group, did not exercise. It was found that the exercising group had a significant increase in pelvic floor muscular strength compared to the control group, and the results indicated that the success of the exercises depended on the training frequency and the intensity of the contraction.

The pelvic floor exercises concern the action of raising the pelvic floor muscles and tightening the sphincters. These exercises are all safe and essential to maintain a healthy pelvic floor. Specific pelvic floor exercises will be discussed in Chapter IV.

CHAPTER III

COMPONENTS OF AN EXERCISE PROGRAM

Exercise has become an integral part of many women's lives and continues to remain important throughout their childbearing years. Women continue exercising during pregnancy to help ease the discomforts of pregnancy, maintain fitness levels, and regain their shape after delivery. A realistic, comprehensive, well-designed fitness program contains three major components: the actual exercise regime, regulation of diet and nutrition, and the emotions and mental attitudes of the pregnant woman. This well-rounded fitness program will provide women who are pregnant with the best results and the greatest benefits that can be obtained from regular exercise.

Exercise

Exercise during pregnancy offers women many benefits physiologically, musculoskeletally, and psychosocially. Regular exercise increases a woman's energy level and aerobic capacity (helpful for endurance demands of labor and delivery), and improves digestion and circulation, which reduces the occurrence of hemorrhoids, constipation, leg cramps, swollen extremities, and varicose veins. Other benefits include a decreased risk of excessive weight gain, improved posture, reduced backaches, reduced pelvic and rectal pressure, and an overall sense of well-being with increased self-confidence. Improved muscular strength, endurance, tone, and flexibility will also help promote a healthy delivery and speedy recovery.^{19,23,37-39}

The safety of the mother and fetus is the primary concern of any exercise program; consequently, it has been highly recommended that pregnant women seek medical clearance from their physician before beginning an exercise regime. The medical and exercise history of the woman must first be assessed to get a sense of her overall activity level before an exercise prescription can be given. Mothers should then be supervised and advised by medical professionals regarding their personal programs, and any restrictions or concerns deemed appropriate throughout pregnancy. Women should not exercise during pregnancy if they are experiencing any of the contraindicated conditions listed in Figure 3.1.^{3,19,22,24,26,39-43} Health care professionals and pregnant females must also be aware of the precautionary categories (Fig. 3.2), and contact the physician for specific guidelines prior to initiating an exercise program.^{3,19,22,24,39-41,43} Getting medical attention also ensures that the pregnant woman receives proper prenatal care, a definite advantage for a healthy pregnancy.^{5,19,22-24,37,40,44,45}

Exercise programs for pregnant women must be individualized, taking into account a woman's current fitness level, stage of pregnancy, and the time and energy available to commit to exercise.^{26,42} The mode, intensity, frequency, and duration of exercise are all ultimately the decision of the pregnant woman. A woman must assume responsibility for her exercise program and use common sense to monitor her body and its response to exercise.^{40,46,47} Being alert to medical conditions that may indicate the need to change or stop exercising is the most important thing a woman must be aware of throughout her pregnancy. If any of the symptoms or warning signs listed in Figure 3.3 occur before, during, or after exercise, a woman should stop exercising and contact her physician immediately.^{19,24,37-39,48}

Fig. 3.1-Contraindications for Exercise During Pregnancy

1. Maternal active myocardial disease, congestive heart failure, rheumatic heart disease
2. Premature labor (current or past pregnancy)
3. Persistent vaginal bleeding (second or third trimester)
4. Placenta previa
5. Pre-term rupture of membranes
6. Multiple gestations
7. Incomplete cervix/cerclage
8. History of frequent miscarriages (3 or more)
9. Maternal diabetes or pregnancy-induced hypertension
10. Intrauterine growth retardation/fetal distress
11. Limited respiratory reserves
12. Systemic infections
13. Anemia
14. Thyrotoxicosis
15. Pre-eclampsia
16. Toxemia and/or convulsive seizures
17. Contractions lasting several hours post exercise
18. Recent pulmonary embolism
19. Thrombophelbitis
20. Acute infectious disease
21. Severe isoimmunization
22. No prenatal care

*Do not exercise if experiencing any of these conditions; contact physician immediately.

Fig. 3.2-Precautions for Exercise During Pregnancy

1. Chronic hypertension
2. Anemia/blood disorders
3. Cardiac arrhythmia/palpitations
4. Breech presentation (third trimester)
5. History of precipitous (arduous) labor and delivery
6. History of bleeding/spotting
7. Thyroid disorders
8. Diabetes mellitus
9. Excessive obesity
10. Extremely underweight
11. History of intrauterine growth retardation
12. Sedentary lifestyle
13. Cardiovascular disease
14. Asthma
15. Pulmonary restrictive diseases
16. Extreme fatigue
17. Extreme temperatures/overheating
18. Phlebitis
19. Diastasis recti
20. Systemic infections
21. Musculoskeletal complaints and/or pain
22. Uterine contractions (lasting several hours after exercise)

*If experiencing or fit into any of these precautionary categories, contact obstetrician for specific guidelines prior to initiating or continuing a regular exercise program.

Fig. 3.3-Warning Signs and Symptoms for Exercise During Pregnancy

1. Persistent vomiting
2. Abdominal pain or severe heart burn
3. Urination pain or difficulty
4. Chills/fever/constipation/fainting
5. Sharp chest pain
6. Nausea/dizziness/hot flashes/cold chills
7. Visual disturbances
8. Severe headaches
9. Racing heart/palpitations/tachycardia
10. Pubic bone pain
11. Uterine contractions (20-minute intervals or shorter)
12. Amniotic fluid leakage
13. Generalized edema or blotchiness of skin surface
14. Vaginal bleeding
15. Shortness of breath
16. Back or hip pain
17. Numbness in any body part
18. Decreased fetal activity
19. Muscle cramping

*If any of these symptoms or warning signs occur before, during, or after exercise, STOP exercise and contact physician immediately.

During the exercise session itself, it is recommended that a woman use a combination of target heart rate, rate of perceived exertion, and the “talk test” to independently monitor her exercise level. To calculate target heart rate, pregnant women should use the Karvonen Formula, $(220 - \text{age})(\text{intensity})$; exercise intensity for pregnant women should be between 55 and 70% of the target heart rate.^{3,37} Although, because heart rate varies greatly from person to person, many experts feel that perceived exertion is a better indicator of exercise intensity.³¹ Perceived exertion can be defined as a subjective report of the intensity of exercise an individual perceives themselves to be performing at a specific moment in time. Linear scales, such as the Borg’s Rating of Perceived Exertion Scale, can be effectively utilized to assess and monitor a female’s exercise intensity. The “talk test”, which measures the capability of a woman to carry on a conversation, while exercising, without becoming breathless, is also an effective assessment tool.^{2,40}

Pregnant women should engage in regular exercise, at least three to four times per week.^{24,37,39,41} Sporadic, inadequate, or overly strenuous activities will not contribute to overall fitness and may result in injury. In regard to intensity, number of repetitions, and duration of exercise, a woman’s pre-pregnancy fitness level and her stage and success of pregnancy should be considered. An individualized exercise program should then be designed to meet the woman’s personal fitness needs. Exercise sessions should begin with a gradual warm-up (approximately 8-12 minutes), followed by stretching. Stretching exercises should be performed on a single muscle or muscle group; stretching multiple muscle groups may promote joint instability.²² Ballistic (bouncy or jerky)

movements while stretching should be avoided.^{22,24,37} Strength-building activities are then performed, and finally a cool-down concludes the exercise session.^{24,38}

Women should avoid exercise in the supine position after the first trimester. The supine position has been associated with hypotension and reduced venous return due to compression of the vena cava by the enlarging uterus. If there is a need to lie supine, a small wedge or towel roll may be placed under the right hip to lessen the effects of uterine compression and improve cardiac output by shifting the woman slightly left. Prolonged periods of motionless standing and quickly rising from the floor to standing should also be avoided.^{5,19,22,24,37,39,41,47,48}

Musculoskeletal changes that occur during pregnancy serve to contraindicate any exercises that may cause a loss of balance, including activities that require sudden changes in direction, level, or speed. Activities that may involve the potential for even mild abdominal trauma should be avoided, which includes contact sports (basketball and volleyball) and lifting free weights without proper supervision and spotting. Due to the ligament laxity that also occurs during pregnancy, women should avoid jerky, bouncy, or high-impact movements; jumping or jarring motions may strain joints and cause pain. Women should also avoid taking joints past the normal physiologic range, and limit or avoid single leg activities, full sit-ups, double leg raises, straight-leg toe touches, and deep knee bends. All of these activities may further aggravate and strain an already stressed maternal musculoskeletal system.^{5,22,24,39-41,48}

Pregnant women should be instructed to refrain from holding their breath and to avoid activities that increase the tendency towards the Valsalva maneuver. Increases in intra-abdominal pressure, resulting from breath-holding and the Valsalva maneuver, may

lead to undesirable downward forces on the uterus and pelvic floor. Transient hypertension and a reduction of blood flow to the uterus may also occur.^{5,22,24,37}

Maternal body core temperature is normally higher during pregnancy, and when combined with exercise, body temperature may elevate to a point that may be detrimental to the developing fetus. Women should not exceed a temperature of 38.9 degrees Celsius (102 degrees Fahrenheit) during exercise and are advised to refrain from exercise if feverish. To avoid an extreme increase in maternal body temperature, it is recommended that women refrain from exercising in hot, humid climates or in rooms with poor ventilation. Hydration before, during, and after exercise is a necessity to help maintain core body temperature.^{22,24,34,37,39,40,42}

Pregnant women should wear comfortable, loose fitting clothing that stretch with movement and allow the body to breathe; cotton is the recommended fabric. Bras should fit well and provide enough support to help protect the breasts; several bra size changes throughout pregnancy may occur. Shoes must fit properly, and they should be comfortable and supportive. Pregnant women may even experience a change in shoe size due to increased venous pooling and edema in the lower extremities.³⁹

Diet and Nutrition

During pregnancy, good maternal nutrition is essential for the proper growth and development of the fetus. If this nutrient supply is deficient, newborns may experience lower birth weights, delivery complications, infections, or impaired intelligence.³ There are many different, acceptable ways of providing the nutrients needed during pregnancy, such as utilizing nutritional supplements; although, careful selection from a wide variety of foods is necessary.

Caloric intake seems to be the most important nutritional factor that affects the developing fetus and the mother. An estimated additional 85,000 calories, or approximately 300 extra calories per day above pre-pregnancy caloric intake, is required for a typical, healthy pregnancy. These energy needs will vary based on the activity level of the pregnant female. About one-third of the total caloric intake is accounted for by maternal fat gain; the remainder, however, is used as energy for metabolism.^{49,50}

Maternal weight gain for an average female during an adequately nourished pregnancy is approximately 20 to 35 pounds;^{3,19,25,42,48-51} body fat also increases an average of four to five percent.¹⁹ This increase in weight and body fat varies widely and depends on a woman's pre-pregnancy weight and daily energy expenditure. The pattern of weight gain is also variable; although, a three to four pound gain is expected in the first trimester, followed by a twelve to fourteen pound gain in the second trimester. During the final trimester, a weight gain of a pound per week is common.³

Dieting is not advisable for pregnant women, nor should women exercise to lose weight during pregnancy.^{42,48,52} Maintaining an appropriate activity level and consuming the proper nutrients leads to successful, healthy maternal and fetal outcomes.

Nutrients, such as protein, iron, calcium, and sodium, are essential components to a healthy pregnancy. Protein-rich foods are plentiful in the United States, and the majority of non-pregnant women consume more than the recommended amount. Protein plays a vital role in the production of brain cells and mental development of the fetus, elimination of nausea in early pregnancy, and prevention of toxemia in late pregnancy. An additional 10 grams of protein, or a total of 60 grams per day, is recommended for

pregnancy and include foods such as chicken, fish, nonfat milk, and vegetable protein sources, such as beans.^{49,51}

Iron is also required during pregnancy for the expansion of maternal red blood cell volume and for fetal erythropoiesis and growth. Approximately 800 milligrams of iron is needed during the last half of pregnancy; approximately 5-6 milligrams per day. Most women are not capable of providing iron to the fetus to this extent without depleting their own reserves; therefore, a 30 milligram oral supplement should be taken daily. Absorption of this iron may be enhanced by foods such as animal protein and ascorbic acid. Cooking foods in cast iron pans may also increase iron absorption. Tea and milk, however, if taken with iron pills, will inhibit the absorption of iron.⁴⁹

A daily allowance of 1200 milligrams of calcium is required to provide the 30 grams of calcium needed during pregnancy. This nutrient is used to form the bones and teeth of the newborn. If maternal calcium intake is not sufficient, the female's bone cells will actually be used to supply the baby. Muscle cramps (usually in the gastrocnemius muscles), sleeplessness, irritability, and increased tooth decay may indicate an insufficient calcium intake. Milk (1 glass=300 milligrams), cheese, yogurt, salmon, sardines, fortified soymilk, ground sesame seeds, and leafy green vegetables are all sources of calcium.⁴⁹⁻⁵¹

Water retention is normal during pregnancy (7-12 liters) and is needed to support the expansion of total body water, blood volume, and to maintain normal body temperature while exercising. Eight to twelve glasses of water daily is required to maintain hydration, aid in digestion, and fight constipation.^{49,50} Women can monitor their liquid intake by examining the color of their urine; clear, colorless urine indicates

adequate hydration.⁴⁰ Along with the increase in total body water, 22 grams of sodium is gained during pregnancy, which is necessary to maintain the extra maternal blood volume. Pregnant women participating in exercise should consume salt “to taste” and in moderate amounts.^{51,52}

Other nutrients, such as zinc, vitamin B₆, magnesium, and vitamin E, are important during pregnancy. Whole grain cereals will provide women with these nutrients, along with the excellent benefit of fiber (20-30 grams required per day). Folic acid requirements are also increased during pregnancy (400 micrograms) and include foods such as eggs, leafy vegetables, oranges, legumes, whole grain cereals, and wheat germ.^{49,50}

Well-balanced meals should be planned and selected with care to ensure that pregnant women are eating healthy, nutritious meals. According to the American Dietetic Association,⁵⁰ a pregnant women should consume a specified number of servings in each of the five main food groups. An ideal diet includes: three servings from the milk, yogurt, and cheese group; six ounces from the meat, poultry, fish, dry beans, eggs, and nut group; three servings from the fruit group; four servings from the vegetable group; and nine servings from the bread, cereal, rice, and pasta group. Fats, oils, and sweets are also recommended to be eaten in moderation.

As long as a wide variety of foods are consumed and energy levels are sufficient, nutritional requirements most likely will be satisfied. Maternal appetite is probably the best indicator for energy needs, and weight gain should be monitored. Referral to the female’s physician or dietary counselor is necessary if unusual dietary habits or cravings are reported or suspected.

Emotions and Mental Attitude

Women are confronted with the task of resolving conflicting needs and changing priorities, accepting new responsibilities and body changes, altering dietary requirements, adapting to increases in fatigue, and changes in energy levels and sleep requirements during pregnancy.⁵³ These overwhelming changes, along with the extreme fluctuations in hormone levels, may contribute to the changing mental attitudes and heightened emotions pregnant women may experience.⁵¹

Exercise and body awareness help women to remain calm and better cope with the ever changing events encountered during pregnancy. A sense of enhanced well-being, increased body and self-confidence, sense of control, increased energy level and stamina, and improved mood are all emotional benefits resulting from regular exercise. Pregnant women who exercise also report a decrease in tension, anxiety, and fatigue. Participation in group exercise classes or recreational activities provides women with the opportunity to gain social support (with family and friends) and build relationships with other pregnant women.^{3,5,19,37,48,52,53}

Many pregnant women choose to exercise during pregnancy to obtain the many benefits it can provide; although, moderation and precaution must be taken to ensure a healthy, successful pregnancy for mother and child. Many of the physiologic, musculoskeletal, and psychological changes of pregnancy persist 4-6 weeks postpartum. Thus, pre-pregnancy exercise routines should be resumed gradually based on a woman's physical capabilities.⁴¹ Specific exercise suggestions can be found in the following chapter, and for further exercise guidelines and recommendations, refer to the 1994 ACOG Guidelines located in Appendix A and Appendix B.

CHAPTER IV

EXERCISE SUGGESTIONS

Regular exercise has become a way of life for many women, and the majority of these women choose to continue their fitness regime throughout pregnancy. The maternal benefits exercise can provide are immense, provided moderation and precautions are considered when designing an individualized exercise program. This chapter provides specific exercise and stretching suggestions, along with descriptions and modifications for recreational and sports activities women may wish to continue or initiate during pregnancy.

Warm-up/Cool Down Routines

The hormones relaxin and estrogen are released in increasing amounts during pregnancy, which creates softening of ligaments, loosening of joints, and stretching of muscles and tendons to prepare the female's body for childbirth. This ligamentous laxity reduces joint stability and increases the chance of injuries; therefore, it is a must that pregnant women warm-up and cool down when exercising.^{19,44}

Warming up promotes an increase in muscle temperature, routing of more blood to the working muscles, and an increase of synovial fluid in the joints.^{3,19} This allows for increased muscle proficiency and decreased risk of injury. Warm-ups should be performed with gentle, slow, and controlled movements within a comfortable range of motion.¹⁹

A simple warm-up routine may include walking semi-briskly or easy jogging for five to ten minutes, swimming a few laps in the pool, or pedaling a bicycle for a couple of miles.^{3,44} Performing range of motion exercises at each joint is also an effective way to increase blood flow to needed musculature. Range of motion exercises may include the neck, shoulders, elbows, wrists, trunk, pelvis, hips, knees, and ankles.^{19,44}

Ankle pumps is an excellent exercise that pregnant women should incorporate into not only their warm-up and cool down routines, but should be performed throughout the day. Prevention of edema, blood clots, muscle cramping, discomfort, and deformities are all benefits women may gain by utilizing this exercise. It can be performed in sitting, sidelying, or in supine with both legs relaxed and elevated if possible. Crossing the legs should be avoided, which may decrease lower extremity circulation and increase the chance of edema.

Cooling down is the best way for pregnant women to complete their exercise routine. Gradually decreasing activity slowly lowers heart rate, breathing rate, and reduces post-exercise muscle soreness. Cooling down may include a slow jog, swimming a few extra easy laps, or walking in place. Relaxation, visualization, and deep breathing techniques can also be performed as part of the cool down routine. A final stretching regime would then follow.^{3,19}

Stretching

Following brief warm-up and cool down routines, pregnant women should gently and slowly stretch the major muscle groups involved in their exercise regime. Stretching relaxes muscles, promotes circulation, and increases a female's flexibility. It is also a

relaxation technique used to relieve and ease the mind from the stress and burdens pregnant women may be experiencing.³

Stretching should be performed in a relaxed and slow manner, avoiding ballistic movements, due to the increased risk of musculoskeletal injuries during pregnancy. Stretches should never be forced or taken to the maximum point of resistance; no pain should be felt. Women should continue to breathe slowly while stretching and avoid holding their breath.^{3,24,44}

Stretching routines must be tailored to fit an individual's tight spots, body signals, and level and type of activities performed. The following stretches can be utilized to help women remain relaxed and flexible during pregnancy.

Stretch 1. Arm Stretch

Purpose: Stretch trunk, chest, and tricep musculature.

Position: Tailor sitting or standing.

Method: Raise left arm over head, bending at elbow, and allow hand to drop behind back. Grab left elbow with right hand and gently pull back. Hold for 10-15 seconds. Repeat with right arm.



Stretch 2. Outer Arm Stretch

Purpose: Stretch back, shoulder, and arm musculature.

Position: Tailor sitting or standing.

Method: Bring right arm across chest. Place left hand on elbow and gently pull arm closer to chest. Hold for 10-15 seconds. Repeat with left arm.



Stretch 3. Tailor Reach

Purpose: Stretches and strengthens upper body, increases breathing room, and decreases fatigue and tension.

Position: Tailor sit, looking straight ahead.

Method: Perform a pelvic tilt (Exercise 2 or 6). Reach right arm towards ceiling while inhaling. Exhale as return arm to side. Hold for 10-15 seconds. Repeat with left arm. Do not arch back.

Progression: Perform with side bends or while standing.



Stretch 4. Butterfly Stretch

Purpose: Stretch adductors, rests low back, prepares for delivery position, and stretches the perineum.

Position: Tailor sitting with soles of feet together. Place hands on ankles.

Method: Bring feet as close to body as comfortable, keeping back straight. Inhale and relax. Exhale and slowly lean forward. Hold for 10-15 seconds. Relax and repeat.

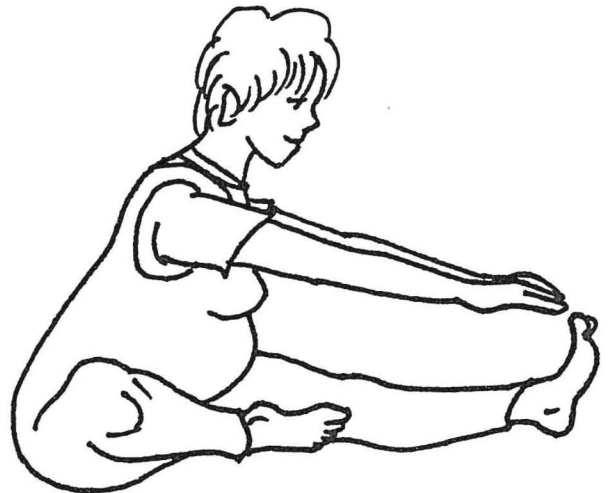


Stretch 5. Hamstring Stretch

Purpose: Stretch trunk and hamstring musculature.

Position: Sitting with left leg extended and foot dorsiflexed, right leg drawn in.

Method: Face forward and lean body towards extended leg with arms reaching towards left foot. Hold for 10-15 seconds. Relax and repeat on right.



Stretch 6. Quadriceps Stretch

Purpose: Stretch quadriceps musculature.

Position: Standing next to a wall or chair for support.

Method: Bend left knee with left hand, pulling heel towards buttocks. Keep thigh parallel to other leg. Hold for 10-15 seconds. Relax and repeat with right leg.



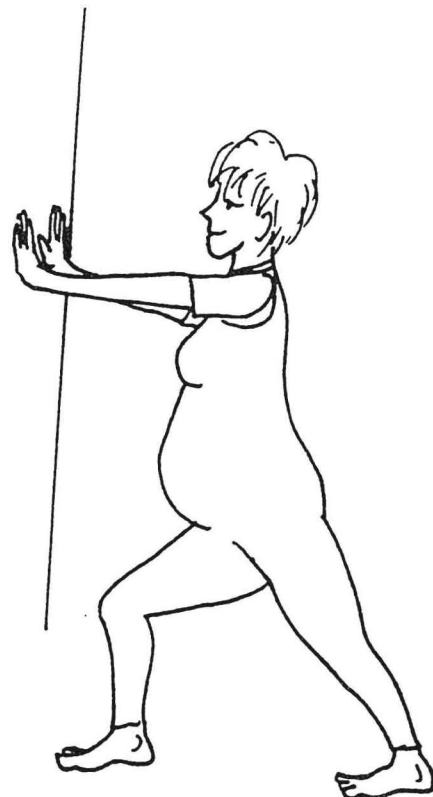
Stretch 7. Gastrocnemius Stretch

Purpose: Stretch gastrocnemius musculature.

Position: Standing facing a wall with right leg forward and statically flexed, and the left leg extended with foot facing forward.

Method: Press heel to floor. Hold for 10-15 seconds. Relax and repeat with right leg.

Alternative: Stand on edge of step.



Postural Training

Correct posture directly affects the quality of breathing, balance, and body comfort. It also serves to prevent or alleviate unnecessary strain and injury on joints and muscles and is used as a starting point from which all movements are initiated.²⁴ Proper postural alignment becomes a challenge for women throughout pregnancy due to the effects progressive weight and changing hormones have on body structures. Pregnant postures may become learned and may not be spontaneously corrected following childbirth; therefore, practicing proper postural techniques are important and mandatory procedures during pregnancy.

To begin postural training, maternal posture should be evaluated with the woman standing in a normal, relaxed position. The pregnant woman should be aware of the common postural deviations occurring within her body, which may include a forward head, rounded shoulders, increased lumbar lordosis, hyperextension of the knees, and excessive inversion or eversion of the ankles. Correction of these postural dysfunctions can be accomplished by utilization of a mirror or by developing a sense for correct postural alignment through practice.⁴⁴

The following exercises can be utilized to aid pregnant women in obtaining, improving, and maintaining proper posture.

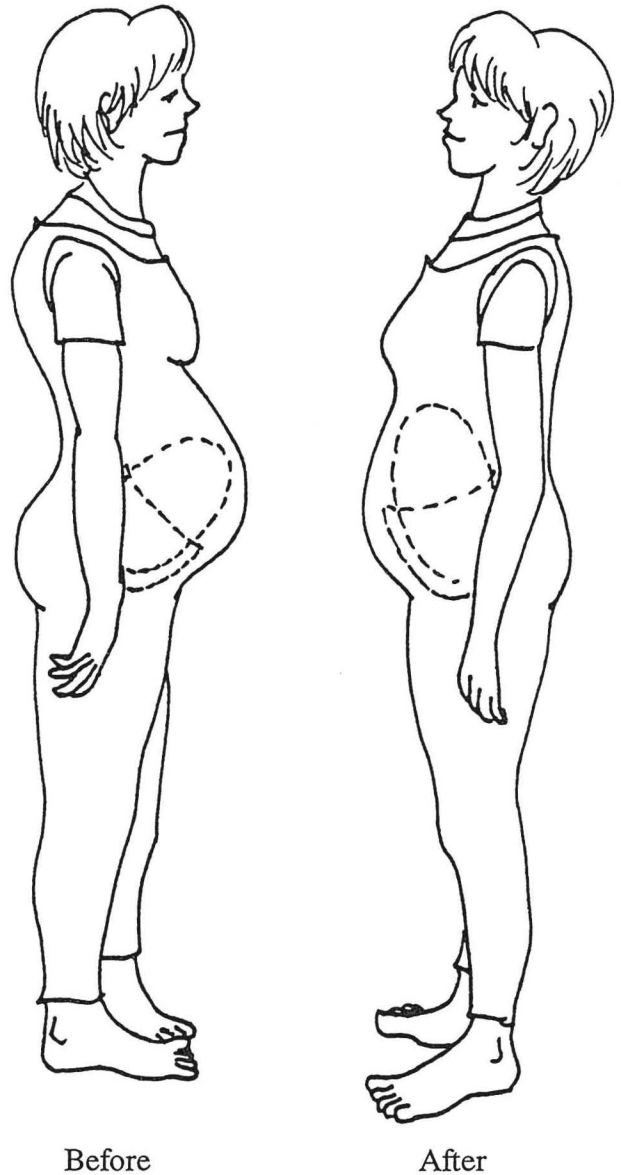
Exercise 1. Posture Check

Purpose: Prevent or reduce unnecessary strain and injury of joints and muscles.

Position: Stand with feet shoulder-width apart, knees slightly bent, and shoulders relaxed.

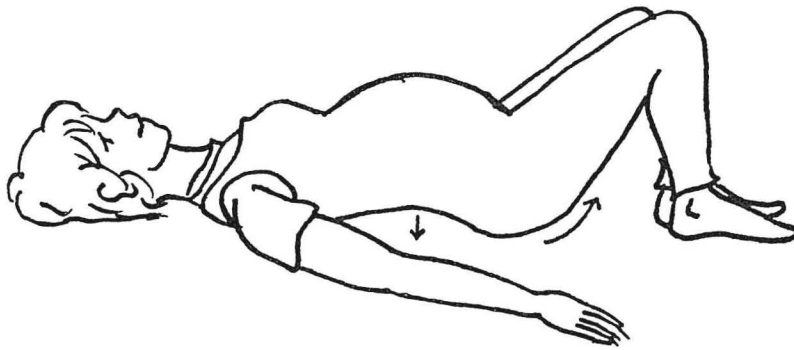
Method: Tighten abdominal muscles and tuck gluteals to rotate pelvis to neutral. Lower shoulders and roll arms out. Straighten neck and tuck chin to align ears over shoulders. Breathe regularly, hold for count of 5, relax, and repeat.

Progression: Perform with eyes closed or while ambulating.



Exercise 2. Pelvic Tilt

- Purpose:** Improves posture, prevents or relieves low back pain, and strengthens abdominal muscles.
- Position:** Lie supine with knees bent.
- Method:** Tighten abdominal muscles and tuck gluteals. Push the small of the back into the floor. Hold for 5 counts, relax, and repeat.
- Progression:** Perform sidelying, sitting, quadruped, and standing.



Exercise 3. Chest Stretch

- Purpose:** Stretch chest musculature.
- Position:** Tailor sitting, sitting on stool, or standing with feet slightly apart.
- Method:** Lace fingers behind back. Slowly lift hands, pulling scapula together and keeping head level.



Abdominals

The abdominal muscles perform many important functions during pregnancy, such as assisting with trunk movements, pelvic stabilization, and restraining the abdominal and pelvic organs.^{3,35} Because the abdominals do play a significant role, it is important for expecting mothers to have strong abdominal muscles prior to pregnancy and continue to exercise them throughout the childbearing year.

In order to accommodate the expanding uterus during pregnancy, the abdominal muscles are capable of stretching to a great degree. When excess stretching or separation of the rectus abdominis occurs, it is referred to as Diastasis recti. Diastasis recti occurs either above, below, or at the level of the umbilicus, and at the midline of the linea alba.²³ Women must monitor this separation of the rectus abdominis, especially before initiating abdominal exercises.

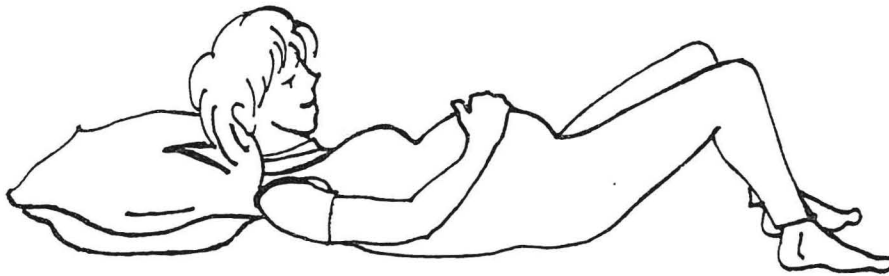
The diastasis recti test must be performed to assess the degree of separation of the muscles before any abdominal exercises are begun.³⁴ Because the separation is painless, the only way pregnant women realize they have Diastasis recti is by performing the recti test.⁵⁴ The following is a description of the procedure pregnant women should always perform before initiating abdominal exercises.

Diastasis Recti Test

Purpose: Protect from further rectus abdominis separation.

Position: Lying supine, knees bent.

Method: Place 2-3 fingertips horizontally, just superior, inferior, or at the level of the umbilicus. Raise head and shoulders off bed. If a separation exist, a gap will be felt by the fingertips or a longitudinal bulge will be seen at the linea alba.



Diastasis recti is measured according to the number of finger-widths that fit into the gap (1 finger-width=1 centimeter). A recti separation greater than two finger-widths indicates that modifications must be applied to the abdominal work-out.^{5,19,22,44,54} The following exercise describes a corrective abdominal procedure for diastasis recti of greater than two finger-widths.

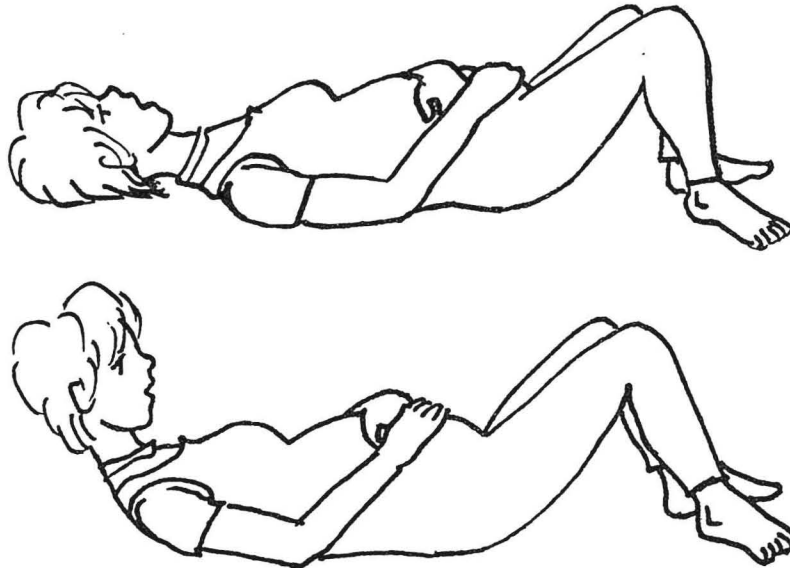
Exercise 4. Corrective Exercise for Diastasis Recti

Purpose: Strengthen abdominals and decrease rectus abdominus split.

Position: Supine, knees bent, cross hands over abdominal area to support the muscles.

Method: While exhaling, gently pull hands toward umbilicus and slowly lift head from floor or until the point just before a bulge appears. Keep shoulders on floor. Return slowly to the starting position and relax.

Alternative: Wrap a sheet (folded lengthwise, 8 inches wide) around waist, criss-crossing it anteriorly. Grasp and pull ends of sheet up and outward at 45 degree angles as contract abdominals, exhale, and raise head from floor. Do not lift shoulders.



Once the rectus abdominis separation is two finger-widths or less, regular abdominal exercises can be resumed; although, the integrity of the linea alba must continually be reassessed.²² The following abdominal exercises are essential for proper abdominal strengthening, keeping in mind that all exercises in the supine position should be limited after the first trimester. All exercises can be modified to standing, sitting, sidelying, or semi-recumbent positions.

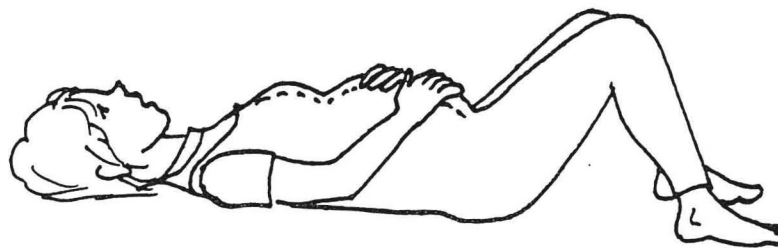
Exercise 5. Deep Breathing with Abdominal Tightening

Purpose: Increase CO₂ and O₂ exchange in the lungs and tone of the abdominal muscles.

Position: Supine or sidelying with knees bent. Place hands over abdominal region.

Method: Inhale through nose, letting abdominal wall expand. Forcibly exhale through mouth, contracting abdominals until all air is out. Repeat.

Progression: Perform in sitting and standing.



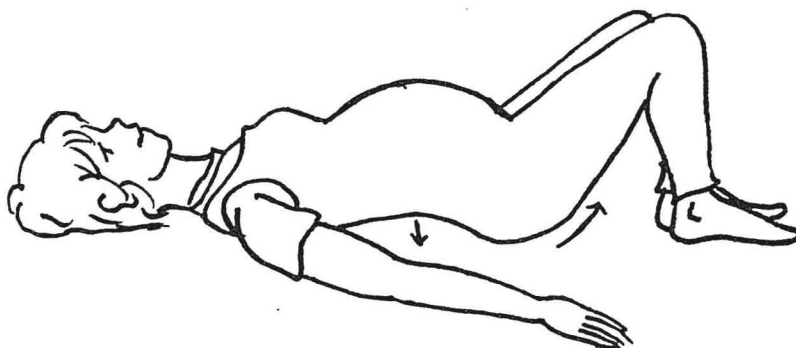
Exercise 6. Pelvic Tilt

Purpose: Improves posture, prevents or relieves low back pain, and strengthens abdominal muscles.

Position: Lie supine with knees bent.

Method: Tighten abdominal muscles and tuck gluteals. Push the small of the back into the floor. Hold for 5 counts, relax, and repeat.

Progression: Perform sidelying, sitting, quadruped, and standing.



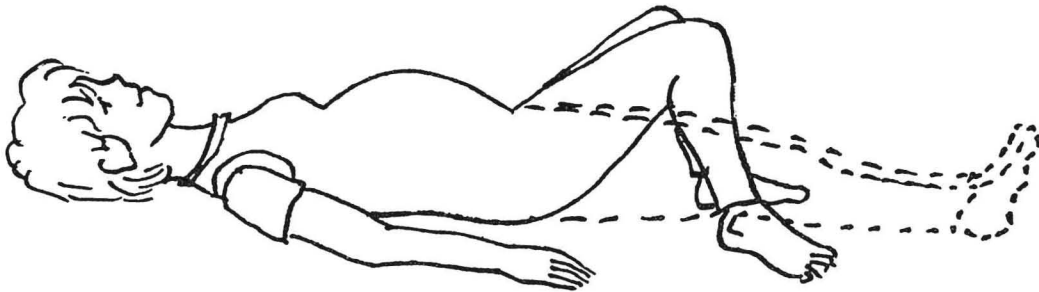
Exercise 7. Heel Sliding

Purpose: Strengthen abdominals.

Position: Supine with knees bent.

Method: Perform pelvic tilt and hold while extending one leg. Stop just before lose pelvic tilt, and return leg to starting position. Repeat with other leg.

Progression: Perform with both legs simultaneously.



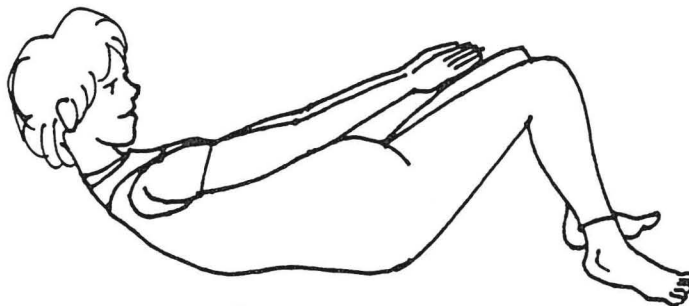
Exercise 8. Straight Curl-ups

Purpose: Strengthen abdominals, maintains good posture, and prepares body for pushing during delivery.

Position: Supine with knees bent.

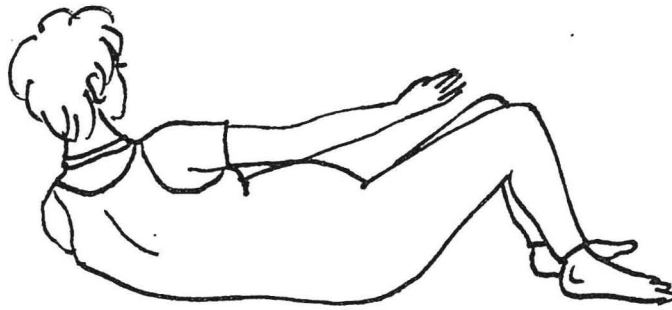
Method: As exhale, tuck chin towards chest and lift head and shoulders off floor, reaching hands towards knees. Hold for count of 5. Inhale as return slowly to start. Relax.

Progression: Arms folded across chest or behind head.



Exercise 9. Diagonal Curl-up

- Purpose:** Strengthen abdominals, maintains good posture, and prepares body for pushing during delivery.
- Position:** Supine with knees bent.
- Method:** As exhale, tuck chin towards chest and lift head and shoulders off floor, reaching outstretched arms to outside of left knee. Inhale as return slowly to starting position. Relax. Bring left shoulder towards right knee.
- Progression:** Arms folded across chest or behind head.



Pelvic Floor

Maintaining the integrity and strength of the pelvic floor musculature is essential for women throughout their lives, but especially during pregnancy.^{5,22,24,34,36} A female's pelvic floor may become dysfunctional during pregnancy due to the many stresses placed upon it. Women may experience a drop or actual prolapse of the pelvic organs, urinary stress incontinence, stress of the musculature resulting from the birthing process, and possible hypertonicity of the pelvic floor.²³ To prevent these dysfunctions and allow a fast return to pre-pregnancy conditions, Kegel exercises should be performed on a regular basis.

Kegel exercises, which are gentle, gradual isometric contractions, are concerned with the action of raising the pelvic floor musculature and tightening the sphincters. Pelvic floor exercises should be incorporated into a woman's daily routine and performed every day for the rest of her life. Reminders may include stopping at a red light, answering the phone, or during commercials on television, etc. It is a private exercise and can be performed at any time, place, and position. All of the exercises are safe and essential to maintain a healthy, efficient pelvic floor.^{5,34,54}

Before women begin performing Kegel exercises, it is important for them to be aware of and locate the musculature that needs to be strengthened. This can be accomplished by performing "The Faucet" exercise, described below.

Exercise 10. The Faucet

- Purpose: Recognize and monitor strength of pelvic floor.
- Position: Seated on the lavatory, legs abducted for urination. Feet may be supported on a stool if voiding is difficult to commence.
- Method: During urination, stop and start the flow a few times. Stop the flow smoothly with no dribbling.
- Progression: Let a smaller amount of urine pass each time, taking care not to increase stress and weakness if this exercise is too difficult.

This exercise should be performed once a month to monitor the progression of muscle strength. Care must be taken to avoid performing this exercise during first morning or late at night urination when the bladder is full, to avoid urinary tract infection, or if already experiencing a urinary tract infection. It is also important for women to continue regular breathing while exercising, remembering to pull "up and inward" with the pelvic floor. If a woman is still experiencing difficulty identifying the correct

muscles, insertion of two fingers into the vagina or using a mirror may assist in locating the pelvic floor musculature.^{34,55}

After identification of the pelvic floor musculature has been accomplished, pregnant women should perform the following exercise several times per day, increasing repetitions and time intervals as tolerated.

Exercise 11. Contract and Relax

Purpose: Increase strength, endurance, and support for the fetus as it grows, increases sexual pleasure, helps relax pelvic floor during delivery, and decreases postpartum recovery time.

Position: Any position, anywhere. May want to begin in supine.

Method: Contract and pull up the pelvic floor. Hold for 2-3 seconds and relax. Do maximum of 10 repetitions per session due to substitutions when fatigued.

Progression: Progress to sitting, standing, and squatting. Combined or altered contractions with other muscle groups. Increase time interval to no more than 10 seconds and number of repetitions to 10. Perform exercises 30-50 times per day.

Exercise 12. The Elevator

Purpose: Increase strength, endurance, and support for the fetus as it grows, increases sexual pleasure, helps relax the pelvic floor during delivery, and decreases postpartum recovery time.

Position: Any position, anywhere. May want to begin in supine.

Method: Visualize riding in an elevator. As ascend each floor, contract or draw up the pelvic floor a little more (first floor, then second, third, fourth, and penthouse). Once reach full contraction, begin descending, floor by floor, releasing only at bottom.

Progression: Progress to sitting, standing, and squatting. Perform exercise 30-50 times per day.

Recreational and Sports Activities

During pregnancy, many women wish to remain active and participate in either recreational or sports activities. This is possible as long as women continue to monitor their exercise programs carefully and the effects it has on their ever changing bodies. Women should also be aware that all sporting events pose some degree of danger, and they must decide whether they wish to modify the activities or avoid them. This section will describe some of the activities pregnant women can participate in; although, not every activity is appropriate during pregnancy.

Pregnant women should avoid any activities that pose a risk for abdominal trauma. A blunt trauma to the abdomen may potentially cause serious harm to the fetus, such as sheer stress to the placenta which may result in a separation from the uterus. Women should avoid basketball, soccer, volleyball, softball, football, lacrosse, hockey, boxing, fencing, parachute jumping, hang gliding, gymnastics, water skiing, and scuba diving. Women should also be aware of the risk of suffering falls with activities such as rock climbing, roller blading, ice skating, and downhill skiing.^{3,5,27,39,52}

Walking

If performed using the correct posture, form, and with purpose, walking can be an excellent and safe aerobic exercise for women who are pregnant. It allows women to perform an aerobic activity without placing extra stress and jarring forces on the already compromised joints and ligaments. Walking is also an excellent way for sedentary women to initiate an exercise program.^{3,30,48}

Jogging

Jogging is a safe and enjoyable activity that many pregnant women continue to participate in, with modifications, throughout pregnancy. It provides women the opportunity to maintain flexibility, cardiovascular endurance, and lower extremity strength. Conversely, it is recommended that women who have not run previously, should not initiate jogging after pregnancy has begun.^{3,43,48,52}

Special precautions should be followed if women decide to continue jogging to term. Women should drink plenty of water and eat well-balanced diets to avoid dehydration. Overheating can be controlled by running during the coolest part of the day, stopping if tired or uncomfortable, and keeping distances short (approximately 1-2 miles per day). It is essential that women perform proper warm-up, stretching, and cool down routines to prevent injuries and modify their intensity, frequency, and speed as needed. Appropriate dress including supportive shoes, bras, maternal girdles or prenatal abdominal supports, and stockings are all necessities.^{3,24,43,48,54}

Aerobics

A well-designed prenatal aerobics class can offer women many benefits, while taking into consideration the many changes occurring in their bodies. It increases a female's ability to accommodate to exertion that will be experienced during labor and delivery, burns extra calories, and relieves constipation by stimulating the intestines during movement. Aerobics can also reduce back pain, swelling, pelvic pressure, and fatigue. Flexibility, muscular strength, and aerobic fitness are also maintained during pregnancy.³

It is highly recommended that a certified instructor qualified in exercise training during pregnancy is supervising each class. Pregnant women must follow the same general guidelines regarding hydration, overexertion, moderation, etc. as previously described when exercising. Aerobics can be performed an average of 20 minutes, 3 times per week, but women should listen to their own bodies and only do what is comfortable.^{3,24,43,54}

Bicycling

Whether outdoor biking or using a stationary bike, many women enjoy riding to maintain cardiovascular fitness and condition the lower extremities. Bicycling is an excellent aerobic activity that avoids putting strain on joints and ligaments in a nonweight-bearing position. This activity must be monitored due to the possible pressure on the uterus or low back from a flexed position when riding. Women should be aware of the risk of unexpected falls or accidents when riding outdoors, which can be avoided by using a stationary bike.^{24,43}

Swimming and Water Activities

Swimming is an excellent activity not only for the competitive pregnant athlete, but for all pregnant women. Besides the fact that pregnant women find water activities enjoyable, comforting, and relaxing, swimming also provides distinct medical benefits. These benefits are derived from the hydrostatic pressure, buoyancy, and thermoregulation of water. Hydrostatic pressure, which exerts a force proportional to the depth of immersion, acts uniformly on the body to push extravascular fluid into the vascular spaces.⁵⁵ This proves to be a very beneficial factor for pregnant women who experience

fluid retention and edema. This may also result in better maintenance of uterine and placental blood flow.¹⁹

The buoyancy effect of water supports approximately 90% of a female's body weight, which places the muscles and joints in a relaxed, nonweight-bearing position. This allows for relief from the extra mechanical stress and pressure of pregnancy. Buoyancy also reduces the clumsiness and trouble with balance many women experience during pregnancy.^{3,19,34,38,40} Swimming enables pregnant women to assume the prone position, which promotes optimal blood flow to the uterus by redistributing the weight of the uterus away from the inferior vena cava and the aorta.^{19,40}

Maternal thermoregulation is actually enhanced when exercising in water verses on land. Water conducts heat 25% faster than air; consequently, a female's core temperature will not rise as quickly and her fetus will be protected from overheating.^{40,55} The temperature of the pool should be between 83 and 86 degrees Fahrenheit or feel cool when entering, and hot tubs, saunas, and whirlpools should be avoided.^{3,19}

Other water activities pregnant women can safely participate in include water aerobics and water walking, which are low impact and provide great conditioning.³⁹ Canoeing, rowing, and paddling are also safe water sports pregnant women can participate in, making minor adjustments for comfort and safety.³

Women should avoid diving, scuba diving, water skiing, and surfing throughout pregnancy. These activities may lead to an O₂ debt, decompression syndrome, or trauma to the abdomen. In all cases, the mother or her fetus could be injured.^{31,39,46,48}

Weight Lifting

Strengthening of a woman's muscles, tendons, and ligaments through weight training improves joint stability and provides benefits during labor, delivery, and recovery.²⁴ Thus, many women continue to lift during pregnancy and must modify their lifts to promote maternal and fetal safety.

It is recommended that pregnant women use weight machines versus free weights to reduce the chance of dropping a weight on the vulnerable abdomen. If free weights are preferred, a spotter is a necessity. Women should perform moderate repetitions (usually 8-12) with light weights (5-10 pounds), lifting with slow, controlled movements. After the first trimester, exercises that require the supine position should be avoided due to possible hypotension and reduced venous return caused by the enlarging uterus compressing the inferior vena cava. Breathing properly, exhaling during the exertion phase (lifting) and inhaling during the recovery phase (lowering), and avoiding the Valsalva maneuver is imperative to allow proper venous return to the heart, maintain arterial pressure, avoid orthostatic hypotension, and allow adequate blood flow to the uterus.^{3,19,43,56}

Racquet Sports

Badminton, tennis, and racquetball are generally safe sports for pregnant women, if played in moderation. The intensity of competition should be reduced as pregnancy progresses. Sudden stopping, rapid changes in directions, and reflex reactions may lead to unwanted injuries due to impaired coordination resulting from an increase in weight and a change in the center of gravity. Overstretching, especially of the ankles and knees,

is common, thus it is recommended that this activity be limited to women who exercise regularly and have well-developed musculature.^{24,39,43,48}

Horseback Riding

Women who enjoy horseback riding may continue to ride during pregnancy, but must make some modifications to protect themselves and their child. Pregnant women should avoid sitting trots, which may create discomfort of the back and jarring of the uterus, and stop jumping at approximately 24 weeks gestation due to the enlarging uterus making contact with the pommel of the saddle and the saddle itself. It is also recommended that females avoid breaking horses. If planning to ride throughout pregnancy, women should have one specific horse they are familiar with and trust, to avoid accidents, use the stirrups, and only walk and canter after 28 weeks gestation.^{27,39}

Winter Activities

Skiing (either downhill or cross-country) or ice skating should not be performed during pregnancy unless the woman is an expert. Because of the altered balance women experience during pregnancy, there is an increased risk for injuries and hard falls, which may result in abdominal trauma. Pregnant women should avoid skiing and skating competitively, altitudes over 10,000 feet, and crowded slopes and rinks. Cross-country skiing is consider safer than either downhill skiing or ice skating and is one of the best “total body” workouts. It maintains cardiovascular fitness along with working all the major muscle groups.^{3,5,39,43,46,48}

CHAPTER V

CONCLUSION

The current trend toward a more physically fit society has definitely created an upsurge of interest among pregnant women. These women are searching for the safest and most effective ways to remain physically fit and continue leading healthy lifestyles. They are also looking to alleviate and possibly eliminate some of the preventable problems experienced during pregnancy.

The topic of exercise during pregnancy has raised many questions among researchers and health care professionals regarding benefits, necessity, safety, types, and amount, but no definite answers have been given thus far. The majority of research conducted to date has been inconclusive and scarce; consequently, it is imperative that further research and exploration is generated to provide professionals the resources to recommend appropriate and safe activities for pregnant women.

Health care professionals, especially physical therapists, must be prepared to assume roles as designers, advisors, and teachers to promote safe activities and maintain maternal and fetal well-being. The medical community is obligated and must assume responsibility to investigate and become knowledgeable on the current literature and research available on exercise during pregnancy.

Physical therapists play a significant role in implementing exercise regimes into a woman's daily routine. Therapists must be aware of the maternal body changes, both

physiologic and musculoskeletal, that occur during pregnancy, and how those changes affect the way women move and tolerate activity. The current ACOG guidelines (Appendix A and Appendix B) must also be followed when establishing an exercise program to ensure safe and beneficial results.

The female body goes through a state of enormous physiologic and musculoskeletal changes during pregnancy. The main goal of exercise is to promote a new energy level by improving the efficiency of the various systems of the body. Pregnancy alone actually increases this efficiency, and when combined with exercise, the benefits prevail, providing an overall enhanced and healthier pregnancy.

It is essential that each exercise regime is individualized to meet the needs, goals, and demands of the mother and her fetus. A proper warm-up and cool down routine is essential to include in an exercise program due to the ligamentous laxity that occurs during pregnancy. This laxity reduces joint stability and increases the chance for injuries to occur. Gentle stretching is also an important component. It relaxes muscles, promotes circulation, and increases a female's flexibility.

Proper postural alignment is necessary to enhance breathing, balance, and overall body comfort. Because it also serves to prevent or alleviate unnecessary strain and injury on joints and muscles, postural training should be utilized to aid pregnant women in obtaining, improving, and maintaining proper posture. Muscle specific exercises, such as abdominal and pelvic floor regimes, are also essential to include in an exercise program.

During pregnancy, good maternal nutrition is vital for the proper growth and development of the fetus. It will also impact a female's energy level, along with her emotions and attitudes. The psychological aspects of pregnancy and exercise should also

be taken into consideration when prescribing an exercise regime. A woman must be motivated and have some source of social support to be successful.

Most importantly, women must assume responsibility and a sense of control over their own bodies, pregnancies, and lives.¹ Women must be taught how to monitor their changing bodies, and how exercise affects these changes. Consequently, the exercise programs should be educationally based to ensure that pregnant women understand and are competent in recognizing the contraindications, warning signs, and precautions that may occur when exercising during pregnancy. It is recommended that “common sense” is the best prescription for exercise during pregnancy and moderation is key. Ideally, the goal is to allow women to slowly become independent and to be able to customize their own exercise programs postpartum and for the rest of their lives.

Pregnancy should not be a period of confinement or limitation. Women should be encouraged to remain active, given no complications exist. Conversely, women must also be made aware that prenatal exercise is not a requirement for a healthy pregnancy.^{1,52} Exercise during pregnancy is not essential, but it does provide significant benefits for the female and her fetus.

Probably one of the most important benefits derived from exercising during pregnancy is the impact it has on longevity. Women who exercise throughout pregnancy usually incorporate fitness as lifelong ambitions. By portraying themselves as healthy role models for their children, women who continue leading healthy lifestyles may contribute to the fit lifestyles their children may choose to encompass, which will indirectly have an impact on the entire nation’s fitness levels.

The current health system is modeling the majority of its care in the way of prevention. Exercise during pregnancy actually fits into this pattern like a puzzle piece. Prevention of the many discomforts and symptoms experienced during pregnancy is achieved through fitness, which will provide women with both healthy and successful pregnancies. By being an informed health care provider, pregnant women will have the option to strive for this physical fitness during pregnancy and be able to maintain it for a lifetime.

APPENDIX A
ACOG General Guidelines

1994 ACOG GENERAL GUIDELINES FOR EXERCISE*

The following guidelines will help the ob-gyn counsel the average woman seeking to improve her physical fitness through exercise without incurring excessive risk of injury.

Guidelines for Aerobic Exercise

1. For impact activities, it is recommended that exercise routines involving repeated foot impacts be limited to 30 minutes in duration at intensities not exceeding 75% of maximal heart rate. There should be a day of rest between such sessions.
2. A resilient floor should be selected for exercise that involves repeated foot impacts. If such a surface is not available, the exercise routines should be modified to ensure that the feet remain close to the floor throughout the program.
3. Aerobic exercise should be preceded by a gentle warm-up routine that utilizes the full range of motion of the joints. This increases the elasticity of the muscles and will help prevent potentially injurious movements.
4. Muscles that are used repeatedly during aerobic exercise must be carefully stretched before and afterward.
5. To reduce the severity of impact shock on the lower extremities, repetitive jumping on the same foot should not exceed four consecutive jumps.
6. Extremes of joint flexion and extension (such as deep knee bends and ballistic hyperextension of the knee) should be avoided.
7. The feet should be moved repeatedly to prevent cramping in the intrinsic muscles of the foot.
8. Trunk rotation should be avoided while on the feet with hips or lower spine flexed. Rotational activity in this position subjects the intervertebral disks to very high mechanical stress.
9. Intense physical activity should always be followed by a cool down period of at least 10 minutes of lighter activity to prevent pooling of blood in the extremities. Hot showers and baths should be avoided immediately after intense physical activity.

10. Participants should be given a specific means of assessing physical status and progress. Working heart rate should be measured during peak levels of exercise to ensure that the intensity of activity is within the desired range. Regular measurement of the recovery heart rate will motivate participants by documenting their progress. Failure to progress as measured by this method may indicate the need for more intense activity during the aerobic phase or may signal the presence of other problems.

Guidelines for Strengthening Exercises

1. Strengthening exercises should not be performed on the same muscles on consecutive days.
2. A general warm-up routine should be performed before muscles are made to work against resistance.
3. Muscle-strengthening exercises should be preceded and followed by stretching exercises that are specific for the muscles that are made to work against resistance.
4. All strengthening exercises should be performed in a slow and controlled manner. Ballistic (rapid or jerky) movements increase the risk of injury.
5. The most efficient way to improve strength is to allow brief rest periods between bouts of vigorous exercise. Repetitions should be limited to short sets (10 or fewer) that are repeated later.
6. When the strength of one muscle or muscle group is disproportionate to that of the antagonist(s) for that muscle or group, the weaker muscle should be strengthened to restore balance around the joint.
7. The breath should not be held during strength-training exercises. Exhalation should take place during the exertion phase of each repetition.

Guidelines for Stretching Exercises

1. Stretching exercises may be performed as often as desired, preferably at least once a day.
2. A general warm-up routine should be performed before muscles are stretched.
3. Stretching routines should be performed statically, without holding the breath. Rapid, jerky movements should be avoided.

4. Each stretch should be held long enough so that relaxation will occur sufficiently to achieve the maximum benefit of the stretch. This can vary from as little as 6 seconds in some individuals to 20 seconds in others.
5. Muscles should be stretched only to the point of tension. Pain should be regarded as a signal that a stretch has gone too far.

*American College of Obstetricians and Gynecologists. ACOG Technical Bulletin 173. Washington, DC: ACOG; October 1992.

APPENDIX B
ACOG Guidelines for Exercise
During Pregnancy

1994 ACOG GUIDELINES FOR EXERCISE DURING PREGNANCY*

There are no data in humans to indicate that pregnant women should limit exercise intensity and lower target heart rates because of potential adverse effects. For women who do not have any additional risk factors for adverse maternal or perinatal outcome, the following recommendations may be made:

1. During pregnancy, women can continue to exercise and derive health benefits even from mild-to-moderate exercise routines. Regular exercise (at least three times per week) is preferable to intermittent activity.
2. Women should avoid exercise in the supine position after the first trimester. Such a position is associated with decreased cardiac output in most pregnant women; because the remaining cardiac output will be preferentially distributed away from splanchnic beds (including the uterus) during vigorous exercise, such regimens are best avoided during pregnancy. Prolonged periods of motionless standing should also be avoided.
3. Women should be aware of the decreased oxygen available for aerobic exercise during pregnancy. They should be encouraged to modify the intensity of their exercise according to maternal symptoms. Pregnant women should stop exercising when fatigued and not exercise to exhaustion. Weight-bearing exercises may under some circumstances be continued at intensities similar to those prior to pregnancy throughout pregnancy. Non-weight-bearing exercises such as cycling or swimming will minimize the risk of injury and facilitate the continuation of exercise during pregnancy.
4. Morphologic changes in pregnancy should serve as a relative contraindication to types of exercise in which loss of balance could be detrimental to maternal or fetal well-being, especially in the third trimester. Further, any type of exercise involving the potential for even mild abdominal trauma should be avoided.
5. Pregnancy requires an additional 300 kcal/d in order to maintain metabolic homeostasis. Thus, women who exercise during pregnancy should be particularly careful to ensure an adequate diet.

6. Pregnant women who exercise in the first trimester should augment heat dissipation by ensuring adequate hydration, appropriate clothing, and optimal environmental surroundings during exercise.
7. Many of the physiologic and morphologic changes of pregnancy persist 4-6 week postpartum. Thus, prepregnancy exercise routines should be resumed gradually based on a woman's physical capability.

*American College of Obstetricians and Gynecologists. ACOG Technical Bulletin 189. Washington, DC: ACOG; February 1994.

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