



AFP - April 15, 1998

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Exercise During Pregnancy

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[A patient information
handout on exercise
during pregnancy](#), written
by the authors of this
article, is provided on
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Exercise has become a vital part of many women's lives. However, theoretic concerns have been raised about the safety of some forms of exercise during pregnancy. Because of the physiologic changes associated with pregnancy, as well as the hemodynamic response to exercise, some precautions should be observed. The physician should screen for any contraindications to exercise and encourage patients to avoid overly vigorous activity, especially in the third trimester, when most pregnant women have a decreased tolerance for weight-bearing exercise. Adequate hydration and appropriate ventilation are important in preventing the possible teratogenic effects of overheating. Pregnant women should avoid exercise that involves the risk of abdominal trauma, falls or excessive joint stress, as in contact sports and vigorous racquet sports. In the absence of any obstetric or medical complications, most women can maintain a regular exercise regimen during pregnancy. Some studies have found a greater sense of well-being, shorter labor and fewer obstetric interventions in physically well-conditioned women as compared with other women.

The benefits of regular exercise for nonpregnant women are generally acknowledged. Indeed, an exercise regimen has become an integral part of daily life for many women. However, theoretic concerns arise regarding the effects of exercise on pregnant women. Objective data on the impact of exercise on the mother, the fetus and the course of pregnancy are limited, and results of the few studies in humans are often equivocal or contradictory. Although various exercise guidelines are available, they are usually conservative and are frequently based on controversial opinions.¹ Consequently, the pregnant woman and her physician may be uncertain about the safety of exercise during pregnancy.

This article reviews the theoretic concerns regarding exercise during pregnancy and evaluates the results of clinical trials currently available. General guidelines, based on those issued by the American College of Obstetricians and Gynecologists (ACOG), are provided to assist physicians in advising women who wish to initiate or continue a regular exercise program during pregnancy.

Physiologic Changes of Pregnancy

Musculoskeletal

One of the most obvious changes in pregnancy is the alteration of the woman's body. Mechanical changes related to the weight of growing breasts, uterus and fetus, as well as an increase in lumbar lordosis, result in a shift in the woman's center of gravity, which may cause problems with balance. In addition, weight-bearing exercise becomes a greater concern when vertical impact forces, which are usually twice an individual's body weight, are further increased during pregnancy. Sudden movements may exacerbate these mechanical difficulties and increase the potential for injury. Most women report greater discomfort with exercise in the later stages of pregnancy. Abdominal and pelvic discomfort from weight-bearing exercise is most likely

secondary to tension on the round ligaments, increased uterine mobility or pelvic instability.

Increases in joint laxity may lead to a higher risk of strains or sprains. During pregnancy, hormonal changes are thought to induce a greater laxity in joints, assisting in the softening of the pubic symphysis to accommodate delivery. One study has demonstrated increased mobility of the metacarpophalangeal joints.² However, an increased injury rate in pregnant patients has not been documented.

Maternal and Fetal Temperature

The metabolic rate increases during both exercise and pregnancy, resulting in greater heat production. Fetoplacental metabolism generates additional heat, which maintains fetal temperature at 0.5 to 1.0°C (0.9 to 1.8°F) above maternal levels. Theoretically, when exercise and pregnancy are combined, a rise in maternal core temperature could decrease fetal heat dissipation to the mother. Some data suggest a teratogenic potential when maternal temperatures rise above 39.2°C (102.6°F), especially in the first trimester.³

Animal studies of the possible teratogenic effect of heat in early pregnancy have demonstrated an increase in congenital abnormalities, particularly midline fusion defects of the central nervous system. Human studies are limited, but a possible increase in relative risk of defects has been noted with hot tub use early in pregnancy.⁴ However, in clinical studies, a decrease in maternal body temperature of 0.3°C (0.5°F) occurs in the first trimester, with further decreases of 0.1°C (0.2°F) per month through 37 weeks of gestation.⁵ Physiologic changes that may account for this fall in core temperature include increased minute ventilation and increases in skin blood flow, which augment maternal heat dissipation.

Hemodynamic

Exercise acts in concert with pregnancy to increase heart rate, stroke volume and cardiac output.⁶ However, during exercise, blood is diverted from abdominal viscera, including the uterus, to supply exercising muscle. The decrease in splanchnic blood flow can reach 50 percent and raises theoretic concerns about fetal hypoxemia.⁷ Studies of flow velocity profiles in the fetal aorta and umbilical circulation have yielded contradictory and inconclusive results.^{8,9}

Measurements of the effect of exercise on fetal heart rate demonstrate either no significant change or short-term increases of five to 15 beats per minute.³ Two studies^{10,11} have detected fetal bradycardia during vigorous exercise in untrained women performing near maximal capacity. All episodes of fetal bradycardia resolved in less than two minutes. In the same women, submaximal exertion to 70 percent of maximal aerobic power did not cause fetal bradycardia. Pregnancy outcomes in the subjects with transient fetal bradycardia were not significantly different from those in the other subjects.

Several factors may mitigate exercise-induced decreases in splanchnic blood flow. These factors include increases in maternal plasma volume and heart rate, as well as decreased systemic vascular resistance. The resultant changes maximize cardiac output and optimize blood flow to the placenta and the developing fetus. These alterations in cardiovascular response to exercise may take as long as seven months to return to antepartum levels.¹²

Maternal body position also affects cardiac output during pregnancy. After the first trimester, the supine position is associated with a 9 percent decrease in cardiac output.¹³ This may be secondary to compression by the enlarging uterus and a relative obstruction of venous return. Cardiac output is optimal when the patient assumes a left or right side-lying position. Prolonged, motionless standing during pregnancy is associated with a decrease in cardiac output of up to 18 percent.

The effect of exercise on cardiac function during pregnancy remains uncertain despite decades of studies. In one study,¹⁴ ST-segment depression was noted in 12 percent of patients during strenuous bicycling. These electrocardiographic changes, however, were not associated with signs or symptoms of cardiac ischemia and were seen during testing throughout pregnancy as well as at seven weeks postpartum. No harmful effects were noted in the mother or the fetus. The exact etiology of this ST depression is unknown, but it may be secondary to altered sympathetic regulation.

Oxygen Demands

Adaptive changes occur in the pulmonary system during pregnancy and exercise. During rest, pregnant and nonpregnant women have an equivalent respiratory frequency. However, mild increases in tidal volume and oxygen consumption are noted in pregnant women, presumably as an adaptive response to the increased oxygen requirement of the fetus.

With mild exercise, pregnant women have a greater increase in respiratory frequency and oxygen consumption to meet their greater oxygen demand. As exercise increases to moderate and maximal levels, however, pregnant women demonstrate

decreased respiratory frequency, lower tidal volume and maximal oxygen consumption. The oxygen demand at high levels of activity appears to overwhelm the adaptive changes that occur at rest. This may be partially due to the obstructive effect of an enlarged uterus on diaphragmatic movement. Subjective effort with aerobic exercise is heightened, and several studies have shown a decreased maximal voluntary exercise performance in pregnant women.^{12,15}

Energy Demands

Both exercise and pregnancy are associated with a high demand for energy. In the first two trimesters, an increased intake of 150 calories per day is recommended; an increase of 300 calories per day is required in the third trimester.¹⁶ Caloric demands with exercise are even higher, although no studies have focused on exact requirements. The competing energy demands of the exercising mother and the growing fetus raise the theoretic concern that excessive exercise might adversely affect fetal development.

In clinical studies, women who exercise during pregnancy do not show significant differences in weight during the first and second trimesters. However, some evidence suggests that continuous exercise in the second and third trimesters is associated with decreased maternal and fetal weight gain. One study noted a modest reduction in birth weight (approximately 300 g [10.6 oz]), due chiefly to decreased subcutaneous fat in the fetus.¹⁷ However, the overall weight gain during pregnancy remains well within normal limits in exercising patients.¹⁸

Women who exercise during pregnancy may require a higher energy intake than the extra 150 to 300 calories per day that are recommended for nonexercising pregnant women.

Impact of Pregnancy on Exercise Performance

Pregnancy appears to have the greatest impact on weight-bearing exercise. A study of well-trained runners¹⁸ noted a progressive decline in all aspects of performance during pregnancy. Many of these women voluntarily stopped exercising by the third trimester. The principal reasons cited included fatigue, nausea and morphologic changes associated with pelvic pressure and discomfort. Decreased exercise performance capacity stabilizes at 50 percent of prepregnant levels by the sixth month of gestation.¹⁹ This pattern of decreased performance is not seen with non-weight-bearing exercises such as cycling or swimming. Women who engage in these activities are able to maintain high-intensity, moderate-duration exercise with no decline in overall performance throughout their pregnancies.^{20,21}

Labor and Outcome

Investigators have cited some theoretic reasons for concern about premature labor in women who exercise in late pregnancy. Exercise is known to increase circulating levels of norepinephrine and epinephrine.²² Norepinephrine has been shown to increase both the strength and the frequency of uterine contractions. In contrast, epinephrine has an inhibiting effect on uterine activity. Runners often complain of contractions during exercise, but actual measurements with external tokodynamometry have not demonstrated consistent changes in uterine contractility. Tokodynamometry is, of course, logistically difficult in this situation and may not be reliable. The study did not find any evidence of an increase in preterm labor, premature rupture of the membranes or fetal distress.²³

A meta-analysis of the effects of physical exercise on pregnancy outcome found no significant difference in maternal weight gain, infant birth weight, length of gestation, length of labor or Apgar scores.²⁴ The authors noted that only a few research studies with human subjects were available. In addition, a multitude of other variables, such as genetic and socioeconomic factors, nutritional state and environmental factors, may have a confounding role.

Variable results in length of labor may be explained by the degree of conditioning in women. In a study involving well-conditioned women,²⁵ no premature onset of labor or premature rupture of the membranes was noted. Compared with other women, the well-conditioned subjects were found to have shorter labor, less need for obstetric intervention and fewer signs of fetal compromise.

Exercise may make pregnancy more comfortable, shorten labor and reduce the need for obstetric interventions.

Exercise also may have a favorable effect on the subjective experience of discomfort during pregnancy. In a study tracking exercise throughout pregnancy,²⁶ women who exercised in the three months before pregnancy felt better during the first trimester than those who did not exercise. Exercise in the first and second trimesters was correlated with feeling better in the

third trimester. Another study of maternal exercise²⁷ showed a decrease in perceived exertion during labor. No difference was found in gestational length, maternal weight or duration of the first stage of labor.

Although an exercise regimen may reduce some common discomforts of pregnancy, the lack of difference in pregnancy outcome suggests that exercise does not yield additional benefits for the infant.

Contraindications to Exercise

Although data are sparse, there appears to be no reason why women who are in good health should not be permitted to engage in exercise while pregnant. However, women with medical or obstetric complications should be encouraged to avoid vigorous physical activity. Given the current lack of data, a conservative approach is warranted when doubt exists. Contraindications to exercise during pregnancy, as listed in the most recent ACOG technical bulletin, are given in *Table 1*.¹

Recommendations

A firm basis for exercise recommendations is lacking. Studies in humans are limited and thus may demonstrate significant bias. Any exercise regimen should be individually structured to the patient; her goals, physical conditioning and general health should be considered. For informed consent, the physician should offer an explanation of the theoretic causes of concern, balanced with a reminder that clinical studies to date have shown no adverse effects from moderate exercise.

Studies have not documented a significant rise in core temperature with exercise, but thermal stressors present a theoretic risk of congenital anomalies in early pregnancy. The patient can minimize thermal stress by performing exercise in the early morning or late evening to improve heat dissipation when it is hot outside. Fans may be used during stationary cycling or other indoor exercise, and swimming may be an option to improve conductive heat loss.

It is prudent to avoid exercise when the weather is very hot or humid, since heat dissipation is impaired at these times.

The intensity, duration and frequency of exercise should start at a level that does not result in pain, shortness of breath or excessive fatigue. Exercise may then progress at a rate that avoids significant discomfort. Patients should be counseled to perform frequent self-assessments of physical conditioning and well-being, including hydration, caloric intake, quality of rest and presence of muscle or joint pain. It should be stressed that decreases in exercise performance are common, especially later in pregnancy. The goal is to allow the pregnant patient to obtain the maximal benefits of general well-being derived from exercise, while ensuring that no detrimental effects occur in the mother or the fetus.

The importance of maintaining adequate hydration should be emphasized. Drinking up to 1 pint of liquid before exercising and 1 cup of liquid every 20 minutes during exercise should be sufficient to maintain adequate hydration. Even if the patient is not thirsty after exercise, she should drink enough liquid to replenish lost fluids. It is common to lose 1 to 2 quarts of fluid per hour in sweat.

Exercises performed in the supine position are inadvisable after the first trimester, as are prolonged periods of motionless standing.¹ Both of these body positions have been associated with decreased cardiac output. Prolonged Valsalva maneuvers with isometric exercise such as weight lifting should be avoided because they may result in decreases in splanchnic blood flow and uterine perfusion.

TABLE 1
Contraindications to Exercise During Pregnancy

Contraindications

- Pregnancy-induced hypertension
- Preterm rupture of membranes
- Preterm labor during the prior or current pregnancy
- Incompetent cervix or cerclage placement
- Persistent second- or third-trimester bleeding
- Placenta previa
- Intrauterine growth retardation

Relative contraindications

- Chronic hypertension
- Thyroid function abnormality
- Cardiac disease
- Vascular disease
- Pulmonary disease

Adapted with permission from American College of Obstetricians and Gynecologists. Exercise during pregnancy and the postpartum period. ACOG Technical Bulletin 189. Washington, D.C.: American College of Obstetricians and Gynecologists, 1994.

Because of the potentially teratogenic effect of increased core body temperature, it is prudent to avoid exercise in very hot or humid weather.

Maternal weight should be routinely followed. The patient should show a normal weight gain throughout the pregnancy, independent of exercise. Some experts have recommended a baseline ultrasound examination at 16 to 20 weeks, coupled with serial fundal height measurements; however, no definite benefits of this assessment have been demonstrated. An ultrasound evaluation would be indicated only if a size/date discrepancy were noted.

Activities that require exceptional balance or extreme range of motion should be avoided in late pregnancy. The patient should also be discouraged from performing exercises that involve sudden changes in body position. The shift in center of gravity may result in increased instability and a greater risk of falls. Activities that incur the risk of fetal and maternal injury from abdominal trauma should be avoided. A summary of recommendations regarding sports activities is provided in *Table 2*.

Some women may experience a subjective increase in contractions during exercise in the late trimester, but these will generally resolve spontaneously without adverse sequelae. If contractions are still felt 30 minutes after exercise, the physician should be notified. Cervical checks or monitoring for contractions should be based on the patient's history and physical examination.

Final Comment

The physiologic interactions between pregnancy and exercise are not fully understood. Although some theoretic concerns remain about exercise in pregnancy, the data thus far have been reassuring. It should be kept in mind, however, that there are major deficits in our knowledge. The outcomes of racquet and ball sports during pregnancy have not been investigated. Many of the reported studies have involved women in middle to upper socioeconomic groups, and extrapolation to other groups cannot be assumed. Some studies of women working for long hours or at heavy labor have found a negative effect on birth weight and an increased incidence of preterm labor.²⁸ Although such associations have not been noted with exercise, they may exist.

Some studies have demonstrated possible benefits of exercise during pregnancy. An example is the trend toward shorter labor and less need for intervention in well-conditioned and highly trained women.^{25,29} This benefit is difficult to establish as a result of exercise alone because exercise is associated with multiple positive cofactors such as better nutritional status and avoidance of tobacco and caffeine. Although variations in study results are noted, the physical conditioning of the subjects as well as the type and timing of exercise may explain some of the discrepancies.

Whether exercise is harmful or whether it improves the course and outcome of pregnancy is largely unknown. Therefore, no definitive recommendation can be made to promote exercise during pregnancy. Nevertheless, there appears to be no reason that most women cannot continue with exercise during pregnancy and reap the possible benefits of improvement in well-being.

TABLE 2
Recommendations for Sport
Activities During Pregnancy

Activities to encourage

- Walking
- Stationary cycling
- Low-impact aerobics
- Swimming

Activities to discourage

Contact sports (increased risk of abdominal trauma)

- Hockey (field and ice)
- Boxing
- Wrestling
- Football
- Soccer

High-risk sports (increased potential for falls/trauma)

- Gymnastics
- Horseback riding
- Skating
- Skiing (snow and water)
- Hang gliding
- Vigorous racquet sports
- Weight lifting
- Scuba diving

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