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Exercise During Pregnancy

Safe and Beneficial for Most

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Series Editor: Nicholas A. DiNubile, MD

In brief **Regular, moderate exercise does not significantly affect length of gestation or birth weight, and it may ease pregnancy and labor. Active pregnant women should maintain adequate hydration and nutrition, avoid hyperthermia, and take precautions if obstetric or medical complications are present. Supine exercise, contact sports, high-altitude exertion, and scuba diving should be avoided, and some women, including those who lift weights or do high-impact exercise, may need to modify their routines. Most women can begin or continue to exercise during pregnancy.**

As attitudes toward exercise have changed in recent decades, the shift with regard to exercise during pregnancy has been particularly marked. In the 1950s, prevailing standards of care allowed a pregnant woman 1 mile of walking daily, preferably broken up into several sessions.[1] In

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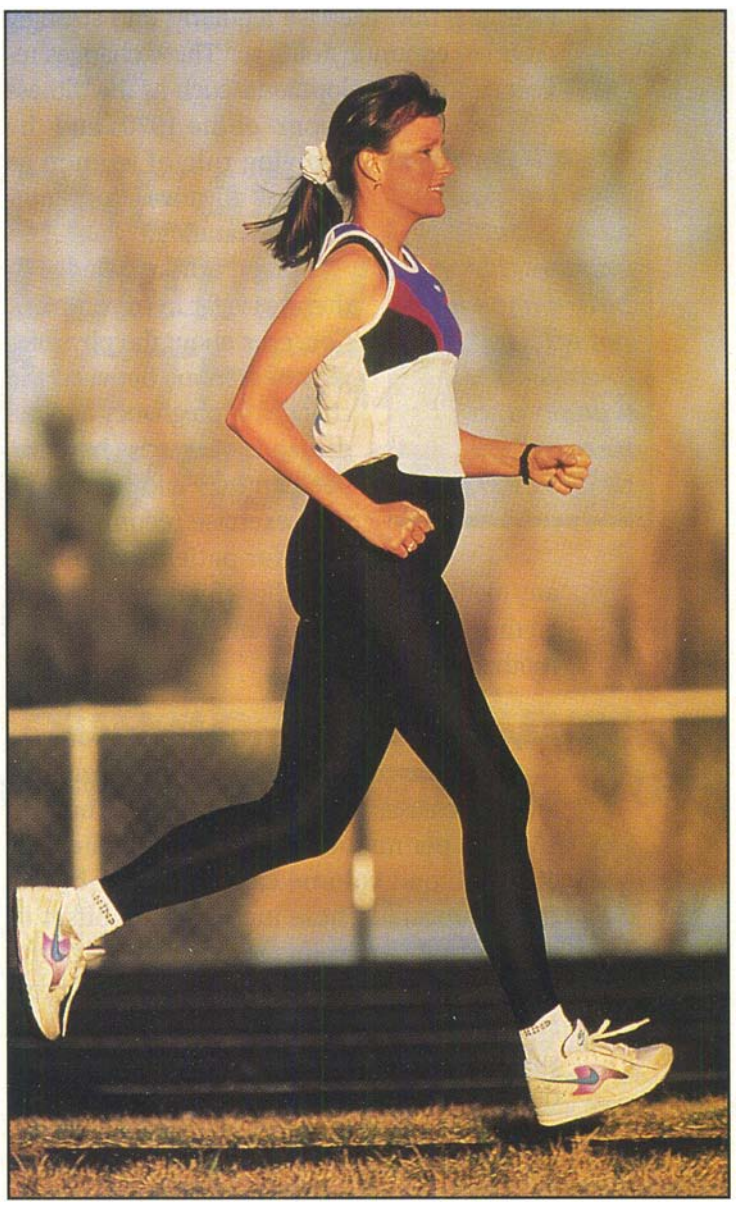

Women who have been active before pregnancy can often continue an exercise routine with modifications. Though pregnancy is not a time to begin a new sport or intensive training, it can offer an opportunity for sedentary women to initiate positive changes.

1985, the American College of Obstetrics and Gynecology (ACOG) endorsed the safety of most aerobic exercise but placed definite limits on duration (15 minutes) and heart rate (140 beats per minute).[2] A decade later the organization issued recommendations, based on physiologic evidence, that women with uncomplicated pregnancies can exercise safely with virtually the same safeguards as nonpregnant women.[3] Many women of childbearing age, 15% by one estimate, now exercise regularly, and strongly desire to continue doing so.[4] These changes reflect cultural developments such as the "fitness boom" of the 1970s and the evolving role of women as much as advances in scientific understanding.[5]

Data are inconclusive, but it appears that birth weight is not affected in exercising women who have proper calorie intake.

In fact, our knowledge in this area is far from complete. Concerns about the physiologic interactions between the changes of pregnancy and the demands of exercise have not been entirely laid to rest.[6] As with exercise recommendations for patients who have any medical condition, those for pregnant women must balance the risks and benefits—to both mother and fetus.

Physiologic Concerns and Adaptations

Cardiovascular. Relative to prepregnancy levels, increases of up to 50% in cardiac output, 15 beats per minute in resting heart rate, and 45% in blood volume can take place by the third trimester. These increases are offset to some extent by an increased capacity of the veins, resulting in stable or reduced blood pressure, and greater vasodilation at the skin, resulting in greater heat loss and a reduced tendency for hyperthermia.[7]

The cardiovascular impact of the dual stresses of exercise and pregnancy has been the focus of much investigation. The demands of exercising muscle divert blood flow from the uteroplacental unit, raising the theoretical risk of fetal hypoxia. In actuality, compensatory changes with exercise, such as increased maternal hematocrit and oxygen extraction, appear to prevent impairment of fetal oxygenation.[5] Furthermore, repeated studies have shown, at most, short-term, limited fetal heart rate increases of 5 to 15 beats per minute, which do not pose a threat to the fetus. Episodes of fetal bradycardia are relatively rare in the absence of obstetric or medical complications and do not appear to affect pregnancy outcome.[8]

The supine position is associated with decreased maternal cardiac output after the first trimester; this has led to the caveat against exercise in this position.

In addition, studies of women living at high altitudes during their pregnancies[9] showed reduced uterine blood flow. These results suggest that women should use caution, avoiding exertion at altitudes over 8,250 ft (2,500 m), at least until after 4 to 5 days of exposure.[10,11]

Metabolic. Hyperthermia is a concern, given that both exercise and pregnancy increase metabolic rate and that maternal core temperatures in excess of 102.6°F (39.2°C) are potentially teratogenic in the first trimester.[12] Here too, adaptive changes associated with pregnancy, such as increased minute ventilation and skin blood flow, augment heat dissipation and offset somewhat the potential hyperthermic effects of exercise.[13] Still, sensible precautions are indicated, such as maintaining adequate hydration and avoid exercising in very hot, humid environments.[3]

Probably because of the combined effect of limited expansion of the diaphragm (owing to an enlarged uterus) and increased fetal oxygen demand,[14] $\dot{V}O_2$max is significantly decreased in pregnant women during exercise as compared with nonpregnant women.[1] As a result, carbohydrates are used preferentially (as indicated by indirect calorimetry),[15] resulting in significantly reduced plasma glucose concentrations during continuous prolonged (longer than 45 minutes) or strenuous bouts.[16] Therefore, to reduce the risk of hypoglycemia, consuming adequate calories and limiting workout sessions to less than 45 minutes should be recommended.

Musculoskeletal. Marked musculoskeletal alterations in the pregnant woman's body could potentially increase the risk of injury during ex-

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Pregnant Athletes Test the Limits

Although a moderate exercise schedule is generally recommended during pregnancy, some highly conditioned women appear able to train safely at considerably more demanding levels.

One recent study[1] found that a rigorous protocol continued nearly to term had no adverse effect on fetal growth. It involved 42 well-trained women, some competitive at national or international levels (three world-class in bicycle, marathon, and biathlon competitions), who followed exercise protocols that included strength training, interval training, and endurance training 6 days a week. A "high-intensity" group's regimen consisted of two 2½-hour endurance training bouts weekly; "moderate" exercisers' workouts lasted 1½ hours.

In both groups, most women continued to exercise to within 4 days of labor. There was no significant difference in mean birth weights between the moderate- and high-intensity exercise groups (for both groups, mean birth weights were about 7 lb, 15 oz or 3,600 g), and these weights were within or higher than birth-weight ranges among healthy women recorded elsewhere. Neither the rate of complications nor any other indices of pregnancy outcome were adversely affected.

A case report[2] described a 33-year-old elite marathon runner (personal best time: 2 hours, 34 minutes for the 42.2 km race) who continued to train an average of 66.5 miles (107 km) weekly up to 3 days before the birth of twins by elective cesarean section. "These data show that an endurance athlete can continue to train intensively during a twin pregnancy with no apparent effect on maternal and fetal health," the authors wrote.

Competitive athletes, however, will likely experience a decrease in their performance during pregnancy.[3]

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ercise. Growth of the breasts, uterus, and fetus increases lumbar lordosis and shifts the center of gravity forward, putting strain on the lower back, and hormonal changes lead to increased joint laxity and mobility.[17] Though increases in athletic injury rates for pregnant women have not been documented,[12] caution and moderation are important as pregnancy progresses. Prudence dictates that activities such as contact sports be avoided, and that weight-bearing exercise be limited in women affected by joint-laxity changes.[12]

Effects on the Fetus

Most research has focused on the effects of exercise on fetal growth and length of gestation.

Birth weight. With regard to fetal weight in women who exercise, findings have been inconsistent. One widely cited study[18] found mean birth weight to be substantially lower when women exercised at or above 50% of preconception levels, compared with nonexercisers, while another study[19] found no difference between birth weights of offspring of vigorous exercisers and those of sedentary women. A prospective study[20] of more than 800 pregnant women found that the babies of those who expended a mean of 2,000 kcal/wk in leisure-time physical activity (a level that does not necessarily reflect *intense* activity) were significantly heavier at birth than those of nonexercisers. It appears, though, that birth weight is not affected in women who have a proper calorie intake.

One review[21] concluded that "current evidence appears to indicate participation in moderate to vigorous activity throughout pregnancy may enhance birth weight," with a caution that more severe regimens could result in lighter off-

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spring. This reviewer also suggested that careful quantification of calorie balance—the key to interpretation and missing from most studies—is needed for more definitive conclusions.

Gestation length. A similar picture emerges with regard to preterm delivery. The concern is that increased norepinephrine and prostaglandin output during exercise could stimulate uterine activity and premature labor,[15] and, in fact, a number of epidemiologic studies[22] have associated risk with various kinds of occupational activity. Other investigations[23] suggest that prolonged standing at work—rather than active movement—is the critical factor. Generally, studies of occupational activity are complicated, if not confounded, by such variables as socioeconomic status, stress, and fatigue.[5]

The few investigations that focused on recreational activity per se have tended to associate exercise with positive effects on term length. In one poorly controlled series[24] of 876 consecutive prenatal patients from Pennsylvania and New York, long-term heavy exercisers who expended more than 1,000 kcal/wk doing aerobic activity were more likely to deliver close to term than those who exercised less or not at all; they showed a marked reduction in risk of early delivery, and late deliveries in this group were significantly more likely to be spontaneous. "The observed reduction in risk of preterm delivery in a general obstetrical population is evidence of the safety, as well as the potential benefits, of exercise during pregnancy," the authors concluded.

Effects on the Mother

Course of pregnancy. Whether exercise has a positive effect on the course of pregnancy—beyond the general benefit of maintaining fitness—is open to question, but at least some data suggest it does. Attenuation of such symptoms as nausea, fatigue, and back pain has been reported,[25] as well as improvements in self-esteem and other psychological parameters.[26] One observational study[19] of 398 women found an inverse association between exercise and symptoms, with an increase in symptoms after exercise was reduced.

Labor and delivery. The effect of exercise on labor is uncertain. Many women report feeling that being fit made labor easier,[27] and a number of studies have confirmed this. One poorly controlled, nonrandomized study[28] found shorter active labor (223 vs 302 minutes) among women who had exercised throughout pregnancy; in another,[29] a significant inverse correlation between fitness and labor duration emerged for multiparas but not primiparas. Some other investigators,[5] however, have found no correlation between fitness, training level, and labor.

Recommendations

As a general rule, I recommend exercise to all my pregnant patients. Those who have been active will want to stay fit, and, though pregnancy is not a time to begin training intensively for a new sport, for sedentary women it often represents a window of opportunity for positive lifestyle changes.

Many women report feeling that being fit made labor easier. A number of studies have confirmed this, but some have found no correlation.

Beginners. For women who have previously been sedentary, non–weight-bearing activities (eg, swimming, stationary cycling) pose the least risk of injury, and moderate walking is also safe for most. A schedule of one 20- to 30-minute exercise session daily at a comfortable pace is a reasonable goal. Because of the theoretical increase in risk of injury to joints, a jogging program should not be initiated at this time.

Previously active women. In the absence of obstetric or medical complications, most active women can continue to exercise in accustomed ways at close to prepregnancy levels. Participation in a full range of activities—sports such as volleyball and tennis, as well as aerobic exercise—are generally safe, but contact sports and scuba diving should be avoided, as well as any activity with the potential for causing abdominal trauma. Exercise during the first few days of exposure to high altitude is also not recommended because altitude, as well as the requirements of pregnancy, reduces oxygen availability.

Running. While most habitual runners can

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Exercise and Gestational Diabetes

Gestational diabetes mellitus (GDM) is the most common complication of pregnancy, affecting 3% to 6% of pregnant Americans.[1] It is the consequence of hormone-related insulin resistance. As in type 2 diabetes, exercise has a role in treatment and, perhaps, prevention.

The American Diabetes Association (ADA) has, in fact, endorsed exercise as "a helpful adjunctive therapy" for GDM when euglycemia is not effected by diet alone.[2] One study[3] cited in an ADA report compared GDM patients who did aerobic arm exercise with patients who used diet alone, and found that glycemic levels began to diverge by the fourth week, primarily because of the low-intensity exercise regimen. By week 6, hemoglobin A_{1c}, fasting plasma glucose, and response to glucose challenge had normalized in the exercising group, while no improvement had occurred among the controls.

Another randomized study,[4] which used a higher-intensity exercise regimen, resulted in normoglycemia within 1 week. The protocol used in this study is currently implemented in clinic settings.

Women who have GDM must take particular precautions with exercise, including monitoring blood glucose, regulating meal times, scheduling periods of rest, and carefully tracking fetal activity and uterine contractions.

Whether exercise can prevent GDM in populations at risk has been the subject of limited investigation. One study[5] showed a significant reduction in risk among exercising women who were morbidly obese before pregnancy (body mass index above 33), but no difference among those who weighed less.

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continue to participate until late in pregnancy, those who are simply trying to maintain fitness (as opposed to competing) are well advised to reduce their running time to under 45 minutes.

Weight training. Until recently, weight training during pregnancy was unheard of. Now, many women want to continue their established routine and should be instructed in how to do so safely. Relatively light weights and moderate repetitions will maintain flexibility and muscle tone while minimizing the risk of ligament and joint injury. Lifting of heavy weights should be avoided, except under proper prescription and supervision.

General precautions. All pregnant women, regardless of their activity or fitness level, should take precautions against dehydration and hyperthermia. They should avoid exertion in hot, humid environments and should drink adequate fluids before, during, and after exercise. Appropriate clothing and other strategies (eg, using a small fan while using an exercise cycle) will facilitate heat dissipation. This is especially important in the first trimester. Prolonged use of hot tubs and whirlpools may lead to episodes of hypotension, which could be detrimental to the fetus.

To avoid compromising fetal growth, caloric intake must be adequate to offset the combined demands of pregnancy (an additional 300 kcal/day) and exercise.

Except in the case of competitive athletes who are determined to maintain high performance for as long as possible (see "Pregnant Athletes Test the Limits," page 54), I counsel pa-

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tients to avoid strenuous activity in favor of moderation; in other words, they should be able to converse while working out. During pregnancy, there are no known added benefits, and more potential complications, with vigorous exertion.

Oxygen cost during pregnancy is higher, limiting the ability to perform high-intensity tasks. Regular exercisers may therefore need to be advised to heed signs of fatigue and curtail workouts short of exhaustion to reduce the potential risk of hypoglycemia. Sessions for recreational athletes should generally be limited to 45 minutes.

Warning signs. Pregnant women should be alerted to signs that should prompt them to stop exercising and seek medical attention. In addition to excessive fatigue, these include pain (particularly in the back or pubic area), dizziness, shortness of breath, palpitations, decreased fetal movement, persistent contractions,[13] rupture of membranes, and vaginal bleeding.

Contraindications. Some women should not exercise during pregnancy. According to the ACOG guidelines,[3] careful evaluation should be done to determine if exercise is appropriate for pregnant women who have cardiac disease or constrictive lung disease. Second- or third-trimester bleeding, pregnancy-induced hypertension, preterm labor with present or previous pregnancies, intrauterine growth retardation, incompetent cervix, placenta previa, and premature rupture of membranes are absolute contraindications to exercise.[3]

Patients with multiple gestation are at significant risk for premature labor, and, if they have additional risk factors, the aggregate risk is even higher. Exercise programs for women with multiple gestation should therefore be individualized and medically supervised.

Women who are excessively obese or significantly underweight should exercise under supervision and with extreme caution, if at all, as should those who have type 1 diabetes, pregnancy-induced hypertension, seizure disorder, or anemia. Women who have gestational diabetes mellitus are often helped by exercise, and such programs have been endorsed by the American Diabetes Association and the Second and Third International Workshop-Conference on gestational diabetes.[30] (See "Exercise and Gestational Diabetes," page 58.)

Monitor and Encourage

Although risks are minimal with moderation, even healthy, active women should be examined periodically to assess the effect of their exercise programs on the developing fetus, and their regimen should be adjusted or discontinued if necessary. Nonetheless, the consensus seems clear: In the absence of pregnancy complications, exercise has minimal risks and demonstrated benefits. **PSM**

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MRI is also helpful in diagnosing ligamentous injury (such as to the ACL), which, in one study,[10] occured in 38% of patients (6 of 16) who had femoral physeal fractures. MRI provides excellent visualization of the knee ligaments and may help confirm the extent of these associated injuries when physical exam findings are equivocal.

Treatment. Treatment for a nondisplaced distal femoral physeal fracture should include immobilizing the knee in a long leg cast, prescribing non–weight-bearing use of crutches, and following up with weekly radiographs to assess for fracture displacement. If displacement is suspected or diagnosed, the patient should be referred to an orthopedic specialist. **PSM**

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