

Exercise during pregnancy and the postpartum period

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INTRODUCTION — Women should be encouraged to engage in aerobic and muscle strength conditioning exercises as these activities have an essential role in health maintenance and the prevention and treatment of disease in all stages of life, including pregnancy. Regular aerobic exercise during an uncomplicated pregnancy maintains or improves physical fitness and cardiorespiratory function, enhances psychological well-being, and reduces the risks for sedentary lifestyle-related comorbidities. However, exercise routines may have to be modified during pregnancy to accommodate the normal anatomic and physiological changes that occur in pregnant women and to avoid adverse effects on the fetus.

Pregnancy is an ideal time for positive lifestyle modifications, including increasing physical activity and consuming a more healthy diet. When pregnant, women tend to be highly motivated to improve unhealthy behaviors and have frequent visits with their providers, which facilitates counseling, support, and supervision.

This topic will discuss the benefits and risks of exercise during pregnancy and provide guidance about the frequency, type, intensity, and duration of exercise for various populations of pregnant and postpartum women. A healthy diet is also important and is reviewed separately. (See ["Nutrition in pregnancy"](#).)

BENEFITS AND RISKS

Benefits — Potential benefits of exercise in pregnancy include:

- The same long-term medical and psychological benefits of exercise derived by nonpregnant individuals. (See ["The benefits and risks of exercise"](#), section on 'Benefits of exercise'.)
- Maintenance or improvement of cardiorespiratory endurance, muscular strength and endurance, flexibility, and body composition [1-4].
- Maintenance or improvement in agility, coordination, balance, power, reaction time, and speed [1-4].
- Avoidance of excessive gestational weight gain [5-7].
- Prevention or reduction in severity of orthopedic symptoms, such as low back pain and pelvic girdle pain [8-10].

- Prevention of urinary incontinence – Pelvic floor muscle exercises (Kegel exercises) performed during pregnancy help to decrease the short-term risk of urinary incontinence in women without prior incontinence, but a long-term benefit has not been established. (See ["Urinary incontinence and pelvic organ prolapse associated with pregnancy and childbirth", section on 'Prophylactic pelvic floor muscle exercises'.](#))
- Reduction in risk of delivery of a macrosomic or large for gestational age newborn (odds ratio [OR] 0.69, 95% CI 0.55-0.86 in one meta-analysis of randomized trials [11]).
- Possible reduction in risk of developing gestational diabetes. (See ['Women with or at risk for diabetes'](#) below.)
- Possible reduction in risk of developing preeclampsia. In a systematic review/meta-analysis of 11 cohort and four case-control studies, the risk of preeclampsia appeared to be reduced with increasing levels of physical activity before and during early pregnancy [12].
- Possible reduction in the duration of the first stage of labor but no reduction in the second stage [13,14].
- Possible reduction in risk of cesarean delivery [15-17].

These benefits are not completely independent. For example, overweight and obese women who lose significant weight pre-pregnancy through exercise and diet and avoid excessive gestational weight gain can reduce their likelihood of developing gestational diabetes and diabetes- and obesity-related comorbidities, such as macrosomia, preeclampsia, obstetrically indicated preterm delivery, and cesarean delivery. (See ["Obesity in pregnancy: Complications and maternal management"](#) and ["Gestational diabetes mellitus: Obstetrical issues and management", section on 'Consequences of GDM'.](#))

Risks — Potential risks of exercise in pregnancy include:

- Maternal trauma, which may lead to an obstetric complication, such as abruption, and thus impact the fetus.
- Hyperthermia – Maternal core temperature of 102.2°F (39°C) in the first four to six weeks of pregnancy has been associated with an increased risk for neural tube defects [18,19]. However, it is unlikely that body core temperature would reach teratogenic levels during normal exercise. In a controlled neutral environment during 60 minutes of exercise at an intensity of 55 percent of VO₂ max, rectal temperature in pregnant women rose by only 1°F (0.6°C) and stayed <100.4°F (38°C) in one study [20]. However, running a marathon on a very hot day or strenuous exercise in a hot environment could raise core temperature significantly. "Hot yoga" or "hot Pilates" may also cause unsafe hyperthermia. Thermoregulation improves during pregnancy, possibly due to increased circulation to the skin, increased minute ventilation, and increased plasma volume [21].
- Reduction in uteroplacental blood flow – During exercise blood flow is preferentially directed to working muscles. Reports of sporadic episodes of fetal bradycardia during maternal exercise have raised concerns that maternal exercise could compromise uterine blood flow, resulting in hypoxia-related fetal injury [22-24]. However, the body of evidence suggests that the normal fetus compensates for any transient changes in uteroplacental blood flow during maternal exercise and is not at risk of harm, even in previously sedentary pregnant women [22,25-29].

External fetal monitors have been used extensively to evaluate fetal heart rate (FHR) responses to maternal exercise on a treadmill or exercise cycle, and the findings have been reassuring. In these studies, maternal exercise was generally associated with a 10 to 30 beat/minute increase in FHR, independent of gestational age and intensity of exercise [22]. The increase in FHR was sometimes accompanied by FHR accelerations and post-exercise FHR reactivity was generally achieved within 20 minutes. It is likely that the increase in FHR is a normal physiologic response to a transient reduction in uterine blood flow and to transplacental passage of maternal catecholamines, which are elevated during exercise. These fetal responses are protective mechanisms that increase blood flow and facilitate exchange of the respiratory gases across the placenta. In some cases, however, a prolonged reduction in uteroplacental blood flow can result in fetal hypoxemia, leading to vagal stimulation and bradycardia [30].

Studies of the fetal response to maternal exercise are limited by the technical difficulty of externally recording the FHR during maternal exercise. FHR tracings are frequently obscured by artifacts induced by maternal movement. To avoid this problem, a pilot study applied internal scalp electrodes to the fetuses of two elite athletes who volunteered to exercise while in labor [31]. The athletes engaged in an incremental resistance bicycle ergometry test and reached 60 percent of their last known maximum aerobic capacity, after which the tests were suspended. In each case, the FHR remained normal during the test. Although the study was small, it provides additional evidence that maternal exercise at this level is not deleterious to the fetus, even during the most challenging exercise conditions, such as labor. In contrast, fetal bradycardia developed in six Olympic-level athletes exercising at ≥ 90 percent of maximal heart rate at 23 to 29 weeks of gestation, and mean uterine artery blood flow fell to 50 percent of the initial value [32]. FHR and umbilical artery Doppler indices normalized quickly after cessation of exercise. As there are no proven health benefits for strenuous exercise in pregnancy, it should only be considered by elite athletes whose pregnancies are closely monitored. (See '[Intensity of exercise](#)' below.)

A few studies have evaluated parameters other than the FHR, such as standard umbilical and uterine artery Doppler indices [24,33,34] and fetal breathing and activity patterns [35,36], to assess fetal health in response to maternal aerobic dancing, cycling, or walking/jogging on a treadmill. These studies also suggest that fetal responses to maternal exercise are transient, normal physiological responses to maternal exercise and adverse fetal events are unlikely to occur in otherwise uncomplicated gestations.

- Impaired fetal growth – Although exercise may have a small negative effect on birth weight, it does not appear to increase the risk of delivery of a small for gestational age infant. In a 2015 systematic review of the effect of supervised prenatal exercise on fetal growth, randomization to standard prenatal care plus a supervised prenatal exercise program (aerobic, resistance, or both) did not adversely affect birth weight compared with standard prenatal care alone (mean difference in birth weight -31 g) or the risk for delivery of a small for gestational age newborn (odds ratio 1.02, 95% 0.72-1.46) [11]. The frequency of the prescribed exercise regimen ranged from one to five times per week, the time of each session ranged from 15 to 70 minutes, and the duration of the interventions ranged from 6 to 33 weeks, ending in the mid to late third trimester. Although reassuring, these findings do not address the safety of more intense, frequent, and prolonged exercise sessions in pregnancy. Information on this type of exercise in pregnancy is sparse. (See '[Elite/competitive athletes](#)' below.)

- Light to moderate recreational physical activity/exercise probably does **not** increase the risk of miscarriage or preterm delivery in women with uncomplicated pregnancies; recall bias in positive retrospective studies is a limitation of these studies [37-39]. The effect of strenuous exercise in early pregnancy on miscarriage risk is less clear as contradictory findings have been reported [37,40-42]. The only prospective study observed an increased frequency of miscarriage in women who reported high physical strain (eg, exhausting tennis match, long-distance running, frequent occupational lifting of heavy loads [>20 kg, 44 pounds]) around the time of implantation; however, even though the cohort was recruited prospectively, exposure data collection was sometimes obtained retrospectively after the miscarriage [40]. These findings need further confirmation in future studies. A potential bias in many studies is the possible confounding effect of nausea and vomiting of pregnancy. If women with this disorder exercise less strenuously and less often in early pregnancy compared with women without the disorder, this would bias outcomes to favor non/low-exercisers since women with nausea and vomiting of pregnancy are known to have a reduced risk of miscarriage. (See ['Women at increased risk for miscarriage or preterm birth'](#) below.)

PRESCRIBING EXERCISE FOR PREGNANT WOMEN

Pre-exercise and ongoing risk assessment — Pregnant women who want to continue or initiate an exercise program should be evaluated for medical and obstetrical factors that may increase their risk for maternal or fetal complications and injuries. As with nonpregnant individuals, a thorough clinical evaluation should be performed, including medical history, current medical condition and medications, past and present pregnancy-related complications, and current exercise and physical activity levels. (See ["The benefits and risks of exercise", section on 'Medical evaluation prior to exercise'](#).)

Standardized questionnaires and resources are available to assist with the screening process, such as the American College of Obstetricians and Gynecologists' Antepartum Records and Postpartum form [43], the Physical Activity Readiness form [44], and the American College of Sports Medicine's Health/Fitness Standards and Guidelines assessment manual [45].

Contraindications to exercise during pregnancy — Women with some pre-existing or developing medical and obstetrical conditions may have to restrict or avoid exercise; the author uses guidelines published by the American College of Obstetricians and Gynecologists ([table 1](#)) [46].

Exercise can adversely impact some obstetric complications, independent of the woman's previous fitness level. For example, Doppler velocimetry of pregnancies complicated by preeclampsia and fetal growth restriction has revealed increased uteroplacental resistance indices and fetal cerebral vasodilatation after exercise [47,48], which supports avoidance of moderate or strenuous exercise in patients with uteroplacental insufficiency.

Exercise prescription — The exercise prescription in pregnancy follows the same principles and guidelines and includes the same components prescribed to nonpregnant subjects, modified to minimize maternal and fetal risks/injuries and maximize benefits [44,46].

The exercise prescription includes a description of:

- Types of exercise to include/avoid
- Intensity, progression in difficulty over time
- Frequency and duration

A typical exercise session begins with warm-ups and stretching (5 to 10 minutes), followed by the exercise program (30 minutes per session and at least 150 minutes/week), and ending with cool down (5 to 10 minutes).

Choosing an exercise program — The exercise prescription for the development and maintenance of fitness consists of activities to improve cardiorespiratory (aerobic exercise) and musculoskeletal (resistive exercise) status. Women should choose exercises that activate large muscle groups in a rhythmic and continuous fashion (eg, walking, aerobic dance, swimming, cycling, rowing, jogging) and maintain strength, the core muscles, and flexibility ([table 2](#)).

Women may safely continue most of their prepregnancy recreational activities or modify them as pregnancy conditions change. Women who engaged in regular exercise before pregnancy and who have uncomplicated pregnancies should be able to engage in high-intensity exercise, such as jogging and aerobics, during pregnancy.

However, some activities should be avoided ([table 2](#)) and the following principles should be considered when choosing an exercise program:

- Activities with a high risk of falling or those with a high risk of abdominal trauma are contraindicated because of the risk for placental abruption as well as maternal injury.
- Activities that require jumping movements and quick changes in direction can stress joints and increase the risk of joint injury.
- Flexibility exercises should be individualized to reduce susceptibility to joint injury. Because of increased relaxation of ligaments in pregnancy, joints are supported less effectively, especially in women with poor muscle mass. Activities that may result in excessive joint stress should be discontinued, modified, or include cautionary advice, with consideration of individual abilities.
- Yoga is generally safe for pregnant women and their fetuses [\[49\]](#). It can increase maternal strength and fitness as well as reduce stress. Women should avoid hot yoga and use their judgment about modifying or avoiding yoga positions that are uncomfortable or likely to result in loss of balance and falling.
- Exercises that require a supine position should be avoided after the first trimester as this position predisposes many pregnant women to hypotensive episodes.
- Strength training can be performed during pregnancy, but information about safety is limited. Studies focused on low-intensity resistance training with low weights (free or machine) (eg, ≤10 pounds [4.5 kg]) with multiple repetitions lifted through a dynamic range of motion suggest this level of activity is safe and effective during pregnancy [\[50,51\]](#). Although supporting data are lacking, a prudent approach is to avoid heavy-resistance weight lifting, any exercises that result in marked straining, and intense repetitive isometric exercises during pregnancy. Women who continue heavy strength training in pregnancy should be aware that the Valsalva maneuver causes a rapid increase in blood pressure and intra-abdominal pressure and therefore may temporarily decrease uteroplacental blood flow [\[21\]](#). Avoiding this maneuver by exhaling with an open airway also seems prudent.

In the United States, the National Institute for Occupational Safety and Health has published clinical guidelines for occupational lifting in uncomplicated pregnancies [\[52\]](#). In the absence of

better information, these guidelines may be extrapolated to non-occupational lifting, and are reviewed separately. (See ["Working during pregnancy", section on 'Lifting'](#).)

- Exercise can be weight-bearing or non-weight-bearing, with different impacts on the body [53,54]. Weight-bearing exercises are performed less efficiently in pregnancy and are more energy-costly, since they contain a component of added body weight [55]; however, they are well tolerated by previously active pregnant women.

Because of pregnancy-related anatomical and physiological changes, women may prefer non-weight-bearing physical activities during pregnancy (see ["Musculoskeletal changes and pain during pregnancy and postpartum", section on 'Normal pregnancy changes'](#)). Aquatic exercise is a particularly advantageous non-weight-bearing activity for pregnant women since the following occur during immersion: Peripheral edema is reduced, the forces across weight-bearing joints are reduced, body heat is readily dissipated into the water, and loss of balance and falling are of minimal concern [56]. Swimming in the prone position has not been associated with adverse effects and has the advantage of creating a weight-supported condition that is easily tolerated.

- Prolonged or intense exercise can lead to dehydration and hyperthermia, which should be avoided. Basal metabolic rate and heat production are increased during pregnancy so maintenance of euhydration is particularly critical to heat balance during any prolonged exercise and any exercise in hot, humid weather. (See ["Hydration and energy"](#) below and ["Exertional heat illness in adolescents and adults: Epidemiology, thermoregulation, risk factors, and diagnosis"](#) and ["Exertional heat illness in adolescents and adults: Management and prevention"](#).)

To prevent hyperthermia, the Royal College of Obstetricians and Gynaecologists recommends limiting exposure to temperatures exceeding 90°F (32°C) and keeping hydrotherapy pool temperatures ≤95°F (35°C) [57].

- SCUBA diving should be avoided throughout pregnancy because the fetus is at increased risk for decompression sickness secondary to the inability of the fetal pulmonary circulation to filter bubble formation [46,58].
- Lowlanders should avoid exercise during the first three to four days of exposure to moderate to high altitude (above 6000 feet [2500 m]) because of the reduction in oxygen availability [59]. Adverse effects on the fetus have not been reported at altitudes up to 6000 feet (2500 m) typically used for mountain sports, such as hiking or skiing [59,60].

Maladaptation could result in acute mountain sickness, a medical emergency. All women recreationally active at these altitudes should be made aware of the signs of altitude sickness (headache, poor sleep, anorexia, fatigue, nausea, vomiting, and, in severe cases, pulmonary edema). They should stop exercising, return to a lower altitude as soon as possible, and seek medical attention if such symptoms occur. (See ["High altitude illness: Physiology, risk factors, and general prevention"](#).)

Frequency and duration of exercise — Most guidelines suggest 30 minutes of exercise daily, five to seven days per week [1,46,61-65]. Pregnant women who have not been regular exercisers should follow a gradual progression of increasing the duration of exercise and can begin with as little as 10 minutes.

There are minimal data on the safe upper limit for the duration of exercise in pregnancy, and intensity must also be considered in this assessment (see '[Intensity of exercise](#)' below). In general, fit pregnant women wishing to engage in prolonged exercise (over 45 minutes of continuous exercise) should exercise in a thermoneutral environment or in controlled environmental conditions (air conditioning), with attention to proper hydration and subjective feelings of heat stress.

Intensity of exercise — Prescription of exercise intensity in pregnancy is individually tailored to the individual's level of physical ability, ideally involves easily quantified activities (eg, walking, swimming, stationary cycling), and is increased gradually. A reasonable approach for previously sedentary women is to initially engage in low- to moderate-intensity exercise (casual to brisk walk and low-intensity workouts), increasing the intensity gradually. Although an upper level of safe exercise intensity in pregnancy has not been established, we believe that women who were regular exercisers before pregnancy and who have uncomplicated, healthy pregnancies should be able to engage in high-intensity exercise programs (eg, jogging, aerobics) with no adverse effects [\[21,46,65\]](#).

Exercise intensity can be monitored based on perceived exertion, heart rate, or metabolic equivalents (METs). When exercise is self-paced, most pregnant women (including athletes) will voluntarily reduce their exercise intensity as pregnancy progresses [\[1,46\]](#). Athletes should expect overall activity and fitness levels to decline somewhat as pregnancy progresses [\[1,63\]](#); however, improving athletic performance in pregnancy is possible [\[3,66\]](#), with medical guidance and clearance.

- **Monitoring perceived exertion** – The use of perceived exertion appears to be the most practical method of gauging exercise intensity [\[1,46\]](#). For moderate exercise, ratings of perceived exertion should be 13 to 14 (somewhat hard) on a Borg Rating of Perceived Exertion scale, where 6 represents no exertion and 20 represents maximal exertion [\[67\]](#).

Even simpler and more practical is the "talk test": The individual should be able to carry on a normal conversation with moderate exercise intensity. By comparison, vigorous exercise is associated with substantial increases in breathing, inability to carry on a normal conversation easily, and perspiration.

- **Monitoring heart rate** – "Fit" women, such as elite athletes, who wish to use heart rate to gauge exercise intensity to maintain physical fitness can use the following heart rate training zone reference as a guide [\[21,68-70\]](#):
 - Age 20 to 29 years – 145 to 160 beats/minute
 - Age 30 to 39 years – 140 to 156 beats/minute

Target training heart rate recommendations for pregnant women vary by country [\[65\]](#) and baseline fitness level (eg, "low" versus "active" versus "fit" [\[70\]](#)). They are not widely used. Available data are limited because exercise studies conducted on pregnant women lack controls and standardization, ignore fitness level or estimate it based on maximal oxygen consumption data, and do not distinguish between weight-bearing and non-weight-bearing exercise [\[69,71\]](#).

- **Monitoring METs** – Nonpregnant individuals are advised to participate in regular moderate-intensity exercise routines defined as exercise of 3 to 4 METs or any activity that is equivalent in difficulty to brisk walking [\[1,44\]](#). In the absence of medical or obstetrical complications, there is no reason to alter this recommendation for pregnant women. Moderate exercise

appears to be an appropriate goal for the two-thirds of pregnant women who have not been engaging in regular exercise prior to pregnancy.

Based on our experience, exercise intensity can be safely increased to 6 to 7 METs in well-conditioned healthy mothers (walking 3.5 miles per hour uphill is 6 METs) ([table 3](#)) [[1](#)]. A combination of moderate and more vigorous exercise usually results in an improvement in fitness.

Hydration and energy — Dehydration is a risk with intense or prolonged exercise or exercise in a hot environment; appropriate hydration before, during, and after exercise is important in these settings. Any loss of weight during an exercise session is fluid loss that should be made up before the next exercise session (1 pound [0.45 kg] weight loss equals approximately 1 pint [16 ounces (United States)] of fluid [0.5 L]).

The caloric costs of exercise should be estimated and balanced by appropriate caloric intake and awareness of hypoglycemia symptoms. In a study that compared glucose homeostasis in nonpregnant women and the same women in the third trimester during one hour of exercise on a stationary bicycle at 55 percent VO₂ max, blood glucose levels decreased at a faster rate in pregnancy and approached hypoglycemic levels (below 70 mg/dL [3.9 mmol/L]) after 45 minutes of continuous moderate-intensity exercise [[20](#)].

Ketonuria is detected occasionally in women who exercise vigorously or for a prolonged period of time. Ketonuria indicates a catabolic state, and can occur in anyone who has a negative caloric balance. A small degree of ketonuria in pregnant women is unlikely to be associated with measurable deficits in the newborn [[72,73](#)].

When to stop exercising — A pregnant woman should stop exercising and call her health care provider if she has any of the following warning signs of a potential problem [[46](#)]:

- Vaginal bleeding
- Regular painful contractions
- Leakage of amniotic fluid
- New dyspnea before exertion
- Dizziness
- Headache
- Chest pain
- Muscle weakness affecting balance
- Calf pain or swelling

SPECIAL POPULATIONS — Pregnant women who are elite/competitive athletes and those with diabetes, severe obesity, or hypertension are counseled on an individual basis. Modified exercise routines, closer pregnancy supervision, and additional testing may be indicated.

Elite/competitive athletes — Competitive athletes maintain a more strenuous training schedule throughout pregnancy and resume high-intensity postpartum training sooner than most recreational athletes. The concerns of the pregnant, competitive athlete fall into two general categories: effects of pregnancy on competitive ability and effects of strenuous training and competition on pregnancy.

Available data suggest that a woman's aerobic fitness stays the same or improves slightly during pregnancy if she continues to exercise as her maternal symptoms permit [21]. Interestingly, at least 17 athletes have competed at the Olympics while pregnant and a few have medaled [74].

Most elite athletes will decrease their pace of training during pregnancy. As pregnancy progresses, weight gain, physiologic anemia, edema, and musculoskeletal changes and pain can prevent the athlete from maintaining her prepregnancy level of performance, but this depends on the specific requirements of her sport [75,76]. For example, a tennis player may be less able to rapidly stop and start or change direction. Attempts to substitute compensatory movements for finely tuned skilled movements will, at the very least, result in inefficient movement and decrease competitive performance, and may also increase the risk of injury. One-third of injuries recorded in pregnancy have been attributed to physical activities and exercise; in one study, the reported incidence was 4.1/1000 hours of exercise [77]. Ligament laxity and increased stress on the joints and spine, particularly during weight-bearing exercise, may predispose pregnant athletes to sprains. (See "[Musculoskeletal changes and pain during pregnancy and postpartum](#)".)

Elite female athletes who maintain the same high-intensity training in pregnancy are also at risk for "overtraining syndrome." Although not reported in pregnancy, clinicians attending elite athletes should be aware of this complication, which presents with excessive and more rapid manifestation of fatigue, sleep disorders, lack of weight gain, an increased frequency of musculoskeletal injuries, and persistent tachycardia at rest. (See "[Overtraining syndrome in athletes](#)".)

Based on low-quality evidence, it appears prudent for elite female athletes to avoid strenuous exercise in the week after ovulation and avoid repetitive heavy lifting during the first trimester, as these activities may increase the risk of miscarriage [39]. A Finnish case control study of physiotherapist reported a odds ratio of 3.5, 95% CI 1.1-9.0 between occupational heavy lifting and spontaneous abortion [78]. Heavy lifting in pregnancy has been arbitrarily defined in the literature between 10 to 20 kg or 22 to 44 lb more than 20 times/week [52].

No studies have evaluated pregnancy duration in elite athletes. Anecdotal information suggests that strenuous training does not cause preterm labor or delivery. However, a competitive athlete with a history of preterm labor should consider either decreasing training or discontinuing training during pregnancy, given the absence of strong data indicating that strenuous exercise has no impact on length of gestation in women at risk for preterm birth [79].

Dehydration may provoke uterine contractions, so particular attention should be paid to maintaining proper hydration during and between high-intensity, prolonged exercise sessions and exercise in hot, humid weather. Fluid balance during an exercise session can be monitored by self-weighing before and after the session. (See "[Hydration and energy](#)" above.)

Because training in elite athletes is likely to be high-intensity, prolonged, and frequent, it is likely that gestational weight gain and fetal growth will be less than for sedentary individuals. One study of endurance athletes observed significant reductions in birth weight, which was attributed to decreased neonatal fat mass [80]. A competitive athlete with a small for gestational age infant (past or current pregnancy) or at risk for a small for gestational age infant because of pregnancy complications should consider either decreasing training or discontinuing training during pregnancy in consultation with an obstetrician or maternal-fetal specialist.

Women with or at risk for diabetes — Exercise is increasingly promoted as an intervention to reduce the risk of gestational diabetes [81] or as part of the therapeutic regimen for nonpregnant individuals with diabetes mellitus. In addition to its cardiovascular benefits, exercise can also

improve glycemic control, which largely results from increased tissue sensitivity to insulin. (See ["Effects of exercise in adults with diabetes mellitus"](#).)

Exercise may also help to reduce the risk of developing gestational diabetes or improve glucose control in women with gestational or pregestational diabetes. The author advises overweight, sedentary pregnant women with pregestational diabetes to engage in a minimum of 15 metabolic equivalent (MET) hours of physical activity per week, preferably building up to ≥ 28 MET hours of physical activity per week to ameliorate glycemic control [81,82].

He similarly advises overweight, sedentary pregnant women without diabetes to reduce their risk of developing gestational diabetes. Non-weight-bearing exercise can be sustained longer at higher intensity and may be more effective in previously sedentary pregnant women. Furthermore, one study of measurements by indirect calorimetry suggested preferential carbohydrate utilization during this type of activity, independent of fitness level and weight [53]. (See ["Diabetes mellitus in pregnancy: Screening and diagnosis"](#), section on 'Preventive approaches for risk reduction' and ["Gestational diabetes mellitus: Glycemic control and maternal prognosis"](#), section on 'Exercise'.)

Obese women — Clinical trials under medical supervision have demonstrated that lifestyle intervention for weight-gain restriction and moderate exercise can be safely prescribed in pregnancy [83]. Despite methodological pitfalls in these studies, the evidence suggests overweight/obese pregnant women who exercise and follow a judicious diet can reduce their risks for developing gestational diabetes and preeclampsia, avoid excessive gestational weight gain, and increase the likelihood of a normal birth weight neonate [4]. (See ["Weight gain and loss in pregnancy"](#).)

Women at increased risk for miscarriage or preterm birth — For most pregnant women, physical activity/exercise does not increase the risk of miscarriage or preterm delivery, and bed rest does not reduce the risk of miscarriage or preterm delivery. However, studies on exercise in pregnancy have generally excluded women at high risk of miscarriage or preterm birth.

Given the absence of reassuring data in high risk women, we agree with expert opinion that women at high risk for miscarriage or preterm birth should limit their level of exercise/physical activity, particularly strength training and heavy lifting, in pregnancy [46,51,84]. (See ["Choosing an exercise program"](#) above.)

Women at increased risk for fetal growth restriction — As discussed above, women with low-risk pregnancies who regularly participated in a supervised prenatal exercise program appeared to have a clinically insignificant reduction in birth weight [11]. (See ["Risks"](#) above.)

The effect of exercise in women at high risk for fetal growth restriction (eg, previous pregnancy with growth restriction) is unknown. Given the lack of clear evidence of safety in this subgroup, it is prudent for women who exercise regularly and are at high risk of fetal growth restriction to reduce their level of exercise in the second and third trimesters, in addition to standard monitoring of fetal growth [46].

Postpartum women — For the most part, the physiologic and anatomic changes of pregnancy return to the prepregnancy state by approximately six weeks postpartum. Prepregnancy exercise routines can be resumed gradually postpartum, based upon an individual woman's physical capability and comfort and as soon as medically safe, depending on the mode of delivery and the presence of medical or surgical complications [46]. The competitive athlete with an uncomplicated

pregnancy, delivery, and postpartum course may resume training within days after delivery: No maternal complications are associated with resumption of early training [66].

Exercise and a healthy diet postpartum promote weight loss, which can improve or prevent many future obesity-related risks, such as diabetes mellitus and hypertension. (See "[Obesity in adults: Role of physical activity and exercise](#)", section on 'Benefits'.)

A decreased frequency of postpartum depression has been associated with return to physical activity following pregnancy but only if the exercise is stress-relieving and not stress-provoking [85]. (See "[Postpartum unipolar major depression: Epidemiology, clinical features, assessment, and diagnosis](#)".)

Breastfeeding women — Women who exercise to moderate levels of exertion do not have changes in breast milk composition or infant acceptance of breast milk; however, exercise at maximal levels has been associated with significant but short-term elevations in lactic acid in breast milk and less infant acceptance [86-90]. Nursing before exercise avoids the potential problems associated with increased acidity of breast milk and also avoids the discomfort of engorged breasts while exercising [90].

Modest weight reduction while nursing appears to be safe and does not compromise neonatal weight gain [86-89]. In a 2012 meta-analysis (four randomized trials, n = 170 women 3 to 16 weeks postpartum), maternal exercise programs of 11 days, 10 weeks, 12 weeks, or 16 weeks duration did not significantly reduce infant weight gain compared with a variety of control programs [89]. Most of these women had previously been sedentary. In strenuously training mothers, anecdotal reports have described failure of infants to gain weight as rapidly as expected. It is possible that inadequate fluid or nutritional intake in vigorously exercising mothers, rather than exercise itself, could lead to decreased milk production, resulting in suboptimal infant weight gain.

Post-cesarean delivery — Early ambulation and return to normal prepregnancy physical activities and exercise routines as soon as medically safe could reduce comorbidities associated with postsurgery sedentary lifestyle [91,92] and appears to enhance restoration of physical function after orthopedic and other surgeries [93]. The presence of the following factors delays resumption of some or all physical activities [46,64,94]:

- Medical complications (eg, anemia, cardiorespiratory disorders, thromboembolism)
- Pain and need for analgesia
- Surgical and postoperative complications (eg, nausea/vomiting, abnormal wound healing, neuropathy, incontinence)

Recreational and elite athletes, in particular, are eager to regain prepregnancy fitness levels, since it is recognized that cessation of training for three to four weeks decreases endurance performance by 4 to 25 percent [95]. However, rapid resumption of physical activities should be individualized and occur only after medical clearance, which should establish symptom-free and/or controlled stable vital signs, reactivation/stabilization and ability to control muscle functions, and restoration/stabilization of motor skills.

Exercise prescription — After medical clearance, we suggest the following exercise prescription.

- **Week 1 to 2 after discharge**

- A walking program, initially at least 10 minutes/day several times a day, and progress, as tolerated, to regain cardiorespiratory fitness.
- Use of stairs at home with assistance at slow pace and increased frequency, as tolerated.
- Lifting – The American College of Obstetricians and Gynecologists recommends, after cesarean delivery, temporary abstinence from lifting objects heavier than the newborn [96]. It is in this author's experience that women who engaged in muscle strengthening activities prior to and during pregnancy have the ability to lift objects heavier than recommended without difficulty or consequences. However, upper safe limits have not been established; thus, caution should be exercised. It is also recognized that muscle strength abilities are a function of muscle mass and previous training. A 15- to 30-day detraining period can lead to significant muscle atrophy; as such, additional restrictions can only lead to further muscle loss and detraining [97].

The concern about the integrity of the abdominal wall and potential negative effect of increased intra-abdominal pressure during Valsalva or during heavy lifting after laparotomies has been refuted in small studies, suggesting that increased intra-abdominal pressure occurs more frequently during unavoidable activities like standing from a seated position rather than Valsalva [98]. (See "[Complications of abdominal surgical incisions](#)", section on 'Lifting'.)

For advanced recreational or elite athletes, the wound healing process of the abdominal wall will determine the timing for return to more strenuous type of exercises. The abdominal fascia regains 51 to 59 percent of its original tensile strength at 42 days, 70 to 89 percent at 120 days, and 73 to 93 percent by 140 days [99]. Individual responses after abdominal surgeries vary, and moderation should be exercised until the patients are free of pain or other symptoms.

- **Week 3 and beyond** – Significant lordosis, low back pain, or joint laxity will require a longer recovery time and a modified exercise routine. Wound conditions, the degree of abdominal wall laxity, and rectus abdominis diastasis may interfere with physical activity and exercise; some patients may benefit from use of an abdominal binder during the first few sessions.
 - Pelvic tilting and abdominal curl – Supine position on flat surface, bend knees, arms by sides, push slowly low back against surface, correct lordosis, and tighten abdominal wall. Aim for 10 to 12 repetitions.
 - Lower back lift – Supine position, hands by side, bend knees, lift shoulders and head a few inches off the surface, lift lower back off the surface, and hold for a few seconds. Repeat and increase frequency over time as tolerated. Aim for 10 to 12 repetitions.
 - Oblique curls – Supine position, bend knees, hands bend to the head, elbows to the side. Curl shoulders alternating to the opposite knee. Avoid forceful movements. Aim for 10 to 12 repetitions.
 - Lateral tilts – Supine position, hands by the side, tighten abdominal wall, bend knees, slowly roll knees to one side and then slowly to the other side. Aim for 10 to 12 repetitions.

- Kegel pelvic floor muscle exercises – Several times per day, as tolerated. (See "[Pelvic organ prolapse in women: Epidemiology, risk factors, clinical manifestations, and management](#)", section on 'Pelvic floor muscle exercises'.)

- **Week 6 and beyond**

- Women who, prior to their pregnancies, engaged in gym/club-apparatus activities may slowly and cautiously resume these activities using low settings on the equipment. Joints and ligaments may require as much as three months to return to prepregnancy configuration.
- The "Physical activity guidelines for Americans" recommend that all adults engage in at least 150 minutes of moderate-intensity physical activity per week (or 30 minutes each day). At six weeks postpartum, women should aim to follow these guidelines. The government guidelines emphasize that "strong scientific evidence shows that physical activity helps people maintain a stable weight over time" and prevent comorbidities [100]. (See "[The benefits and risks of exercise](#)".)

GUIDELINES FROM SELECTED NATIONAL ORGANIZATIONS — A comparison of guidelines for physical activity from around the world for pregnant women revealed consensus that physical activity in pregnancy is beneficial to most women and has minimal risks, but may require some modifications to accommodate the normal maternal anatomic and physiologic changes and fetal requirements [65].

There was also close to universal consensus that certain maternal, fetal, or environmental conditions are absolute or relative contraindications for exercise in pregnancy. Among these conditions are significant or active cardiovascular disease, restrictive lung disease, poorly controlled thyroid disease, multiple gestation (triplets or higher), preeclampsia, premature labor and premature rupture of membranes, severe anemia, poorly controlled type I diabetes, persistent bleeding, extreme obesity, and extreme underweight.

American College of Obstetricians and Gynecologists — In December 2015, the American College of Obstetricians and Gynecologists (ACOG) updated their guidelines for physical activity and exercise during pregnancy and the postpartum period [46]. The guidelines focus on benefits of exercise, fetal and maternal risks, safety issues, environment (temperature), and mode of exercise (weight-bearing versus non-weight-bearing exercise). These guidelines are in accordance with the Physical Activity Guidelines issued by the United States Department of Health and Human Services [101].

Key conclusions of the ACOG guidance statement are listed below [46]:

- Regular physical activity during pregnancy improves or maintains physical fitness, helps with weight management, reduces the risk of gestational diabetes in obese women, and enhances psychological well-being.
- Physical activity in pregnancy has minimal risks and benefits most women, but some modification to exercise routines may be necessary because of normal anatomic and physiologic changes and fetal requirements.
- Before recommending an exercise program, clinicians should perform a thorough clinical evaluation to ensure that the patient does not have a medical reason to avoid exercise.

- Women with uncomplicated pregnancies should be encouraged to engage in aerobic and strength conditioning exercises before, during, and after pregnancy.
- Bed rest, although frequently prescribed in the past (for prevention of second-trimester loss, preterm birth, and other conditions) is rarely indicated and, in most cases, allowing ambulation such as walking should be considered.

The exercise prescription described in this topic is generally consistent with that detailed in ACOG's guidance. (See ['Exercise prescription'](#) above.)

American College of Sports Medicine — The American College of Sports Medicine (ACSM) advises that healthy women with normal pregnancies may either continue their regular exercise regimen or begin a new exercise program during pregnancy [\[44,63\]](#).

The ACSM guidance addresses multiple exercise-related issues including temperature regulation, appropriate hydration and dietary intake, safe exercise positions, weight-bearing and non-weight-bearing exercise, intensity and duration of exercise, activities to avoid, and complications. The ACSM discouraged heavy weight lifting and similar activities that require straining.

Society of Obstetricians and Gynaecologists of Canada and the Canadian Society for Exercise Physiology — A joint committee of the Society of Obstetricians and Gynaecologists of Canada and the Canadian Society for Exercise Physiology recommended that all women without contraindications should be encouraged to participate in aerobic and strength-conditioning exercises during pregnancy [\[64\]](#). They also suggested pelvic floor exercises for postpartum women.

Royal College of Obstetricians and Gynaecologists — The Royal College of Obstetricians and Gynaecologists suggests that all pregnant women participate in aerobic and strength-conditioning exercise as part of a healthy lifestyle during their pregnancy [\[57\]](#). Previously sedentary women should begin with 15 minutes of continuous exercise three times a week, gradually increasing the frequency and duration to 30-minute sessions four to seven times a week. Physically active women should maintain a good fitness level throughout pregnancy, without trying to reach their peak fitness level or train for athletic competition.

International Olympic Committee — In September 2015, the International Olympic Committee convened an international scientific advisory committee to review information on exercise in pregnancy, primarily as it relates to recreational and elite athletes [\[21,39\]](#). The committee focused on: (1) the significance of known normal anatomical and physiological changes that occur in pregnancy and associated side effects and complications, which could interfere or preclude strenuous physical activities and athletic/competitive activities in pregnancy; (2) providing recommendations for pregnant athletes engaging in such activities and their health care providers; and (3) identifying gaps in the published information that will require future focus and research.

The committee concluded that the few published studies that focused on elite pregnant athletes indicated that aerobic fitness (in the absence of medical/obstetrical complications) can be maintained in pregnancy. The activities reviewed involved endurance (including altitude exertion), resistance, and flexibility. The committee also recognized that there is limited information available on strength and flexibility training in pregnancy, particularly in elite athletes.

World Health Organization — The World Health Organization global recommendations on physical activity for health recognizes a sedentary lifestyle and excessive weight gain as independent risk factors for maternal obesity and related comorbidities, such as gestational

diabetes, but cautions that pregnant and postpartum women may need to take extra safeguards and seek medical advice before attempting to achieve the recommended levels of physical activity for their age group [61].

INFORMATION FOR PATIENTS — UpToDate offers two types of patient education materials, "The Basics" and "Beyond the Basics." The Basics patient education pieces are written in plain language, at the 5th to 6th grade reading level, and they answer the four or five key questions a patient might have about a given condition. These articles are best for patients who want a general overview and who prefer short, easy-to-read materials. Beyond the Basics patient education pieces are longer, more sophisticated, and more detailed. These articles are written at the 10th to 12th grade reading level and are best for patients who want in-depth information and are comfortable with some medical jargon.

Here are the patient education articles that are relevant to this topic. We encourage you to print or e-mail these topics to your patients. (You can also locate patient education articles on a variety of subjects by searching on "patient info" and the keyword(s) of interest.)

- Basics topic (see ["Patient education: Activity during pregnancy \(The Basics\)"](#))

SUMMARY AND RECOMMENDATIONS

- We agree with recommendations of major medical societies that women with uncomplicated pregnancies should be encouraged to exercise as part of a healthy lifestyle before, during, and after pregnancy. (See ['Guidelines from selected national organizations'](#) above.)
- Exercise during pregnancy has minimal risks and demonstrated benefits for most pregnant women, including maintenance or improvement of physical fitness, control of gestational weight gain, reduction in low back pain, and possibly a reduction in risk of developing gestational diabetes or preeclampsia. Moderate exercise is not a direct cause of any adverse pregnancy outcome; however, pregnant women may be at greater risk of injuries to joints, falling, and significant abdominal trauma during certain types of exercise. Abdominal trauma can result in placental abruption, which can lead to fetal death or morbidity. (See ['Benefits and risks'](#) above.)
- Prior to participation in an exercise program, pregnant women should be evaluated for medical and obstetrical contraindications to exercise ([table 1](#)). (See ['Pre-exercise and ongoing risk assessment'](#) above.)
- Some sports should be avoided in pregnancy ([table 2](#)). Contact sports and physical activities in which the risk of falls/trauma is high are a concern in pregnancy because of the risk of fetal harm from maternal trauma. SCUBA diving should also be avoided because of the potential for fetal harm. (See ['Choosing an exercise program'](#) above.)
- Maintenance of euhydration is particularly critical to heat balance during prolonged exercise and exercise in hot, humid weather; hyperthermia in very early pregnancy may increase the risk for neural tube defects. The caloric costs of exercise should be estimated and balanced by appropriate caloric intake and awareness of hypoglycemia symptoms. (See ['Hydration and energy'](#) above and ['Risks'](#) above.)
- The intensity, frequency, and duration of exercise depend on patient-specific factors. For most healthy pregnant women, the following exercise prescription is reasonable: moderate-intensity

exercise (able to carry on a normal conversation during exercise) that includes aerobic exercise and strength training, performed for 30 minutes daily, five to seven days per week.

Previously sedentary women should begin with 10 to 20 minutes of continuous low-intensity exercise three times per week, increasing the intensity, frequency, and duration gradually.

Physically active women can engage in moderate to vigorous physical activity. They should strive to maintain a good fitness level throughout pregnancy without trying to reach their peak fitness level or train for athletic competition. (See '[Exercise prescription](#)' above.)

- We advise women at high risk for preterm birth or fetal growth restriction who exercise to reduce their level of exercise in the second and third trimesters. (See '[Women at increased risk for miscarriage or preterm birth](#)' above and '[Women at increased risk for fetal growth restriction](#)' above.)

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GRAPHICS

Contraindications to aerobic exercise during pregnancy

Absolute contraindications to aerobic exercise during pregnancy

- Hemodynamically significant heart disease
- Restrictive lung disease
- Incompetent cervix or cerclage
- Multiple gestation at risk of premature labor
- Persistent second- or third-trimester bleeding
- Placenta previa after 26 weeks of gestation
- Premature labor during the current pregnancy
- Ruptured membranes
- Preeclampsia or pregnancy-induced hypertension
- Severe anemia

Relative contraindications to aerobic exercise during pregnancy

- Anemia
- Unevaluated maternal cardiac arrhythmia
- Chronic bronchitis
- Poorly controlled type 1 diabetes
- Extreme morbid obesity
- Extreme underweight (BMI less than 12)
- History of extremely sedentary lifestyle
- Intrauterine growth restriction in current pregnancy
- Poorly controlled hypertension
- Orthopedic limitations
- Poorly controlled seizure disorder
- Poorly controlled hyperthyroidism
- Heavy smoker

BMI: body mass index.

From: American College of Obstetricians and Gynecologists. ACOG Committee Opinion No. 650: Physical Activity and Exercise During Pregnancy and the Postpartum Period. Obstet Gynecol 2015; 126:e135. DOI: [10.1097/AOG.0000000000001214](https://doi.org/10.1097/AOG.0000000000001214). Copyright © 2015 American College of Obstetricians and Gynecologists. Reproduced with permission from Lippincott Williams & Wilkins. Unauthorized reproduction of this material is prohibited.

Graphic 108037 Version 1.0

Safe and unsafe recreational exercises in pregnancy

Examples of safe and unsafe physical activities during pregnancy*
The following activities are safe to initiate or continue*:
<ul style="list-style-type: none">▪ Walking▪ Swimming▪ Stationary cycling▪ Low-impact aerobics▪ Yoga, modified[¶]▪ Pilates, modified▪ Running or jogging^Δ▪ Racquet sports^{Δ◇}▪ Strength training^Δ▪ Pelvic floor muscle training (Kegel)
The following activities should be avoided:
<ul style="list-style-type: none">▪ Contact sports (eg, ice hockey, boxing, soccer, and basketball)▪ Activities with a high risk of falling or otherwise hitting the abdomen against a hard surface (eg, downhill snow skiing, water skiing, surfing, off-road cycling, gymnastics, and horseback riding)▪ Scuba diving▪ Sky diving▪ "Hot yoga" or "hot pilates"

* In women with uncomplicated pregnancies in consultation with an obstetric care provider.

¶ Yoga positions that result in decreased venous return and hypotension should be avoided as much as possible.

Δ In consultation with an obstetric care provider, running or jogging, racquet sports, and strength training may be safe for pregnant women who participated in these activities regularly before pregnancy. Moderate intensity is optimal (eg, $\leq 80\%$ age predicted maximum heart rate, rate of perceived exertion 13 or 14 on the Borg scale, or ability to converse while exercising). High intensity strenuous exercise should be avoided ($>90\%$ age predicted maximum heart rate).

◇ Racquet sports wherein a pregnant woman's changing balance may affect rapid movements and increase the risk of falling should be avoided as much as possible.

Adapted from: American College of Obstetricians and Gynecologists. ACOG Committee Opinion No. 650: Physical Activity and Exercise During Pregnancy and the Postpartum Period. Obstet Gynecol 2015; 126:e135. DOI: [10.1097/AOG.0000000000001214](https://doi.org/10.1097/AOG.0000000000001214). Copyright © 2015 American College of Obstetricians and Gynecologists. Reproduced with permission from Lippincott Williams & Wilkins. Unauthorized reproduction of this material is prohibited.

Graphic 108041 Version 2.0

Leisure activity energy expenditure in metabolic equivalents (METs)

Activity	Mean	Range
Archery	3.9	3 to 4
Backpacking	--	5 to 11
Badminton	5.8	4 to 9+
Basketball		
Gameplay	8.3	7 to 12+
Non-game	--	3 to 9
Billiards	2.5	--
Bowling	--	2 to 4
Boxing		
In-ring	13.3	--
Sparring	8.3	--
Canoeing, rowing, kayaking	--	3 to 8
Conditioning exercise	--	3 to 8+
Climbing hills	7.2	5 to 10+
Cricket	5.2	4.6 to 7.4
Croquet	3.5	--
Cycling		
Pleasure or to work	--	3 to 8+
10 miles per hour	7.0	--
Dancing (social, square, tap)	--	3.7 to 7.4
Dancing (aerobic)	--	6 to 9
Fencing	--	6 to 10+
Field hockey	8.0	--
Fishing		
From bank	3.7	2 to 4
Wading in stream	--	5 to 6
Football (touch)	7.9	6 to 10
Golf		
Power cart	--	2 to 3
Walking (carrying bag or pulling cart)	5.1	4 to 7
Handball	--	8 to 12+
Hiking (cross country)	--	3 to 7
Horseback riding		
Galloping	8.2	--
Trotting	6.6	--
Walking	2.4	--
Horseshoe pitching	--	2 to 3
Hunting (bow or gun)		
Small game (walking, carrying light load)	--	3 to 7
Big game (dragging carcass, walking)	--	3 to 14

Judo	13.5	--
Mountain climbing	--	5-to 10+
Music playing	--	2 to 3
Paddleball, raquetball	9	8 to 12
Rope jumping	11	--
60 to 80 skips/minute	9	--
120 to 140 skips/minute	--	11 to 12
Running		--
12 minutes/mile	8.7	--
11 minutes/mile	9.4	--
10 minutes/mile	10.2	--
9 minutes/mile	11.2	--
8 minutes/mile	12.5	--
7 minutes/mile	14.1	--
6 minutes/mile	16.3	--
Sailing	--	2 to 5
Scuba diving	--	5 to 10
Shuffleboard	--	2 to 3
Skating, ice and roller	--	5 to 8
Skiing, snow		
Downhill	--	5-to 8
Cross-country	--	6 to 12+
Skiing, water	--	5 to 7
Sledding, tobogganing	--	4 to 8
Snowshoeing	9.9	7 to 14
Squash	--	8 to 12+
Soccer	--	5 to 12+
Stairclimbing	--	4 to 8
Swimming	--	4 to 8+
Table tennis	4.1	3 to 5
Tennis	6.5	4 to 9+
Volleyball	--	3 to 6

Adapted from: American College of Sports Medicine. Guidelines for Exercise Testing and Prescription, 3rd ed, Lea and Febiger, Philadelphia 1986, p.20.

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Contributor Disclosures

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Contributor disclosures are reviewed for conflicts of interest by the editorial group. When found, these are addressed by vetting through a multi-level review process, and through requirements for references to be provided to support the content. Appropriately referenced content is required of all authors and must conform to UpToDate standards of evidence.

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