# EXERCISE REGIMEN IN PREGNANCY: INDICATIONS, CONTRAINDICATIONS PERMISSIBLE TYPES AND BENEFITS

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**Abstract**
*Exercise has been copiously reported as a great tool in medical and health care, both at the prophylactic and therapeutic levels. The review took a critical look at exercise in pregnancy, considering the various contraindications, indications, limitations, and permissible exercises in the different trimesters of pregnancy. The review identified several contraindications to exercise prescription during pregnancy, such as gestational hypertension, preeclampsia, ruptured membranes, incompetent cervix, bleeding in the second or third trimester, multiple gestations at risk for premature labour, placenta praevia, and premature labour with intrauterine growth restriction, extremes of weight, and poorly controlled medical co-morbidities, such as type 1 diabetes mellitus, seizure disorder, and thyroid disease. The various effects of exercise on maternal and foetal health in pregnancy, such as prevention of perinatal depression, increased incidence of vaginal delivery, reducing time for labour and reducing the incidence of caesarian sessions, improving maternal-foetal circulation and foetal growth, preventing hypertension and preeclampsia, and reducing the incidence of gestational diabetes mellitus, were lucidly discussed in the review. The need for the encouragement of pregnant women to adhere to exercise in pregnancy has been assigned to health educators for better health promotion and health-seeking behaviour.*

***Keywords:*** *Exercise regimen, Pregnancy, Indications, Contraindications, Trimesters*

## Introduction

Physical exercise is any motion of the body caused by the contraction of skeletal muscles at any stage of life. It keeps the heart and lungs healthy through cardiopulmonary activities, increases longevity, lowers the risk of obesity and its co-morbidities, and improves cardio-respiratory fitness. Encouragement of pregnant women to keep up their healthy lifestyle practises, such as exercise, a balanced diet rich in fruit and vegetables, and quitting smoking, is an important aspect of maternal health care and a good therapeutic regimen (Okueso & Anetor, 2016; Beetham et al, 2019).

According to evidence-based recommendations from the World Health Organisation and the American College of Sports Medicine (American College of Sports Medicine, 2018, Okafor, & Goon, 2020). The benefits of exercise for the majority of adults are undeniable and vastly outweigh the risks. Pregnancy exercise is good for the health of both the mother and the foetus. It is recommended that healthy pregnant women engage in at least 150 minutes per

week of moderately strenuous physical exercise, such as brisk walking, swimming, water workout, riding a stationary bike, strenght training. In the absence of medical or obstetric complications, pregnant women are advised to exercise daily for at least 30 minutes at a moderate intensity and/or 3–5 times per week for at least 15–30 minutes (Adesegun, Cai, Sivak, Chari, Davenport, 2019, Berghella & Saccone, 2017). Pregnancy is a significant time that is marked by a number of emotional, biochemical, physiological, and physical changes. These changes may affect the pregnant women's capacity to carry out their varied duties, which may have an impact on their performance, quality of life, and physical activity during pregnancy (Berghella & Saccone, 2017).

Physical activity during pregnancy has been proven to be beneficial across a variety of populations. Retrospective and prospective data on physical activity during pregnancy show a decrease in physical activity, intensity, and duration as pregnancy progresses by shifting towards performing less intense, more comfortable modes of activity with lower energy expenditure (Newton & May, 2017). This is true despite the established health benefits attributed to physical activity during pregnancy. Several theories have been proposed for improving adherence to physical activity and healthy behaviours in human and also in pregnancy.

A model based on cognitive theory proposes that the future physical activity behaviour of an individual is dependent primarily on whether engaging in physical activity will lead to positive or negative outcomes (Takani et al., 2018). A socio-ecological model that emphasises physical environmental factors as important determinants of health behaviour has been used to promote physical activity adherence in the adult population. Previous studies have shown a decline in physical activity among pregnant women even in the Western developed world, particularly the USA, Europe, and Australia, where the built environment and community design encourage physical activity. Similar findings exist in the developing world, such as Nigeria, Ethiopia, and Cameroon, where the built environment and community design may be considered poor and do not motivate physical activity. Promotion of healthy behaviour may therefore be dependent on the perceived positive health and well-being benefits that are harnessed from the continuity of such an action. (Takani et al., 2018).

Various complaints of pregnant women, especially in the third trimester of pregnancy, are shortness of breath, lower back pain, haemorrhoids, sleep disturbance, pain in the pelvic area, dizziness, abdominal cramps, leg cramps, frequent urination, and discomfort due to sudden and anxious contractions (Okueso, Olawunmi, & Okundare, 2017; Pregnancy & Heart Disease, 2019; Beetham et al., 2019). One complaint among pregnant women that often occurs is sleep disturbance, even though the pregnancy is normal. Sleep disorders that pregnant women often experience include a decrease in sleep duration. Most pregnant women experience sleep disorders, and only 1.9% of women do not

wake up at night during the third trimester of pregnancy. Sleep disturbance in pregnant women can decrease the percentage of slow sleep waves and REM (Rapid Eye Movement) sleep, increasing in stage one. Sleep disturbances in pregnant women occur in the first trimester, second trimester, and third trimester.

Sleep disorders are more likely to be reported in the third trimester. In the third trimester, the number of sleep disorders is higher due to discomforts such as back pain. This is due to compensation from the enlargement of the uterus to the anterior position, which shifts the centre of the heavy power back towards the two limbs (Pregnancy & Heart Disease, 2019). The sacroiliac and pubic joints will increase in mobility, which is thought to be due to hormonal influences. This causes discomfort in the lower back, especially at the end of pregnancy when you are urinating a lot and spontaneously waking up from sleep. Foetal movements, heartburn, cramps in the legs, fatigue, and difficulty starting sleep or sleeping until the morning hormonal and physical changes during pregnancy cause significant changes in regular sleep routines and sleep quality (Pregnancy and Heart Disease, 2019).

Sleep problems in pregnancy are common, and they vary depending on the trimesters. By the third trimester, women experience more problems sleeping. Studies investigating sleep quality in pregnancy indicate that pregnant women in the third trimester have poor sleep quality at percentages ranging from 50% to 89.3%. Studies on sleep quality show that poor sleep quality in pregnancy has negative effects on labour as well as on foetal health. It is indicated that pregnant women with poor sleep quality usually have a caesarean section or experience prolonged labour if they have a vaginal birth. The effect of poor sleep quality on neonatal health is revealed in low APGAR scores and low birth weight. Besides, it is reported that prenatal sleep disorders trigger the development of postpartum depression. Relaxation exercises are important as they reduce tension in muscles. They involve conscious contraction and relaxation of the big muscle groups in the body examples are:squeezing of eyes tightly shut, clenching of jaw, Taking of deep breath and slowly letting it out, getting into comfortable position. The purpose is to help individuals check their entire body and notice the tensions, to be able to control their muscles, and to relax the tension in their body in the shortest time possible. By reducing the tension in muscles, relaxation exercises help pregnant women have more comfortable sleep and better sleep quality (Hinman et al., 2015).

Moderate-intensity aerobic exercise throughout pregnancy is known to result in lower caesarean delivery indications, a lower incidence of gestational diabetes and hypertensive disorders, decreased maternal weight gain, improvements in antenatal and postnatal depression, and has not been found to negatively affect birth weight. However, studies investigating the effects of vigorous-intensity exercise on birth weight have been mixed. This is clinically important, as birth weight is the single most important predictor of neonatal

morbidity and mortality. Research has shown that foetal hypoglycemia in hypoxic conditions can result in infants born small for gestational age. So, while moderate-intensity exercise throughout pregnancy is beneficial, it is not known whether vigorous-intensity exercise is detrimental, particularly in the third trimester when the needs of the foetus are greater (ACOG, 2020).

A decrease in utero-placental blood flow occurs during vigorous-intensity exercise and has been shown to result in foetal bradycardia. Physical exertion demands greater substrate utilisation and, as such, re-directs blood to the working muscles while also generating heat and excess by-products. The combination of these adaptations challenges the greater demands required by the foetus during pregnancy. Indeed, reduced foetal movement after vigorous-intensity exercise in the third trimester has been shown in studies with both conditioned and unconditioned mothers. It seems likely that the increasing physiological demands during each trimester of pregnancy will require variations in exercise training accordingly. However, current guidelines for pregnancy are not trimester-specific (US Dept. of Health & Human Services, 2018).

**Exercise Prescription as a Therapeutic Regimen**

Before advising the initiation or continuation of physical activity during pregnancy, a physician must assess the woman's risk level. Healthy women without contraindications to exercise are considered low-risk regardless of their previous activity level, whereas women with certain chronic medical conditions, including cardiovascular, respiratory, and systemic diseases, or relative contraindications are considered high-risk (Ehrlich et al., 2016). Familiarity with absolute and relative contraindications to exercise is thus important for both the physician and patient. Absolute contraindications include gestational hypertension, preeclampsia, ruptured membranes, an incompetent cervix, bleeding in the second or third trimester, multiple gestations at risk for premature labour, placenta previa, and premature labour. Relative contraindications include: intrauterine growth restriction, extreme weight, and poorly controlled medical co-morbidities such as type 1 diabetes mellitus, hypertension, seizure disorder, and thyroid disease. Pregnant women should also stop exercising based on signs and symptoms that may develop. The frequency, intensity, type, and duration (FITT) should be outlined according to her physical activity state prior to pregnancy. The PARmed-X for pregnancy is a set of guidelines developed in Canada to help health practitioners evaluate a pregnant woman's ability to safely engage in physical activity as well as prescribe a basic exercise regimen. (ACOG, 2020).

**Physical Training in Pregnancy**

Strenuous exercise during pregnancy has become a hot topic for those who want to keep up their training during pregnancy as more women compete in sports. The key issues in this demographic are how pregnancy affects competing and

how pregnancy affects training. This training programme of muscle strengthening, aerobic exercise, and endurance exercise could be used to guide exercise prescription for physically active women as it significantly increased the participants' VO2 max from week 17 of gestation to 12 weeks postpartum (Berghella & Saccone, 2017; ACOG, 2020) Although there isn't much research looking at the safety of vigorous exercise for the foetus, the findings are generally encouraging. Increased first trimester intense recreational physical activity was associated with a lower risk of preterm birth, although this level of exercise had no appreciable impact on birth weight. During the second trimester, women who had been categorised as not exercising, exercising moderately, or exercising strenuously six months before becoming pregnant had a moderate-intensity exercise test.

Marin-Jimenez *et al.,* (2019) suggested that physically active women can continue or increase their activity to vigorous-intensity exercise during pregnancy, while physically inactive women can start moderate-intensity exercise safely because post-exercise biophysical profiles were normal and there were no significant differences among the groups in APGAR scores or birth weights. In order to determine the impact of vigorous exercise on foetal health, the three groups of women also underwent a peak exercise test. Biophysical profiles, once again, were ultimately comforting for all groups. Notably, there were transitory foetal heart rate decelerations and changes in uterine blood flow in five very active women immediately following exercise. This raises questions about whether vigorous activity reduces blood flow to the uterus. Similarly, in a small study of six pregnant Olympic-level endurance athletes, maternal-foetal circulation during and after exercise showed that vigorous exercise, where the maternal heart rate was greater than 90% of the maximum, was associated with decreased uterine artery blood flow and foetal bradycardia that resolved soon after exercise was stopped. Thus, even though there may be foetal cardiovascular changes associated with high-intensity exercise, they do not appear to significantly affect neonatal outcomes; however, there is cause for concern (Marin-Jimenez *et al*., 2019).

**Anatomical and Physiological Aspects of Exercise in Pregnancy**

Recommendations for exercise should take into account the anatomical and physiological changes brought on by pregnancy. Weight growth and a change in the centre of gravity that causes increasing lordosis are the two most noticeable alterations during pregnancy (Pivanik *et al*., 2016). As a result of these modifications, the stresses acting on joints and the spine during weight-bearing activity rise. As a result, low back discomfort affects more than 60% of pregnant women. Increasing the strength of your back and abdominal muscles might lower this risk. Pregnancy often causes decreases in systemic vascular resistance and increases in blood volume, heart rate, stroke volume, and cardiac output. These

hemodynamic changes define the circulatory reserve needed to support the pregnant lady and foetus both at rest and during exercise. When recommending exercise modifications during pregnancy, it is important to take into account the possibility that maintaining a supine position may cause decreased venous return because ofaortocaval compression from the gravid uterus after 20 weeks of pregnancy (Holliday et al., 2023).

**Table 1**: **Cardiovascular changes in a normal pregnancy**

| | First Trimester | Second Trimester | Third Trimester | Stage 1 Labor | Stage 2 Labor | Early Postpartum | 3–6 months Postpartum |
|---|---|---|---|---|---|---|---|
| Cardiac Output | ↑5–10% | ↑↑35–45% | | ↑30% | ↑↑50% | ↑↑↑60–80% immediately, then rapidly decreases within the first hour | Return to pre-pregnancy values |
| Heart Rate | ↑3–5% | ↑10–15% | ↑15-20% | During uterine contractions: ↑40–50% | | Remains elevated at third trimester values | Return to pre-pregnancy values |
| Blood Pressure | ↓10% | ↓5% | ↑5% | During uterine contractions: ↑SBP 15–25% ↑DBP 10–15% | | ↓SBP 5–10% within 48 hours; may increase again between days 3–6 due to fluid shifts | Return to pre-pregnancy values |
| Plasma Volume | ↑ | ↑↑40–50% | | ↑ | ↑↑ | ↑↑↑500 mL due to autotransfusion | Return to pre-pregnancy values |

Abbreviations: SBP, systolic blood pressure; DBP, diastolic blood pressure.

*Hemodynamic changes that occur during pregnancy, labor, and postpartum (compared with prepregnancy) should be understood to identify early interventions (such as blood pressure control and diuresis) that may be needed to prevent clinical deterioration in a woman with cardiovascular disease.

Data from Kuhn JC, Falk RS, Langesaeter E. Haemodynamic changes during labour: continuous minimally invasive monitoring in 20 healthy parturients. Int J Obstet Anesth 2017;31:74–83; Ouzounian JG, Elkayam U. Physiologic changes during normal pregnancy and delivery. Cardiol Clin 2012;30:317–29; Sanghavi M, Rutherford JD. Cardiovascular physiology of pregnancy. Circulation 2014;130:1003–8; Shen M, Tan H, Zhou S, Smith GN, Walker MC, Wen SW. Trajectory of blood pressure change during pregnancy and the role of pre-gravid blood pressure: a functional data analysis approach. Sci Rep 2017;7:6227; Sohnchen N, Melzer K, Tejada BM, Jastrow-Meyer N, Othenin-Girard V, Irion O, et al. Maternal heart rate changes during labour. Eur J Obstet Gynecol Reprod Biol 2011;158:173–8; *and* Walters BN, Walters T. Hypertension in the puerperium [letter]. Lancet 1987;2:330.

*Source: (Kuhn, Falk & Langestaeter, 2017)*

There are also significant respiratory changes during pregnancy. The increased tidal volume causes minute ventilation to increase by up to 50%. Anaerobic exercise capacity is compromised due to a physiological decline in pulmonary reserve, and oxygen availability for aerobic exercise and a higher workload continually lags. The rising metabolic acidosis brought on by vigorous activity may be more than the physiological respiratory alkalosis of pregnancy can handle. Pregnant women's capacities for both subjective work load and maximal exercise performance are reduced, especially in those who are overweight or obese, which restricts their capacity for more demanding physical activities.

Pregnant women who are normal weight or overweight can boost their aerobic capacity through aerobic exercise (Holliday et al., 2023; Wang et al., 2017).

Temperature regulation is highly dependent on hydration and environmental conditions. During exercise, pregnant women should stay well hydrated, wear loose-fitting clothing, and avoid high heat and humidity to protect against heat stress, particularly during the first trimester. Although exposure to heat from sources such as hot tubs, saunas, or fever has been associated with an increased risk of neural tube defects, exercise would not be expected to increase core body temperature into the range of concern. At least one study found no association between exercise and neural tube defects (Holt & Holden, 2018; US Department of Health & Human Services, 2018).

## Effects of Exercise on Maternal and Foetal Health in Pregnancy

### *Gestational diabetes mellitus*

In parallel to its effect on the incidence of type 2 diabetes mellitus, regular exercise should also decrease the risk of gestational diabetes mellitus. Several review articles have, however, concluded that there is insufficient evidence to support physical activity as an effective intervention to decrease the risk of developing gestational diabetes. Poor compliance with exercise regimens may have contributed to the lack of significance. Nevertheless, multiple studies have shown significantly lower glucose levels on the 24 to 28weeks oral glucose tolerance test in physically active women. Although physical activity may not prevent the development of gestational diabetes, it may help manage it. The majority of studies using exercise as an intervention to treat gestational diabetes mellitus were successful. Women diagnosed with gestational diabetes at 24 to 34 weeks of pregnancy who performed resistance exercise were less likely to require insulin during the remainder of their pregnancy as compared with women with gestational diabetes in the control group. Additionally, exercise modulates maternal weight gain in pregnancy and reduces the risk of large-for-gestational-age newborns, which are concerns with gestational diabetes(Kascia et al., 2019)

### *Hypertension and preeclampsia*

Hypertension and preeclampsia are significant sources of morbidity and mortality in pregnancy. Although physical activity is known to be helpful in preventing cardiovascular disease, a similar association between physical activity in pregnancy and hypertension or preeclampsia has not been definitively shown. Data reported from the North Carolina Pregnancy Risk Assessment Monitoring System indicate that gestational hypertensive complications are less likely in women who are physically active before and during pregnancy. Conversely, an increased risk of developing preeclampsia was shown with greater than 270 minutes of exercise per week in a prospective cohort study of 85,139 pregnant Danish women. A 2012 review of randomised control, cohort, and case-control

studies suggests that there is a trend towards a preventive effect of physical activity on the development of preeclampsia. However, there was a dearth of studies, and the evaluation of the few studies was complicated by differing methodologies, including the quantification of physical activity and the diagnosis of preeclampsia (Mortola *et al*., 2019).

**Maternal-Foetal Circulation and Foetal Growth**

There is theoretical concern that exercise may negatively impact the developing foetus in terms of hemodynamics and growth. However, this is unsubstantiated in the current literature. Multiple studies have shown that blood flow to the foetus is not significantly altered by moderate-intensity physical activity. Interestingly, an increase in total vascular volume, capillary surface area, and parenchymal density was demonstrated in the placentas of women delivering at term who had exercised during the first half or all of their pregnancy. Overall, birth weight was not significantly different between physically active women and inactive women. Additionally, several studies have demonstrated that women who were physically active had a decreased risk of having babies that were large for gestational age. Although additional studies would be beneficial, research thus far indicates that physical activity is safe for the developing foetus (Mortola *et al.,* 2019).

**Labour and Delivery**

Regular exercise may shorten the duration of labour and reduce the risk of caesarean section and operative-assisted vaginal delivery. Improved tone of the abdominal and pelvic floor musculature and aerobic fitness may be important factors. Evidence-based support for this is limited, as there are few contradictory results. Women who participated in an exercise programme throughout their pregnancies had a lower percentage of caesarean sections and instrumental vaginal deliveries compared with a control group. This was in contrast to an earlier randomised controlled trial showing that there was no significant difference in caesarean sections and instrumental vaginal deliveries for women participating in an exercise programme compared with a control group. However, the exercise programme was only from weeks 20 to 36 of gestation, compared with weeks 6 to 39 in the later study. In another study, aerobic fitness was tested only in nulliparous women, who can affect labour duration, and a higher maximal oxygen consumption ($VO_2$ max) as a measure of aerobic fitness was associated with an approximately 30-minute shorter labour duration (Obesity in pregnancy, 2016).

**Perinatal Depression**

Since exercise is associated with fewer depressive symptoms in adults with clinical depression, it has also been hypothesised that exercise would alleviate symptoms of depression during pregnancy and postpartum. Although several

studies report a decrease in depressive symptoms on questionnaire in women who are physically active, the findings are not consistent. One study showed that pregnant women who exercised 1 to 2 times per week but not 3 times or more per week were less likely to report depression, while another study reported decreased depression in pregnant women who exercised 4 times or more per week but not less than 4 times per week. Additionally, it is not clear whether the lower depression scores reported are clinically significant. A meta-analysis of five randomised controlled trials concluded that there is insufficient evidence to determine whether exercise reduces symptoms of postpartum depression (Nakamura et al., 2019)

## Types and Benefits of Exercise in Pregnancy

### *Types of exercises*

Women with uncomplicated pregnancies should be encouraged to engage in aerobic and strength-conditioning exercises before, during, and after pregnancy. Contact activities with a high risk of abdominal trauma or imbalance should be avoided. Scuba diving should be avoided in pregnancy because of the inability of the foetal pulmonary circulation to filter bubble formation (Kascia et al., 2019). Women living at sea level were able to tolerate physical activity up to altitudes of 6,000 feet, suggesting this altitude is safe in pregnancy (Holliday *et al.*, 2023), although more research is needed. Women who reside at higher altitudes may be able to exercise safely at altitudes higher than 6,000 feet.

In those instances, in which women experience low-back pain, exercise in water is an alternative (Newton& May, 2017). A study of the apparent weight reduction during water immersion in a third-trimester pregnant woman measured a mean of 82.9% of body weight, a reduction that lowers the maternal osteoarticular load due to buoyancy (Alberton *et al.*, 2019). There may be additional benefits to aquatic exercise as well. A randomised controlled trial of an aquatic physical exercise programme during pregnancy consisting of three 60-minute exercises demonstrated a greater rate of intact perineum after childbirth (OR 13.54, 95% CI, 2.75–66.56) (Rodriguez *et al.*, 2019).

### *Benefits of exercise in pregnancy*

The following are some of the benefits of exercising for pregnant women:
There is a higher incidence of vaginal delivery and a lower incidence of:

1. Excessive gestational weight gain
2. Gestational diabetes mellitus
3. Gestational hypertensive disorders*
4. Preterm birth
5. Caesarean birth
6. Lower birth weight

## Conclusion

Regular physical activity in all phases of life, including pregnancy, promotes health and enhances wellbeing. Pregnancy is an ideal time for maintaining or adopting a healthy lifestyle, and since exercise has been validly established to have a significant therapeutic effect in pregnancy, it should then be advocated by all stakeholders in public health dealing with maternal health issues**.** For women without contraindications to physical activity, exercise is safe for both the woman and the developing foetus. In general, women who are physically active prior to pregnancy should be advised to maintain and counselled that they can increase their level of activity if desired, while physically inactive women should be encouraged to begin exercising.In line with the discussion in previous pages, the following recommendations were made:

1. A thorough clinical evaluation should be conducted before recommending an exercise regimen to ensure that a pregnant mother does not have a medical reason to avoid exercise.
2. Women with uncomplicated pregnancies should be encouraged to engage in aerobic and strength-conditioning exercises before, during, and after pregnancy through a health literacy programme.
3. Obstetricians, gynaecologists, and other obstetric care providers like midwives, should evaluate women with medical or obstetric complications carefully before making recommendations on physical activity participation during pregnancy.

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