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Physical Activity During Pregnancy and Its Effects on Maternal Physical and Mental Health: A Narrative Review

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Abstract (Structured)

Background. Physical activity adapted to pregnancy can provide important physical and psychological benefits while supporting maternal health.

Aim. To summarize the physiological changes that occur during pregnancy, describe beneficial and safe forms of physical exercise, and discuss their effects on maternal physical and mental health and selected pregnancy and postpartum outcomes.

Material and methods. A structured narrative review was conducted using PubMed. Publications from 2021 to 2026 were prioritized, while older studies were retained when directly relevant to the mechanisms or clinical questions addressed. The source manuscript included 38 publications covering original studies, systematic reviews, meta-analyses, clinical guidelines, consensus documents, and selected relevant reports.

Results. The reviewed evidence indicates that appropriately prescribed exercise during pregnancy is associated with a lower risk of gestational diabetes and hypertensive disorders, lower total gestational weight gain, a lower risk of caesarean section, and potentially shorter labour. Physical activity also supports postpartum recovery and may improve maternal psychological well-being and reduce depressive symptoms. Exercise should nevertheless be adapted to the physiological changes and clinical status of each pregnancy.

Conclusions. Regular, appropriately modified physical activity is beneficial for women with uncomplicated pregnancies and is associated with substantial maternal health benefits and little evidence of harm when appropriately prescribed.

Key words: pregnancy, physical exercise, physical activity, vaginal birth, caesarean section, gestational diabetes, postpartum depression

1. Introduction

Physical activity is any bodily movement produced by skeletal muscles that requires energy expenditure. It includes movement during leisure time, transportation, work, and domestic activities [27].

Physical activity at all stages of life is important for maintaining health. According to the World Health Organization guidelines, adults should undertake 150–300 minutes of moderate-intensity, or 75–150 minutes of vigorous-intensity, physical activity per week, or an equivalent

combination. Regular physical activity is associated with benefits in weight control, bone health, cardiometabolic health, physical fitness, psychosocial outcomes, cognition, and sleep quality [6, 32].

Despite these benefits, insufficient physical activity remains common worldwide. A pooled analysis published in 2024 estimated that 27.5% of adults did not meet recommended levels of aerobic physical activity, while inactivity was substantially more prevalent among adolescents [27]. A 2024 systematic review reported that only a minority of pregnant women exercise regularly [25]. Pregnancy therefore represents an important period in which physical activity should be considered as part of preventive health care, while the type and intensity of exercise should be adapted to maternal and fetal safety.

Research Objective. The objective of this narrative review was to summarize the main anatomical and physiological changes during pregnancy, identify forms of physical exercise considered beneficial and safe, and synthesize evidence on their effects on maternal physical and mental health and selected pregnancy and postpartum outcomes.

Research Problems. The review addressed three main questions: (1) What physiological changes during pregnancy are relevant when prescribing physical activity? (2) Which maternal and pregnancy outcomes are associated with regular physical exercise? (3) What potential benefits and limitations of prenatal exercise should be considered in clinical practice?

Research Hypotheses. As this is a narrative review rather than an original experimental study, no statistical hypotheses were formulated.

2. Research materials and methods

2.1. Search strategy

This study was conducted as a structured narrative review focusing on the positive impact of physical exercise on pregnant women. The literature search was conducted in the PubMed database, with the final update performed on October 4, 2026. The search used combinations of terms related to the main areas of the review, including pregnancy, physical exercise, postpartum, urinary incontinence, gestational diabetes mellitus, caesarean section, preeclampsia, and fetal oxygen supply. Publications from 2021 to 2026 were prioritized.

2.2. Eligibility criteria

Older studies were included only when they directly addressed the mechanisms under review or provided clinically relevant evidence not sufficiently represented in newer publications. Eligible publications included original studies involving human participants, systematic and narrative reviews, meta-analyses, current clinical guidelines, consensus documents, and selected case studies relevant to the topic.

2.3. Data collection and analysis

The selected literature was synthesized narratively according to the major themes of the review: physiological adaptations to pregnancy, maternal and neonatal outcomes associated with prenatal exercise, prevention of pregnancy-related disorders, and maternal mental health. Because the study was a narrative review, no pooled statistical analysis or independent statistical testing was performed.

2.3.1. Statistical software

Not applicable. No original quantitative dataset was analysed.

2.3.2. AI-assisted technologies

During preparation of the manuscript, the authors used AI to improve the clarity and readability of the text and to assist with basic data analysis. The authors reviewed and edited the generated content where necessary and take full responsibility for the final content of the publication. It is important to emphasize that all AI tools were used strictly as assistive instruments under human supervision. The final interpretation of results, classification of errors, and conclusions were determined by human experts in clinical medicine and formal logic. The AI tools served primarily to enhance efficiency in data processing, pattern recognition, and linguistic refinement, rather than replacing human judgment in the analytical process.

3. Research results

3.1. Anatomical and physiological changes during pregnancy

3.1.1. Circulation and cardiovascular system

Major changes occur in a woman's body to support the growing fetus and create a suitable environment for its development. Many of these changes begin shortly after implantation and

continue throughout pregnancy. Total blood volume increases by almost 50%, with a substantial increase in plasma volume. This adaptation supports the enlarged uterus and growing fetus. The number of erythrocytes also increases; however, haematocrit decreases slightly, producing the phenomenon known as physiological anaemia of pregnancy. The coagulation system also undergoes changes, including alterations in platelet count, bleeding time, and prothrombin time [21].

The enlargement of the uterus changes the position of the heart, which moves slightly upwards. Cardiac output and stroke volume increase by approximately 30–50% during pregnancy and increase further during labour. During the first trimester, the increase in cardiac output is mainly attributable to stroke volume, whereas later in pregnancy, particularly during the third trimester, it is increasingly attributable to an increased heart rate [36]. These physiological changes should not be confused with pathological tachycardia, such as postural orthostatic tachycardia syndrome, which can present with similar symptoms [24]. Blood pressure decreases and reaches its lowest level at approximately 20–24 weeks of pregnancy, largely as a consequence of reduced peripheral vascular resistance [26].

3.1.2. Respiratory system

There are substantial changes in the respiratory system during pregnancy. Anatomical changes include elevation of the diaphragm and enlargement of the transverse diameter and circumference of the chest. The altered position of the diaphragm contributes to a slight decrease in total lung capacity, residual volume, and expiratory reserve volume, largely as a result of uterine enlargement. Functionally, tidal volume and minute ventilation increase under hormonal influences, particularly those of progesterone, estrogen, and relaxin [9]. The growing fetus and placenta increase maternal oxygen requirements. Increased minute ventilation raises alveolar oxygen levels and the partial pressure of oxygen in arterial blood. During pregnancy, PaO₂ is approximately 100–110 mmHg, compared with approximately 75–100 mmHg in non-pregnant women, while PaCO₂ decreases from approximately 40 to 27–33 mmHg. Dyspnoea occurs in up to 60–70% of pregnant women, most often during the first or second trimester [9].

3.1.3. Urinary system

There are many anatomical and physiological changes in the urinary system during pregnancy. The kidneys increase in length by approximately 1–1.5 cm, and renal volume increases by about

30%, partly because of increased renal blood flow. Increased progesterone levels induce relaxation of the smooth muscles of the ureters, leading to widening of the renal pelvises and calyces. Progesterone also induces relaxation of the urinary bladder, which is displaced upwards by the enlarging uterus [5, 19]. Functionally, the most important changes include overall vasodilation and decreased vascular resistance. These adaptations are accompanied by lower blood concentrations of uric acid, particularly during the first trimester, lower potassium concentrations, and increased secretion of hormones such as erythropoietin, renin, and the active form of vitamin D [5,11,19].

Table 1. Changes in the urinary system during pregnancy

Parameter	Change
Circulating blood volume	40–50% increase
Renal plasma flow	50–70% increase
Glomerular filtration rate	50% increase
Renal length	1–1.5 cm increase
Renal volume	30% increase

Based on Minami et al. (2025).

3.1.4. Gastrointestinal system

Most gastrointestinal changes involve motility and hormone secretion. Upward displacement of the stomach and slower oesophageal peristalsis promote reflux of acidic gastric contents into the oesophagus. Increased progesterone levels slow colonic motility, which can contribute to constipation. Lower motilin levels may also contribute. These changes may increase the risk of haemorrhoids, which are common during pregnancy [21,22].

3.1.5. Musculoskeletal system

Anatomical changes during pregnancy contribute to increased mobility of the sacroiliac joints and pubic symphysis. These changes, together with hormonal fluctuations, occur from the end of the first trimester and contribute to increased lumbar lordosis and thoracic kyphosis. These adaptations compensate for the shift in the centre of gravity, primarily caused by enlargement of the abdomen. They may predispose pregnant women to musculoskeletal dysfunctions and disorders. Many women report spinal pain, especially in the lumbar region, as well as discomfort

or pain in the tibiofemoral and hip joints. Pain in the lower extremities may also be associated with substantial gestational weight gain [10, 14, 7]. Careful monitoring of physiological changes during pregnancy is therefore important when selecting and modifying physical activity and for the early recognition of complications.

3.2. Beneficial and safe forms of physical exercise

The source review identified several forms of exercise that may be beneficial during pregnancy when appropriately adapted to the woman's health status and stage of pregnancy.

Safe and beneficial exercises
Cycling
Stretching exercises
Yoga
Hydrotherapy and water aerobics
Resistance exercises
Walking

Source: Rodrigues-Denize et al. (2024).

3.3. Birth and postpartum outcomes

Pregnancy and childbirth are physiologically demanding and may be associated with maternal and neonatal complications. Recent data cited in the source manuscript reported that, in 2023, 4.6% of women giving birth for the first time and 2.7% of all women giving birth vaginally experienced a third- or fourth-degree perineal tear. Regular physical activity adapted to pregnancy may provide benefits for both the mother and the growing fetus and may reduce selected adverse outcomes associated with childbirth.

A 2025 systematic review and meta-analysis found that women in exercise groups had a significantly higher rate of normal vaginal birth and a lower risk of caesarean section, with the reported reduction in caesarean section risk of 38% [2]. Another systematic review and meta-analysis reported that prenatal aerobic exercise, including yoga and aquatic exercise, was associated with favourable maternal and neonatal outcomes and a higher rate of normal vaginal birth in selected populations [29].

Recent studies have also reported a shorter duration of the first stage of labour among physically active women. In addition to benefits directly related to childbirth, physical activity may support postpartum recovery. However, exercise does not appear to have a substantial effect on all neonatal outcomes. The reviewed evidence did not show consistent differences in Apgar scores, birth weight, or head circumference [2, 23, 29]. Emergency caesarean section is associated with a greater risk of maternal and neonatal complications than elective caesarean section [35].

3.4. Prevention of pregnancy-related disorders

Several disorders may develop during pregnancy, including gestational diabetes mellitus, hypertensive disorders, obesity, urinary incontinence, venous thromboembolism, cardiovascular disease, chronic kidney disease, and postnatal depression [18]. Regular physical activity has been associated with a lower risk or severity of some of these disorders and may help maintain overall physical fitness.

Current evidence from systematic reviews and meta-analyses indicates that prenatal exercise is associated with a lower risk of gestational diabetes mellitus and hypertensive disorders of pregnancy. A 2026 systematic review and meta-analysis of 88 randomized controlled trials reported reductions in gestational diabetes (RR 0.75, 95% CI 0.63–0.88), hypertensive disorders of pregnancy (RR 0.67, 95% CI 0.54–0.83), caesarean section (RR 0.86, 95% CI 0.80–0.93), and total gestational weight gain [33]. A 2024 review similarly concluded that physical activity decreases the risk of hypertensive disorders of pregnancy and gestational diabetes [28].

A meta-analysis of women with pre-existing medical conditions found that regular physical exercise did not increase the incidence of perinatal complications and was not associated with adverse maternal or neonatal effects. Conversely, exercise was associated with a reduced number of caesarean sections [1]. Evidence is less consistent for urinary incontinence. A 2021 systematic review found no clear association between exercise and improvement in urinary incontinence during pregnancy or postpartum [30]. Potential preventive mechanisms for hypertensive disorders, including preeclampsia, have also been described [12].

Table 2. Selected long-term physiological benefits associated with regular exercise

Potential long-term benefits
Lower blood pressure
Cardiac hypertrophy
Enlargement of the microvascular network
Higher muscle capillary density
Reduction in resting heart rate

Source: van Poppel et al. (2024).

3.5. Mental health

Pregnancy and the perinatal period involve substantial changes in mental well-being related to hormonal changes, stress, sleep deprivation, and the transition to motherhood. This period may be associated with increased vulnerability to depression and anxiety [8]. Regular physical activity may have a positive impact on the mental health of pregnant women. Earlier randomized evidence reported a lower percentage of women with depressive symptoms at 38 weeks of pregnancy and during the postpartum period among physically active women (14.5% versus 29.8% in the control group). Aquatic exercise performed for one hour, three times per week, was also associated with a lower risk of postpartum depression in an earlier randomized trial [13, 15]. More recent systematic reviews and meta-analyses support a beneficial association between prenatal exercise and prenatal or postpartum depressive and anxiety symptoms [7, 13, 16].

4. Discussion

The evidence summarized in this review supports the view that appropriately prescribed physical activity should be considered an important component of health promotion during uncomplicated pregnancy. The potential benefits extend across several domains: cardiometabolic health, gestational weight management, selected obstetric outcomes, physical fitness, and mental well-being. The consistency of findings across systematic reviews and meta-analyses is particularly notable for gestational diabetes, hypertensive disorders, gestational weight gain, and caesarean section [28, 33, 34].

The findings should nevertheless be interpreted in the context of the physiological adaptations of pregnancy. Changes in cardiovascular, respiratory, urinary, gastrointestinal, and musculoskeletal

systems alter exercise tolerance and may require modification of intensity, duration, exercise type, and body position. Current clinical guidance emphasizes individualized assessment and adaptation rather than a single exercise prescription for all pregnant women [American College of Obstetricians and Gynecologists, 2020; 34].

The evidence regarding delivery outcomes is encouraging but should not be interpreted as demonstrating that exercise independently determines mode of delivery. Exercise interventions vary in frequency, duration, intensity, and type, and study populations differ with respect to baseline activity and obstetric risk. Similarly, the absence of consistent effects on some neonatal outcomes indicates that exercise should primarily be viewed as a maternal health intervention with additional potential obstetric benefits [2, 17, 23, 29].

Mental health represents another important area. The reviewed studies suggest that prenatal exercise may reduce depressive and anxiety symptoms and may support the transition to motherhood. However, psychological outcomes are multifactorial, and exercise should complement rather than replace appropriate psychological or psychiatric care when clinically indicated [7, 8, 13, 16].

The evidence base also has limitations. The source manuscript used a structured narrative approach rather than a systematic review protocol, and therefore did not provide a formal PRISMA-style screening process, a quantitative risk-of-bias assessment, or a meta-analytic synthesis performed by the authors. The search was limited to PubMed, and publication years were prioritized rather than treated as a strict eligibility boundary. These features limit reproducibility and mean that the conclusions should be interpreted as a narrative synthesis rather than a definitive estimate of intervention effects.

Future research should provide clearer reporting of exercise dose, adherence, baseline physical activity, pregnancy risk status, and clinically relevant maternal and neonatal outcomes. Further studies are also warranted in populations that remain underrepresented, including athletes and women with complex pre-existing medical conditions. Evidence concerning urinary incontinence, fetal oxygen supply, and longer-term maternal outcomes should also be strengthened [3, 20, 38, 30].

5. Conclusions

Physical activity during pregnancy is recommended for women with uncomplicated pregnancies because it provides multiple physical and psychological benefits and is associated with little or no harm when appropriately prescribed. Exercise should be modified to account for anatomical and physiological changes and individual clinical circumstances. Gynaecologists and other healthcare professionals should encourage regular physical activity as part of preventive care because it may lower the risk of selected pregnancy complications, increase the likelihood of normal vaginal birth, support gestational weight management, and improve maternal mental well-being. Additional research should address specific populations, including athletes and women with more complex medical histories preceding pregnancy.

Disclosure

The authors report no disclosures.

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