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The Physical Activity During Pregnancy: Recommended and Contraindicated Sports

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Abstract

Background. Despite growing evidence supporting the safety and benefits of exercise in pregnancy, pregnant women and their healthcare providers frequently lack clear guidance on which specific sports are safe, which require modification, and which should be avoided.

Aim. This narrative review synthesizes current evidence on physical activity during pregnancy, with focus on classifying specific sports as recommended, conditionally permitted, or contraindicated, and on providing trimester-specific recommendations.

Material and Methods. A structured search of PubMed/MEDLINE, Scopus, and Web of Science was conducted, covering publications from January 2010 to January 2025.

Results. Regular moderate-intensity physical activity reduces the risk of gestational diabetes, excessive weight gain, hypertensive disorders, and prenatal depression. Walking, swimming, stationary cycling, prenatal yoga, Pilates, and moderate resistance training are safe across all trimesters. Contact sports, scuba diving, high-altitude exercise, hot yoga, and maximal-intensity exertion constitute absolute or relative contraindications. Recreational running and tennis may be continued with progressive modification by previously active women.

Conclusions. Physical activity in pregnancy is safe and beneficial when appropriately selected and adapted to each trimester. Current guidelines converge on general principles but lack sport-specific detail. This review provides a clinically applicable, evidence-based classification of individual sports within a trimester-sensitive framework.

Keywords: pregnancy; physical activity; exercise; sports; contraindications; prenatal; gestational diabetes; trimester

1. Introduction

Physical activity is one of the cornerstones of preventive medicine and health promotion across all stages of life. Regular exercise reduces the risk of cardiovascular disease, type 2 diabetes mellitus, obesity, depression, and all-cause mortality, and its benefits are well-documented in the general population (Warburton & Bredin, 2017). However, pregnancy represents a unique physiological state during which the appropriateness, intensity, and type of physical activity require careful consideration - both to protect maternal health and to ensure optimal fetal development.

For decades, physical activity during pregnancy was approached with excessive caution, and in many cases, pregnant women were advised to significantly limit or entirely avoid exercise (Evenson et al., 2019). This conservative stance has been progressively challenged by a growing body of evidence demonstrating not only the safety but the substantial benefits of moderate physical activity throughout an uncomplicated pregnancy. Contemporary guidelines issued by major obstetric and sports medicine organizations - including the American College of Obstetricians and Gynecologists (ACOG), the World Health Organization (WHO), and - most recently - the Polish Society of Gynecologists and Obstetricians together with the Polish Society of Sports Medicine (PTGiP/PTMS) - now actively recommend regular physical activity for most pregnant women in the absence of medical contraindications (ACOG, 2020; WHO, 2020; Kwiatkowska et al., 2023).

Pregnancy induces profound physiological adaptations across virtually all organ systems. Cardiovascular output increases by up to 50%, respiratory mechanics are altered by the enlarging uterus, the center of gravity shifts progressively, ligamentous laxity increases under the influence of relaxin, and oxygen consumption at rest is elevated (Soma-Pillay et al., 2016). These changes directly influence the safety, tolerance, and appropriateness of specific types of physical activity. What is safe and beneficial in the first trimester may carry different risk profiles in the third, and what is appropriate for a low-risk pregnancy may be contraindicated in the setting of placenta previa, preeclampsia, or cervical insufficiency.

Despite the growing consensus on the general benefits of exercise in pregnancy, significant knowledge gaps and practical uncertainties remain - particularly regarding specific sports and activities. Pregnant women and healthcare providers alike frequently lack clear, evidence-based guidance on which sports are safe to continue, which require modification, and which should be avoided entirely. This uncertainty contributes to both unnecessary restriction of beneficial activities and, conversely, continued participation in sports that carry genuine risk for maternal-fetal injury.

Research Objective

The aim of this narrative review is to synthesize the current evidence on physical activity during pregnancy, with particular focus on identifying and classifying specific sports and physical activities as recommended, conditionally permitted, or contraindicated, and on providing trimester-specific and clinical context for these recommendations.

Research Problems

What physiological changes during pregnancy affect exercise tolerance and safety?

Which sports and physical activities are beneficial and safe during an uncomplicated pregnancy?

Which sports carry significant risk and should be avoided or modified during pregnancy?

How do recommendations differ across trimesters and in the presence of clinical risk factors?

Research Hypotheses

Regular, appropriately selected physical activity during pregnancy is safe and beneficial for both mother and fetus across all trimesters in the absence of absolute contraindications, while certain sports pose measurable risks that justify their restriction or prohibition during pregnancy.

2. Research materials and methods

2.1. Participants

This narrative review did not involve direct recruitment of human participants. The study population comprised the existing body of scientific literature pertaining to physical activity and sport during pregnancy. No individual patient data were collected or analyzed.

2.2. Procedure

A structured literature search was conducted across three electronic databases: PubMed/MEDLINE, Scopus, and Web of Science. The following search terms were applied individually and in Boolean combinations (AND, OR): "physical activity pregnancy", "exercise pregnancy safety", "sports pregnancy contraindications", "prenatal exercise", "pregnancy exercise guidelines", "physical activity pregnancy trimester", "exercise pregnancy fetal outcomes", "pregnancy sport risk". In addition, reference lists of included articles were manually screened to identify relevant publications not captured through database searches. Clinical guidelines issued by recognized obstetric and sports medicine organizations were included regardless of publication date due to their authoritative role in clinical practice.

Inclusion criteria: (1) publication between January 2010 and January 2025; (2) written in English; (3) human subjects; (4) direct relevance to physical activity, exercise, or sport during

pregnancy; (5) article type: original research, systematic review, meta-analysis, narrative review, or evidence-based clinical guideline.

Exclusion criteria: (1) publication before 2010; (2) available only as conference abstract, editorial, or letter to the editor; (3) absence of abstract or full text; (4) exclusive focus on postpartum exercise without reference to the antenatal period; (5) non-human subjects.

2.3. Data collection and analysis

2.3.1. Statistical Software

This narrative review did not involve primary data collection or statistical analysis. Findings from included publications were synthesized qualitatively. No statistical software was used.

2.3.2. AI

AI was utilized for one specific purpose in this work: assistance in refining the academic English language of the manuscript, ensuring clarity, consistency, and adherence to scientific writing standards. Claude (Anthropic) was used for additional linguistic refinement of the research manuscript, ensuring proper English grammar, style, and clarity in the presentation of results. It is important to emphasize that all AI tools were used strictly as assistive instruments under human supervision. The final selection of sources, interpretation of evidence, classification of sports activities, and all conclusions were determined by the author. The AI tools served primarily to enhance linguistic quality rather than replacing human judgment in the analytical process.

2.3.3. Data Synthesis

Due to the heterogeneity of study designs, populations, and outcome measures across included publications, a formal meta-analysis was not performed. Findings were synthesized narratively and organized thematically in accordance with the structure of this review: physiological changes during pregnancy, general benefits of physical activity, recommended sports, contraindicated sports, trimester-specific recommendations, and clinical contraindications to exercise.

3. Results

3.1. Physiological changes during pregnancy

Pregnancy induces a cascade of profound physiological adaptations across virtually all organ systems. Understanding these changes is fundamental to evaluating the safety and appropriateness of specific physical activities, as they directly influence exercise tolerance, biomechanics, thermoregulation, and maternal-fetal oxygen delivery.

Cardiovascular system. The cardiovascular system undergoes some of the most significant and earliest adaptations in pregnancy. Cardiac output increases by 30–50% above pre-

pregnancy values, driven by a rise in both stroke volume and heart rate (Soma-Pillay et al., 2016). Plasma volume expands by approximately 40–50%, while red blood cell mass increases by only 20–30%, resulting in the physiological anaemia of pregnancy - a haemodilution that reduces blood viscosity and facilitates placental perfusion (Sanghavi & Rutherford, 2014). Systemic vascular resistance decreases due to the vasodilatory effects of progesterone and prostacyclin, leading to a mild reduction in mean arterial blood pressure during the second trimester, which partially reverses in the third (Soma-Pillay et al., 2016). These adaptations have direct implications for exercise: resting heart rate is elevated, maximal heart rate may be slightly reduced, and the cardiovascular response to submaximal exercise is augmented compared to the non-pregnant state (Mottola et al., 2019).

Respiratory system. The enlarging uterus progressively elevates the diaphragm by up to 4cm, reducing functional residual capacity and expiratory reserve volume. Despite this mechanical disadvantage, minute ventilation increases by approximately 40–50%, primarily through an increase in tidal volume rather than respiratory rate, driven by progesterone-mediated stimulation of the respiratory centre (LoMauro & Aliverti, 2015). This results in a state of compensated respiratory alkalosis, with arterial PCO₂ falling to approximately 30 mmHg. The subjective sensation of dyspnoea, reported by up to 70% of pregnant women, does not necessarily reflect impaired exercise capacity and must be distinguished from pathological breathlessness (Soma-Pillay et al., 2016). Oxygen consumption at rest increases by 15–20% to meet the metabolic demands of the fetoplacental unit, the enlarged uterus, and increased maternal cardiac and respiratory work (LoMauro & Aliverti, 2015).

Musculoskeletal system. Progressive weight gain - averaging 11–16 kg in a normal-weight woman - and the anterior displacement of the gravid uterus shift the centre of gravity forward, altering posture, gait, and balance (Evenson et al., 2014). Compensatory lumbar hyperlordosis increases mechanical stress on the lumbosacral spine and contributes to the high prevalence of low back and pelvic girdle pain in pregnancy, affecting approximately 50–70% of women (Mottola et al., 2019). Relaxin, a peptide hormone produced by the corpus luteum and the placenta, reaches peak concentrations in the first trimester and promotes ligamentous laxity throughout the body - most notably at the sacroiliac joints and pubic symphysis, but also at peripheral joints including the knee and ankle (Soma-Pillay et al., 2016). This generalized joint hypermobility reduces proprioceptive stability and increases the risk of sprains, falls, and musculoskeletal injury during weight-bearing and high-impact activities.

Thermoregulation. Basal metabolic rate increases by approximately 15–20% during pregnancy, generating greater heat production at rest and during exercise (Mottola et al., 2019).

Simultaneously, pregnancy enhances thermoregulatory efficiency through earlier onset of sweating and increased cutaneous blood flow, enabling more effective heat dissipation. Nevertheless, the risk of maternal hyperthermia - which is teratogenic, particularly in the first trimester, where core temperatures exceeding 39.0°C have been associated with neural tube defects - necessitates caution regarding exercise in hot and humid environments, use of hot tubs, or sustained high-intensity exertion (ACOG, 2020). Adequate pre-exercise hydration and avoidance of exercise during peak ambient temperatures are essential preventive measures.

Endocrine and metabolic adaptations. Pregnancy is characterized by progressive insulin resistance, mediated by placental hormones including human placental lactogen, progesterone, and cortisol, which redirect glucose preferentially toward the fetus (Soma-Pillay et al., 2016). This creates a state of accelerated starvation in the mother, with increased reliance on fat oxidation during fasting. Physical activity modulates insulin sensitivity and glucose metabolism, which underpins the established role of exercise in the prevention and management of gestational diabetes mellitus (Mottola et al., 2019). Cortisol levels rise throughout pregnancy, and the hypothalamic-pituitary-adrenal axis shows altered reactivity to exercise-induced stress, though the clinical significance of this for moderate exercise remains limited in uncomplicated pregnancies.

Haematological changes. As noted, plasma volume expansion exceeds the increase in red cell mass, producing physiological anaemia. Iron requirements increase substantially, particularly in the second and third trimesters, to support erythropoiesis and fetal iron stores (Sanghavi & Rutherford, 2014). Pregnancy is also a hypercoagulable state - concentrations of clotting factors I, VII, VIII, X, and XII increase, while natural anticoagulant mechanisms are partially suppressed, raising the risk of venous thromboembolism. This is particularly relevant for activities involving prolonged immobility or high-altitude exposure (ACOG, 2020).

3.2. General benefits of physical activity during pregnancy

Regular physical activity during pregnancy, in the absence of obstetric or medical contraindications, confers substantial benefits for both the mother and the developing fetus. The growing body of evidence supporting these benefits has been instrumental in shifting clinical practice away from the historically conservative approach of recommending rest and activity restriction toward the current consensus actively endorsing moderate exercise throughout pregnancy.

Maternal metabolic benefits. One of the most extensively documented benefits of prenatal exercise is the reduction in risk of gestational diabetes mellitus (GDM). Regular moderate-intensity physical activity improves insulin sensitivity and glucose uptake in skeletal muscle,

counteracting the progressive insulin resistance characteristic of pregnancy. Meta-analyses have demonstrated that women who exercise regularly during pregnancy have a 28–30% lower risk of developing GDM compared to sedentary counterparts (Sanabria-Martínez et al., 2015). Furthermore, in women already diagnosed with GDM, structured exercise programmes have been shown to reduce the need for insulin therapy and improve glycaemic control (Mottola et al., 2019).

Prevention of excessive gestational weight gain. Excessive gestational weight gain is associated with increased risks of caesarean delivery, postpartum weight retention, and long-term maternal obesity, as well as adverse neonatal outcomes including macrosomia. Regular physical activity is an effective strategy for maintaining weight gain within guidelines recommended by the Institute of Medicine, without compromising fetal growth (Nascimento et al., 2015). Women who engage in structured exercise programmes during pregnancy demonstrate significantly lower rates of excessive weight gain compared to inactive controls (Ruchat et al., 2012).

Cardiovascular and musculoskeletal benefits. Exercise during pregnancy reduces the risk of hypertensive disorders, including gestational hypertension and pre-eclampsia, through mechanisms involving improved endothelial function, reduced oxidative stress, and modulation of inflammatory pathways (Aune et al., 2014). Regular physical activity also attenuates the musculoskeletal discomforts commonly associated with pregnancy: structured exercise programmes, particularly those incorporating core strengthening and pelvic floor training, have been shown to reduce the severity of low back pain and pelvic girdle pain (Liddle & Pennick, 2015). Pelvic floor muscle training during pregnancy additionally reduces the risk of urinary incontinence both antenatally and postpartum (Woodley SJ et al., 2020).

Psychological and mental health benefits. Pregnancy is associated with elevated rates of anxiety and depression, affecting approximately 15–20% of women antenatally. Regular physical activity has well-established anxiolytic and antidepressant effects mediated through endorphin release, modulation of the hypothalamic-pituitary-adrenal axis, and improvements in self-efficacy and body image. Exercise during pregnancy has been associated with reduced symptoms of prenatal depression and anxiety, improved sleep quality, and enhanced overall quality of life (Davenport et al., 2018; WHO, 2020).

Benefits for labour and delivery outcomes. Evidence suggests that physically active pregnant women experience more favourable labour outcomes, including shorter duration of active labour, lower rates of operative vaginal delivery, and reduced frequency of caesarean section (Domenjoz et al., 2014). These benefits are thought to reflect improved cardiovascular reserve,

greater muscular endurance, and the psychological preparedness associated with regular exercise.

Fetal and neonatal benefits. The benefits of prenatal exercise extend to the fetus. Regular moderate-intensity exercise has been associated with appropriate fetal growth, without evidence of intrauterine growth restriction when exercise is performed within recommended intensity guidelines (Mottola et al., 2019). Studies have demonstrated that fetuses of exercising mothers show favourable cardiovascular adaptations, including lower baseline fetal heart rate and improved heart rate variability, reflecting enhanced autonomic maturation (May et al., 2010). Additionally, children born to physically active mothers demonstrate improved neurodevelopmental outcomes and healthier metabolic profiles in early childhood (Davenport et al., 2018).

3.3. Recommended sports and physical activities

Current evidence and clinical guidelines consistently identify a range of sports and physical activities as safe, beneficial, and appropriate for women with uncomplicated pregnancies. The following activities are recommended based on their low injury risk, cardiovascular benefit, and adaptability across all three trimesters.

Walking

Walking is universally recommended as the most accessible and safest form of aerobic exercise during pregnancy. It carries minimal risk of falls or trauma, is easily modifiable in intensity and duration, and can be continued throughout all three trimesters without significant modification (ACOG, 2020). Even women who were sedentary prior to pregnancy are encouraged to begin with regular walking as a primary form of prenatal physical activity.

Swimming and water-based exercise

Aquatic exercise is particularly well-suited to pregnancy due to the buoyancy of water, which offloads mechanical stress from weight-bearing joints and the lumbosacral spine, reduces the risk of falls and trauma, and facilitates thermoregulation through heat dissipation (Barakat et al., 2014). Swimming and water aerobics have been shown to reduce oedema of the lower extremities, alleviate low back and pelvic girdle pain, and provide effective cardiovascular conditioning without elevating core body temperature to unsafe levels. Aquatic exercise is recommended across all three trimesters and is particularly valuable in the third trimester when musculoskeletal discomfort limits weight-bearing activities (Bacchi et al., 2018).

Stationary cycling

Cycling on a stationary bicycle eliminates the risk of balance-related falls associated with outdoor cycling, making it a safe cardiovascular option throughout pregnancy, including the

third trimester (ACOG, 2020). The seated position reduces lumbosacral loading, and resistance and duration can be readily adjusted as pregnancy progresses. Handlebar height should be adjusted to accommodate the growing abdomen and maintain an upright posture.

Prenatal yoga and stretching

Yoga adapted for pregnancy promotes flexibility, core stability, pelvic floor awareness, and relaxation, while avoiding poses that involve supine positioning, deep abdominal compression, or significant balance challenges (Curtis et al., 2012). Prenatal yoga has demonstrated benefits for anxiety reduction, sleep quality, and labour preparedness. Hot yoga, however, is explicitly contraindicated due to the risk of maternal hyperthermia (ACOG, 2020).

Pilates

Prenatal Pilates focuses on core muscle activation, pelvic floor strengthening, and postural alignment - all of relevance in the context of pregnancy-related musculoskeletal changes. Evidence supports its effectiveness in reducing low back pain and improving functional movement (Mottola et al., 2019). Exercises in the supine position should be avoided after the first trimester to prevent aortocaval compression by the gravid uterus.

Low-impact aerobics and dance.

Low-impact aerobic exercise and structured dance classes designed for pregnant women provide cardiovascular benefit while minimizing jarring, high-impact movement. These activities support mood, social engagement, and physical conditioning and are appropriate for all trimesters when modified to avoid sudden directional changes and high-intensity intervals (Barakat et al., 2014).

Resistance training and light weightlifting

Moderate resistance training using free weights, resistance bands, or weight machines is considered safe during pregnancy when performed with appropriate modifications: avoiding the Valsalva manoeuvre, maintaining neutral spinal alignment, using submaximal loads, and avoiding supine exercises after the first trimester (Mottola et al., 2019). Resistance training maintains muscular strength and endurance, supports postural stability, and reduces the risk of excessive gestational weight gain.

Running and jogging

Women who were regular runners prior to pregnancy may generally continue running in the first and second trimesters, with progressive reduction in pace, distance, and intensity as pregnancy advances (ACOG, 2020; Mottola et al., 2019; Kuhrt et al., 2018). By the third trimester, biomechanical changes, pelvic girdle laxity, and increased body weight frequently

necessitate transition to lower-impact alternatives such as walking or swimming. Running is not recommended for women who were sedentary before pregnancy.

Table 1. Summary of recommended physical activities during pregnancy - trimester suitability, primary benefits, and key considerations.

Sport / Activity	T1	T2	T3	Primary benefits	Key considerations
Walking	✓	✓	✓	Cardiovascular, accessible	Adjust pace to comfort
Swimming / Water aerobics	✓	✓	✓	Joint offloading, thermoregulation, cardiovascular	Avoid diving starts
Stationary cycling	✓	✓	✓	Cardiovascular, no fall risk	Adjust handlebar height
Prenatal yoga	✓	✓	✓	Flexibility, relaxation, pelvic floor	Avoid hot yoga, supine poses (T2/T3)
Pilates	✓	✓	✓	Core strength, posture, low back pain	Avoid supine after T1
Low-impact aerobics	✓	✓	✓	Cardiovascular, mood	Avoid high-intensity intervals
Resistance training	✓	✓	✓	Muscle strength, weight management	Submaximal loads, no Valsalva
Running /Jogging	✓	✓	X*	Cardiovascular	Only for pre-pregnancy runners; transition to walking in T3

T1 = first trimester; T2 = second trimester; T3 = third trimester; X = generally not recommended / requires modification*

3.4. Contraindicated and high-risk sports

While regular physical activity is broadly encouraged during uncomplicated pregnancy, certain sports and activities carry risks that outweigh their potential benefits and are therefore contraindicated or require significant caution. These recommendations are consistent across major clinical guidelines, including those issued by ACOG (2020), WHO (2020), and PTGiP/PTMS (Kwiatkowska et al., 2023).

Contact and collision sports

Sports involving a significant risk of bodily contact or collision - including ice hockey, football, basketball, martial arts, boxing, and rugby - are contraindicated throughout pregnancy. The primary concern is the risk of direct abdominal trauma, which may result in placental abruption, uterine rupture, premature rupture of membranes, or fetal injury. Blunt abdominal trauma during pregnancy poses a significant risk to both the mother and the fetus, with placental abruption representing one of the most serious and potentially fatal consequences (Mendez-Figueroa et al., 2013)

Scuba diving

Scuba diving is absolutely contraindicated during pregnancy. Animal data suggest possible adverse fetal effects due to fetal decompression illness and hyperbaric oxygen exposure, and while available human data are generally reassuring, they are of insufficient quality to exclude adverse outcomes (Reid & Lorenzo, 2018). The developing fetus lacks the pulmonary capacity to filter nitrogen bubbles from the bloodstream, placing it at direct risk of arterial gas embolism. Snorkelling at the surface, in contrast, is generally considered safe.

High-altitude activities

Exercise at altitudes exceeding 2500 metres above sea level is contraindicated in pregnancy, particularly for women who are not acclimatized. Chronic hypoxia at high altitude impairs uteroplacental blood flow and slows fetal growth, with multigenerational high-altitude residents showing significantly better protection from these effects than short-term visitors (Moore et al., 2011). Skiing at high-altitude resorts and mountaineering are therefore discouraged, though low-to-moderate altitude hiking in acclimatized women with uncomplicated pregnancies may be permissible with appropriate precautions.

Outdoor cycling, skating, and fall-risk activities

Outdoor cycling on roads or trails, ice or inline skating, gymnastics, equestrian sports, and downhill skiing all carry a significant fall risk, particularly as pregnancy advances and the centre of gravity shifts. In the second and third trimesters, relaxin-mediated joint laxity and altered balance increase the risk of sprains and abdominal trauma from falls (Kwiatkowska et al., 2023). These activities are generally discouraged from the second trimester onward.

Tennis and racquet sports

Tennis and other racquet sports occupy an intermediate position between recommended and contraindicated activities, and deserve specific discussion in the context of pregnancy. While recreational tennis at low-to-moderate intensity does not pose a direct risk of abdominal trauma, pregnancy-induced ligamentous laxity - mediated by relaxin - significantly increases the susceptibility of peripheral joints, particularly the knee, ankle, and shoulder, to sprains and overuse injuries during the rapid directional changes and dynamic footwork characteristic of these sports (Soma-Pillay et al., 2016; Mottola et al., 2019). Additionally, the progressive shift in the centre of gravity compromises balance and court agility, increasing fall risk from the second trimester onward. Women who played tennis regularly before pregnancy may continue at a recreational, non-competitive level in the first trimester, with progressive reduction in intensity and avoidance of sudden changes of direction. Competitive play and singles matches

with prolonged high-intensity rallies should be avoided from the second trimester, with transition to doubles or low-impact alternatives recommended.

High-intensity and maximal-effort exercise

Sustained high-intensity exercise - defined as exercise at or above 90% of maximal heart rate - is not recommended during pregnancy. A randomized controlled trial demonstrated that moderate-intensity exercise programmes do not adversely affect uteroplacental or fetal blood flow when performed within safe intensity ranges, but these protective effects may not extend to maximal exertion (de Oliveira Melo et al., 2012). At maximal intensity, redistribution of cardiac output toward exercising muscles may transiently reduce uteroplacental perfusion, with potential consequences for fetal oxygenation (WHO, 2020).

Hot yoga and exercise in high-temperature environments

As discussed in section 3.1, maternal hyperthermia poses a teratogenic risk, particularly in the first trimester. Hot yoga, sauna, steam rooms, and vigorous exercise in hot and humid conditions are therefore contraindicated (ACOG, 2020; Kwiatkowska et al., 2023).

Supine exercise after the first trimester

From the second trimester onward, prolonged exercise in the supine position is contraindicated due to the risk of aortocaval compression syndrome - compression of the inferior vena cava and aorta by the gravid uterus, which reduces maternal cardiac output and impairs uteroplacental perfusion (Lee & Landau, 2017). Exercise programmes should be modified to substitute lateral decubitus, seated, or standing alternatives.

Table 2. Summary of contraindicated and high-risk sports during pregnancy - rationale and trimester-specific considerations.

Sport / Activity	Risk category	Primary risk	Trimester restriction
Contact / Collision sports	Absolute contraindication	Abdominal trauma, placental abruption	All trimesters
Scuba diving	Absolute contraindication	Fetal decompression sickness, gas embolism	All trimesters
High-altitude exercise (>2500 m)	Absolute contraindication	Maternal/fetal hypoxia, fetal growth restriction	All trimesters
Hot yoga / Exercise in heat	Absolute contraindication	Maternal hyperthermia, teratogenicity	All trimesters (esp. T1)
Outdoor cycling / Skating	Relative contraindication	Fall risk, abdominal trauma	From T2 onward
Gymnastics / Equestrian / Downhill skiing	Relative contraindication	Fall risk, high-velocity impact	All trimesters
High-intensity / Maximal exercise	Relative contraindication	Reduced uteroplacental perfusion	All trimesters
Supine exercise	Relative contraindication	Aortocaval compression	From T2 onward
Tennis / Racquet sports	Relative contraindication	Joint injury (ligamentous laxity), fall risk, high intensity	Recreational T1 only; avoid from T2 onward

T1 = first trimester; T2 = second trimester

3.5. Trimester-specific recommendations

The physiological changes of pregnancy are not static - they evolve progressively across the three trimesters, and the appropriateness of specific physical activities must be evaluated in this dynamic context. What is safe and well-tolerated in the first trimester may require modification or cessation by the third, and individual clinical factors may necessitate further adjustment at any stage.

First trimester (weeks 1–13). The first trimester is characterised by rapid hormonal change, early organogenesis, and frequently debilitating symptoms including nausea, vomiting, and fatigue. Despite these challenges, physical activity is safe and encouraged for most women during this period, provided intensity remains moderate (ACOG, 2020; Kwiatkowska et al., 2023). Cardiovascular adaptations - including rising plasma volume and cardiac output - are already underway, and the uterus remains largely within the bony pelvis, affording protection against direct trauma. The primary concerns specific to this trimester are the teratogenic risk of hyperthermia and the theoretical risk of exercise at maximal intensity during the critical window of organogenesis (WHO, 2020). Women who exercised regularly before pregnancy may generally continue their routines with minor modifications; sedentary women should

begin gradually, starting with low-impact activities such as walking or swimming (Mottola et al., 2019).

Second trimester (weeks 14–26). The second trimester is widely considered the most suitable period for regular physical activity during pregnancy. Nausea and fatigue typically resolve, energy levels improve, and the major risks associated with early organogenesis have passed. Cardiovascular fitness is well-maintained, and most women tolerate moderate exercise comfortably (Nascimento et al., 2015). However, several important modifications become necessary during this trimester. The growing uterus begins to exert pressure on the inferior vena cava in the supine position, necessitating avoidance of supine exercise (Lee & Landau, 2017). The progressive shift in the centre of gravity, increasing ligamentous laxity, and growing abdominal circumference require transition away from activities with high fall risk - including outdoor cycling, skating, and court sports involving rapid directional changes (Kwiatkowska et al., 2023). Resistance training should be continued with submaximal loads and avoidance of the Valsalva manoeuvre.

Third trimester (weeks 27–40). Physical activity in the third trimester requires the most individualised approach. The biomechanical and physiological demands of advanced pregnancy - including marked postural changes, significant joint laxity, reduced lung volumes, and elevated resting heart rate - progressively limit exercise tolerance and narrow the range of appropriate activities (Soma-Pillay et al., 2016). Nevertheless, continued physical activity during this period confers important benefits, including reduced risk of excessive gestational weight gain, improved preparation for labour, and attenuation of pregnancy-related musculoskeletal discomfort (Davenport et al., 2018). Walking, swimming, stationary cycling, prenatal yoga, and Pilates remain safe and beneficial throughout the third trimester and are the preferred activities for most women (Barakat et al., 2016; ACOG, 2020). High-impact activities, running, and sports involving balance demands should generally be discontinued or replaced with lower-impact alternatives. Women who experience significant pelvic girdle pain, dyspnoea at rest, or oedema should seek obstetric review before continuing exercise.

General intensity guidelines across all trimesters. Regardless of trimester, exercise intensity during pregnancy should be maintained at a moderate level, commonly defined as 40–59% of heart rate reserve, or a rating of perceived exertion of 12–14 on the Borg scale (Mottola et al., 2019). The "talk test" - the ability to hold a conversation during exercise without breathlessness - provides a simple, practical proxy for appropriate intensity. Exercise sessions should be preceded by adequate warm-up and followed by cool-down, and adequate hydration must be

maintained throughout, particularly in warm environments (WHO, 2020; Kwiatkowska et al., 2023).

3.6. Absolute and relative contraindications to exercise

While physical activity is broadly recommended during uncomplicated pregnancy, certain clinical conditions preclude safe participation in exercise and must be carefully evaluated before initiating or continuing any physical activity programme. Current guidelines distinguish between absolute contraindications - conditions in which exercise is prohibited regardless of type or intensity - and relative contraindications, in which the risks and benefits must be individually assessed, and exercise may be permitted with appropriate modification and medical supervision (ACOG, 2020; Kwiatkowska et al., 2023).

Absolute contraindications

The following clinical conditions constitute absolute contraindications to exercise during pregnancy, meaning that no form of structured physical activity beyond activities of daily living should be undertaken:

Haemodynamically significant heart disease poses an absolute contraindication due to the cardiovascular demands of exercise superimposed on the already elevated cardiac output of pregnancy, which may precipitate decompensation (Mottola et al., 2019). Restrictive lung disease, including severe asthma or other conditions significantly impairing respiratory reserve, precludes safe exercise given the reduced functional residual capacity and elevated oxygen demands of pregnancy (Soma-Pillay et al., 2016). Incompetent cervix or cervical cerclage represents an absolute contraindication, as exercise-induced increases in intra-abdominal pressure may exacerbate cervical insufficiency and precipitate preterm labour. Placenta praevia after 26 weeks of gestation is an absolute contraindication due to the risk of haemorrhage associated with physical exertion and uterine activity. Preterm labour in the current pregnancy, or a history of preterm birth with ongoing risk factors, requires cessation of all non-essential physical activity (ACOG, 2020). Persistent second- or third-trimester bleeding of any aetiology warrants immediate cessation of exercise until the cause is identified and managed. Pre-eclampsia or pregnancy-induced hypertension is an absolute contraindication, as exercise may further elevate blood pressure and compromise uteroplacental perfusion (Kwiatkowska et al., 2023). Premature rupture of membranes precludes exercise due to the risk of infection, cord prolapse, and preterm delivery. Severe anaemia, defined as haemoglobin below 8 g/dl, impairs oxygen-carrying capacity to a degree incompatible with safe exercise during pregnancy (Mottola et al., 2019).

Relative contraindications

The following conditions do not universally preclude exercise but require individual assessment, medical clearance, and ongoing supervision. Exercise may be continued or initiated in a modified form if the supervising clinician determines that benefits outweigh risks: Mild-to-moderate cardiovascular or respiratory disease may permit carefully supervised low-intensity exercise, provided haemodynamic and respiratory parameters are stable (ACOG, 2020). Symptomatic anaemia - haemoglobin between 8 and 10 g/dl - warrants caution and limitation of exercise intensity until corrected. A history of spontaneous abortion or preterm birth in a previous pregnancy, in the absence of current cervical or uterine pathology, does not absolutely preclude exercise but necessitates individual evaluation (Kwiatkowska et al., 2023). Poorly controlled type 1 diabetes mellitus, hypertension, or thyroid disease requires stabilisation of the underlying condition before exercise is resumed, with ongoing monitoring during activity. Extreme obesity (BMI >40 kg/m²) poses biomechanical and cardiovascular challenges that necessitate individually tailored, low-impact exercise programmes under medical supervision (Mottola et al., 2019). Fetal growth restriction identified on ultrasound requires reassessment of the exercise programme, as reduced uteroplacental reserve may limit the safety of even moderate physical activity (de Oliveira Melo et al., 2012). Multiple gestation - twins or higher-order multiples - after 28 weeks of gestation is considered a relative contraindication due to the elevated risk of preterm labour associated with uterine overdistension and physical exertion (ACOG, 2020; WHO, 2020).

4. Discussion

This narrative review synthesizes current evidence on physical activity during pregnancy, with particular emphasis on the classification of specific sports and activities as recommended, conditionally permitted, or contraindicated. The findings presented confirm that regular moderate-intensity physical activity is safe and beneficial for most pregnant women across all three trimesters, while identifying a clearly delineated group of activities that carry disproportionate risk and should be avoided or significantly modified.

One of the most notable observations arising from this review is the high degree of concordance between major international guidelines. ACOG (2020), WHO (2020), and the most recent Polish recommendations issued jointly by PTGiP and PTMS (Kwiatkowska et al., 2023) agree regarding the safety of moderate exercise, the categories of absolute contraindication, and the importance of individual clinical assessment. This convergence reflects the maturation of the evidence base over the past decade and provides clinicians with a consistent framework for counselling pregnant patients. Notably, the 2023 Polish guidelines represent a significant

update in the national context, explicitly discouraging the restriction of physical activity as a preventive measure against pre-eclampsia or preterm birth — a practice previously common in Polish obstetric care - and aligning domestic recommendations with the international consensus (Kwiatkowska et al., 2023).

Despite this convergence at the level of general principles, a meaningful gap remains in the translation of these guidelines into sport-specific clinical advice. Most existing guidelines address exercise in terms of intensity and duration but provide limited granular guidance on individual sports. This review attempts to bridge that gap by classifying specific activities - including tennis, equestrian sports, scuba diving, and high-altitude exercise - within an evidence-based framework. The classification of tennis as a relative contraindication from the second trimester onward, for example, is not explicitly addressed in any of the three major guidelines reviewed, yet follows logically from the documented effects of relaxin-mediated ligamentous laxity, altered balance, and the biomechanical demands of the sport (Soma-Pillay et al., 2016; Mottola et al., 2019). This illustrates a broader pattern: the evidence base supports more specific guidance than current guidelines provide, and narrative reviews such as this one serve an important role in translating physiological and clinical evidence into practical recommendations.

An important and sometimes underappreciated dimension of exercise recommendations in pregnancy is the role of pre-pregnancy fitness. This review consistently distinguishes between women who were physically active before pregnancy and those who were sedentary, reflecting the evidence that the former group can generally continue their activities with progressive modification, while the latter should begin gradually with low-impact activities (ACOG, 2020; Mottola et al., 2019). The case of recreational running illustrates this principle clearly: Kuhrt et al. (2018) demonstrated in a large retrospective cohort that continuing to run during pregnancy does not adversely affect gestational age at delivery or birthweight centile, but this reassurance applies specifically to women who were already runners - not to those initiating running for the first time during pregnancy. Communicating this distinction clearly to patients is an important aspect of antenatal counselling.

A recurring concern in the literature is the potential for exercise to compromise uteroplacental blood flow and fetal oxygenation. The evidence reviewed here suggests that moderate-intensity exercise does not adversely affect uteroplacental or fetal Doppler parameters in uncomplicated pregnancies (de Oliveira Melo et al., 2012), while exercise at or above 90% of maximal heart rate may transiently reduce uterine artery blood flow to a degree that compromises fetal wellbeing (WHO, 2020). This threshold provides a physiologically grounded basis for intensity

recommendations and underscores the importance of avoiding maximal exertion, particularly in the context of competitive sport. Women with pre-existing uteroplacental insufficiency or fetal growth restriction represent a subgroup in which even moderate exercise requires individualised assessment, as their reduced placental reserve may limit the safety margin.

While much of the literature focuses on physical outcomes, the psychological benefits of exercise during pregnancy merit equal emphasis. The association between regular physical activity and reduced rates of prenatal depression, anxiety, and sleep disturbance - documented across multiple study designs (Davenport et al., 2018) - is clinically significant given the high prevalence of mental health disorders in the antenatal period. For many women, the continuation of a familiar sport or exercise routine also carries important implications for identity, social connection, and sense of control during a period of profound physical and psychological transition. These dimensions should be incorporated into clinical counselling alongside purely physical risk-benefit analyses.

Limitations of this review.

This narrative review is subject to several limitations inherent to the study design. Unlike systematic reviews or meta-analyses, narrative reviews do not employ a formal, reproducible synthesis methodology, and the selection of included literature is subject to author bias. The heterogeneity of study designs, populations, and outcome measures across the included publications precludes formal quantitative synthesis and limits the strength of conclusions that can be drawn. Additionally, the evidence base for specific sports - particularly tennis, equestrian activities, and recreational diving - remains limited, and recommendations in these areas rely partly on extrapolation from physiological principles rather than direct empirical data. Future research should prioritise prospective, adequately powered studies examining the safety and outcomes of specific recreational sports during pregnancy, with particular attention to understudied activities and to women with common medical comorbidities such as gestational diabetes and obesity.

5. Conclusions

This narrative review examined the current evidence on physical activity during pregnancy, with particular focus on the classification of specific sports and physical activities as recommended, conditionally permitted, or contraindicated. The following conclusions can be drawn from the synthesized literature:

Regular moderate-intensity physical activity during uncomplicated pregnancy is safe and beneficial for both the mother and the fetus across all three trimesters. The benefits extend beyond physical health to encompass metabolic, psychological, and obstetric outcomes,

including reduced risk of gestational diabetes mellitus, excessive gestational weight gain, hypertensive disorders, prenatal depression, and prolonged labour.

Pregnancy induces profound physiological adaptations (cardiovascular, respiratory, musculoskeletal, hormonal, and thermoregulatory) that evolve continuously across the three trimesters and directly shape what physical activities are safe at any given stage. An activity well-tolerated in early pregnancy may become biomechanically hazardous or physiologically inappropriate by the third trimester, underscoring the need for dynamic, trimester-sensitive guidance rather than a single static recommendation.

Not all sports carry equivalent risk. A clearly defined group of activities - among them contact and collision sports, scuba diving, exercise at high altitude, hot yoga, and sustained maximal-intensity exertion - poses risks sufficiently serious to constitute absolute or relative contraindications regardless of a woman's prior fitness level or athletic experience. For activities involving significant fall risk or supine positioning, the second trimester represents a practical threshold beyond which modification or discontinuation becomes necessary.

Between these two poles lies a clinically important intermediate category. Recreational running and tennis, for example, need not be categorically abandoned by women who were active in these sports before pregnancy; rather, they require thoughtful, progressive adaptation - reduced intensity, modified technique, and timely transition to lower-impact alternatives as the pregnancy advances and the body's demands change.

Perhaps most strikingly, the three major guideline bodies examined in this review - ACOG (2020), WHO (2020), and the joint Polish recommendations of PTGiP and PTMS (Kwiatkowska et al., 2023) - converge on the same fundamental principles, yet none provides the sport-specific granularity that clinicians and patients increasingly need. Bridging that gap between consensus and practical, activity-level guidance is precisely what this review sets out to accomplish.

Clinical decision-making regarding exercise in pregnancy should be individualised, incorporating the patient's pre-pregnancy fitness level, current clinical status, obstetric history, and the presence of absolute or relative contraindications. All pregnant women should be screened for contraindications before initiating or modifying an exercise programme, and should be counselled to discontinue activity and seek medical review upon the onset of warning signs.

Further prospective research is needed to expand the evidence base for sport-specific recommendations, particularly for recreational activities that remain understudied, and to better

characterise safe exercise parameters for pregnant women with common medical comorbidities.

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