NICOLAUS COPERNICUS UNIVERSITY IN TORUŃ

Quality in Sport. eISSN 2450-3118.

Journal Home Page
https://apcz.umk.pl/QS/index

NIERADKA Kornelia, KRAKOWIAK Dominika, KWITOWSKA Patrycja, MURASZEWSKA Emilia, MURASZEWSKI Łukasz, UBYSZ Eryk. The Impact of Physical Activity During Pregnancy on Labor Outcome- a Narrative Review. Quality in Sport. 2026;54:70475. eISSN 2450-3118. https://doi.org/10.12775/QS.2026.54.70475

The journal has been awarded 20 points in the parametric evaluation by the Ministry of Higher Education and Science of Poland. This is according to the Annex to the announcement of the Minister of Higher Education and Science dated 05.01.2024, No. 32553. The journal has a Unique Identifier: 201398. Scientific disciplines assigned: Economics and Finance (Field of Social Sciences); Management and Quality Sciences (Field of Social Sciences).
Punkty Ministerialne z 2019 - aktualny rok 20 punktów. Załącznik do komunikatu Ministra Szkolnictwa Wyższego i Nauki z dnia 05.01.2024 Lp. 32553. Posiada Unikatowy Identyfikator Czasopisma: 201398. Przypisane dyscypliny naukowe: Ekonomia i finanse (Dziedzina nauk społecznych); Nauki o zarządzaniu i jakości (Dziedzina nauk społecznych).
The authors declare that there is no conflict of interest regarding the publication of this paper.
Received: 31.03.2026. Revised: 09.04.2026. Accepted: 09.04.2026. Published: 19.04.2026.

The Impact of Physical Activity During Pregnancy on Labor Outcomes - a Narrative Review

Kornelia Nieradka

District Specialist Hospital in Stalowa Wola

Staszica 4, 37-450 Stalowa Wola

https://orcid.org/0009-0006-0770-8425

kornelianieradka@gmail.com

Dominika Krakowiak

Provincial Specialist Hospital in Częstochowa

Bialska 104/118, 42-202 Częstochowa

https://orcid.org/0009-0007-8627-7332
dkrakowiak55@gmail.com

Patrycja Kwitowska
Provincial Hospital in Poznań
Juraszów 7/19, 60-479 Poznań, Poland
https://orcid.org/0009-0006-7297-2871
patrycjakwitowska@gmail.com

Emilia Muraszewska
University Clinical Hospital in Poznań
Przybyszewskiego 49, 60-355 Poznań, Poland
https://orcid.org/0009-0005-4534-1014
muraszewskaemilia@gmail.com

Łukasz Muraszewski
University Clinical Hospital in Poznań
Przybyszewskiego 49, 60-355 Poznań, Poland
https://orcid.org/0009-0000-0331-9701
lukaszmuraszewski@outlook.com

Eryk Ubysz
Provincial Polyclinical Hospital in Płock of Marcina Kacprzaka
Medyczna 19, 09-400 Płock, Poland
https://orcid.org/0009-0004-9099-7648
eryk.ubysz123@gmail.com

Corresponding Author: Kornelia Nieradka, kornelianieradka@gmail.com

Abstract

Background: Childbirth is shaped by biological, psychological, and environmental factors, with maternal lifestyle being a key modifiable determinant. Physical activity during pregnancy is widely recommended by WHO and ACOG for its safety and health benefits. Beyond general health outcomes, increasing attention has been directed toward the role of prenatal physical activity in influencing labor outcomes.

Aim: The aim was to summarize current research on the relationship between prenatal physical activity and labor outcomes.

Material and methods: A literature search was conducted in PubMed, Scopus, and Google Scholar for studies published between 2010 and 2025. Randomized controlled trials, cohort studies, and systematic reviews on prenatal physical activity and labor outcomes were included and analyzed qualitatively.

Results: Evidence shows that physically active pregnant women may experience shorter labor, reduced cesarean delivery rates, and higher chances of spontaneous vaginal birth. Prenatal exercise does not negatively impact neonatal outcomes, including birth weight, Apgar scores, or gestational age, highlighting its safety for both mother and child.

Conclusions: Moderate physical activity during pregnancy is safe and can enhance labor outcomes. Integrating structured exercise into prenatal care offers a feasible strategy to improve maternal fitness and support positive obstetric outcomes.

Key words: pregnancy, physical activity, exercise, labor, delivery outcomes

1. Introduction

Childbirth is a complex physiological process influenced by multiple biological, psychological, and environmental factors. In recent years, increasing attention has been given to maternal lifestyle as a modifiable determinant of pregnancy and birth outcomes [1-4]. Among these factors, physical activity during pregnancy has gained significant scientific and clinical interest [1, 2, 4]. Unlike many obstetric risk factors, lifestyle-related factors can often be modified through education and behavioral interventions, making physical activity a potentially valuable strategy for improving maternal and neonatal health outcomes at the population level [1, 2].

Current recommendations issued by the World Health Organization (WHO) and the American College of Obstetricians and Gynecologists (ACOG) encourage regular moderate-intensity physical activity in pregnant women without medical or obstetric contraindications [5, 6].

These guidelines emphasize that exercise during pregnancy is generally safe and associated with numerous health benefits. Previous research has shown that prenatal physical activity may reduce the risk of gestational diabetes mellitus, hypertensive disorders of pregnancy, excessive gestational weight gain, and symptoms of anxiety and depression [1-4]. Additional benefits include improved cardiovascular function, enhanced metabolic regulation, better sleep quality, improved overall quality of life, facilitation of postpartum recovery, and long-term maternal health advantages [1, 2, 7, 8].

Despite clear international recommendations, many pregnant women reduce their physical activity levels after conception. Research from different countries indicates that only a minority of women meet the recommended levels of moderate-intensity exercise during pregnancy [2, 7, 9, 10]. Several factors contribute to this decline. Physiological discomforts, such as fatigue, nausea, and musculoskeletal pain, are commonly reported, while psychological concerns (including fear of harming the fetus) further reduce motivation [1, 2, 7, 9, 11]. Sociocultural beliefs and inconsistent advice from multiple sources may reinforce these concerns. Moreover, lack of clear guidance on safe exercise practices and insufficient counseling by healthcare professionals can discourage women from maintaining an active lifestyle [3, 4, 6, 9]. Increasing awareness of the safety and benefits of prenatal physical activity thus represents an important public health strategy aimed at improving both maternal and neonatal outcomes [1, 2, 4].

In addition to general health benefits, maternal physical activity may influence labor progression and delivery outcomes [3, 10, 12-17]. Regular exercise improves cardiovascular efficiency, muscular strength and endurance, and metabolic regulation [1, 9, 13, 14, 17]. These adaptations can support maternal stamina during labor, enhance uterine contractility, and optimize oxygen delivery to both mother and fetus [4, 9, 13,]. Physical activity may also influence hormonal responses, including endorphin release and stress regulation, which can affect pain perception and psychological readiness during childbirth [18, 19]. Collectively, these mechanisms suggest that physically active women may experience more efficient labor, improved pain management, and greater overall resilience during delivery.

Physical activity may also influence key obstetric outcomes, such as labor duration, mode of delivery, and the need for medical interventions, including instrumental delivery or cesarean section [5, 12, 15, 20, 21]. This is especially relevant in the context of increasing global cesarean section rates and the growing medicalization of childbirth. Identifying modifiable

factors that can promote physiological labor and reduce unnecessary interventions remains a central goal in contemporary obstetric care [5, 15, 20, 21].

Despite a growing body of research, the relationship between prenatal physical activity and specific labor outcomes remains incompletely understood. Studies vary considerably in methodology, population characteristics, exercise protocols, and outcome definitions [12, 15, 20, 22]. The type, intensity, frequency, and timing of physical activity are often heterogeneous, and potential confounding factors, such as pre-pregnancy fitness level or body mass index, are not consistently controlled for. As a result, findings are not always directly comparable, making clear clinical conclusions difficult to establish [12, 20].

Given these complexities, summarizing the currently available evidence is essential. The aim of this narrative review is to analyze research investigating the relationship between physical activity during pregnancy and labor outcomes, with particular attention to labor duration, mode of delivery, and obstetric interventions [1, 3, 10, 12, 13, 15, 16].

2. Materials and Methods

2.1 Literature Search and Study Selection

A narrative literature review was conducted using three electronic databases: PubMed, Scopus, and Google Scholar. The search included studies published between 2010 and 2025. Keywords used in the search strategy included “pregnancy,” “physical activity,” “exercise,” “labor,” and “delivery outcomes.”

Priority was given to randomized controlled trials, cohort studies, and systematic reviews investigating the relationship between maternal physical activity and labor outcomes. Titles and abstracts were initially screened, followed by a full-text evaluation of potentially relevant articles. Data concerning exercise type, frequency, intensity, and reported labor outcomes were extracted and summarized qualitatively.

The aim of this review was to provide a clinically relevant overview of current evidence rather than conduct a formal quantitative meta-analysis.

2.2 AI

During the preparation of this manuscript, artificial intelligence (AI) tools were used solely for language editing and structural assistance. AI support was applied to improve clarity, grammar, and academic phrasing of selected sections of the text. The author(s) independently conducted the literature search, critically evaluated the sources, interpreted the findings, and formulated all scientific conclusions. No AI tools were used for data analysis, data fabrication or the creation of scientific results. The author(s) take full responsibility for the integrity, originality, and accuracy of the content.

3. Research results

3.1 Effect of Prenatal Physical Activity on Labor Duration

Several studies suggest that physical activity during pregnancy may be associated with a shorter duration of labor, particularly in the first stage [13, 23, 24]. Evidence from randomized controlled trials indicates that structured exercise programs can positively influence labor progression. A large randomized clinical trial including more than 500 healthy pregnant women demonstrated that participation in a supervised moderate-intensity aerobic exercise program throughout pregnancy significantly reduced both the first stage and total duration of labor compared with the control group [13]. In that study, the mean duration of the first stage of labor was approximately 409 minutes in the exercise group compared with 462 minutes in the control group, while the mean total labor duration was 450 minutes and 507 minutes [13].

Similar findings have been reported in other intervention studies. For example, participation in structured exercise programs, including water-based activities, has been associated with shorter labor duration compared with standard care [23, 25]. In some cases, the reduction in total labor time reached clinically meaningful differences, suggesting that even moderate levels of physical activity may influence labor efficiency.

The relationship between prenatal physical activity and labor duration may be explained by several physiological mechanisms. Regular exercise during pregnancy is associated with improved cardiorespiratory fitness, greater muscular strength, and enhanced endurance capacity [4, 9]. These adaptations may improve maternal tolerance to prolonged physical effort and reduce fatigue during labor. Increased strength and coordination of the abdominal and pelvic floor muscles may also facilitate more effective pushing during the second stage of labor

[4, 9]. Additionally, physical activity may improve posture, pelvic mobility, and overall musculoskeletal function, which can support optimal fetal positioning and more efficient labor progression [4, 9].

From a broader perspective, systematic reviews and meta-analyses provide further support for the beneficial effects of prenatal physical activity. Several high-quality analyses have reported a statistically significant reduction in the duration of the first stage of labor among physically active women compared with inactive controls [12, 15, 20]. However, the overall effect on total labor duration is less consistent, with some studies not observing significant differences, likely due to variability in exercise type, intensity, frequency, and participant characteristics [12, 20].

Overall, current evidence suggests that regular moderate-intensity physical activity during pregnancy may contribute to a modest reduction in labor duration, particularly in the first stage. Nevertheless, further well-designed randomized trials are needed to better define the optimal type and dose of exercise and to clarify its clinical significance in diverse populations [12, 15].

3.2 Effect of Prenatal Physical Activity on Cesarean Delivery Rates

A growing body of evidence suggests that physical activity during pregnancy may be associated with improved delivery outcomes; however, findings regarding cesarean delivery remain inconsistent [2, 12, 15]. While some meta-analyses of randomized controlled trials report a modest reduction in the risk of cesarean section (approximately 10–15%) among physically active women [3, 8, 20], other large-scale reviews have found no significant association [12].

Earlier systematic reviews have suggested that structured exercise interventions may increase the probability of spontaneous vaginal birth and potentially reduce the incidence of cesarean delivery [3,7]; however, these effects are not consistently observed across all studies. Evidence from randomized controlled trials further supports these observations to some extent. For example, studies conducted by Barakat and colleagues indicate that supervised moderate-intensity exercise programs during pregnancy may be associated with lower rates of both cesarean and instrumental deliveries compared with standard prenatal care [13, 21].

The mechanisms underlying these associations are likely multifactorial. Regular physical activity contributes to improved metabolic regulation and helps prevent excessive gestational weight gain, which is an important risk factor for cesarean delivery [1, 2]. In addition, enhanced

cardiovascular efficiency and muscular endurance may improve maternal capacity to tolerate the physiological demands of labor, potentially reducing the risk of maternal exhaustion and subsequent operative intervention [12, 17]. Physical activity may also decrease the risk of pregnancy-related complications, such as gestational diabetes and hypertensive disorders, which are associated with higher rates of cesarean section [1, 5].

From a clinical perspective, even a modest reduction in cesarean delivery rates may have important implications at the population level, given the continuously increasing global rates of surgical delivery [5, 6]. However, the magnitude of the observed effects varies across studies and populations [15, 16]. Differences in exercise protocols, adherence, baseline maternal characteristics, and obstetric care practices may all influence outcomes. Moreover, not all studies demonstrate statistically significant reductions in cesarean rates, highlighting the need for further high-quality randomized trials to better define the role of prenatal physical activity in this context [15, 16, 20].

3.3 Effect of Prenatal Physical Activity on Obstetric Interventions

Evidence suggests that prenatal physical activity may also influence the frequency and type of obstetric interventions during childbirth [12, 20, 21]. Meta-analyses of randomized controlled trials indicate that structured exercise programs during pregnancy are associated with a reduced likelihood of operative delivery and a higher probability of spontaneous vaginal birth [12, 20]. These findings suggest that physically active women may experience a more physiological course of labor, potentially requiring fewer medical interventions.

In addition to cesarean delivery, several studies have examined the impact of physical activity on instrumental vaginal delivery, including vacuum extraction and forceps-assisted birth. Although the results are less consistent, some evidence indicates a modest reduction in the rate of instrumental deliveries among women who engage in regular prenatal exercise [21]. However, other studies have not observed statistically significant differences, which may reflect variability in study design, population characteristics, and definitions of physical activity [12, 20].

Another important aspect is the potential influence of prenatal physical activity on the use of labor analgesia, particularly epidural anesthesia. Some studies suggest that physically active women may be less likely to request epidural analgesia, possibly due to improved pain tolerance, greater physical preparedness, and enhanced psychological resilience [15, 19].

However, findings in this area remain inconclusive, and the relationship between exercise and pain management during labor requires further investigation.

Prenatal physical activity may also indirectly affect the need for interventions such as labor induction or augmentation. Improved metabolic health and a lower incidence of pregnancy-related complications, including gestational diabetes and hypertensive disorders, may reduce the clinical indications for such procedures [1, 12]. Additionally, better physical conditioning may contribute to more efficient labor progression, potentially decreasing the need for pharmacological stimulation of uterine contractions.

Overall, current evidence suggests that regular physical activity during pregnancy may contribute to a reduced need for certain obstetric interventions and support a more physiological labor process. However, the magnitude and consistency of these effects vary across studies. Differences in exercise type, intensity, adherence, and obstetric care practices may significantly influence outcomes. Therefore, further well-designed randomized controlled trials are needed to clarify the role of prenatal physical activity in reducing obstetric interventions and to establish clear clinical recommendations [12, 20].

3.4 Neonatal Outcomes

Available evidence consistently indicates that prenatal physical activity does not adversely affect neonatal health [8, 14, 26, 27, 28, 29]. Most studies report no significant differences in birth weight between infants born to physically active mothers and those born to inactive women [8, 14, 26, 27]. Similarly, Apgar scores at one and five minutes after birth are generally comparable across groups, suggesting that moderate maternal exercise does not compromise immediate neonatal adaptation [8, 14, 29].

Other neonatal parameters, including umbilical cord blood pH, neonatal body composition, and early feeding outcomes, have also been investigated. Findings indicate no increased risk of metabolic or physiological complications among infants of mothers who engaged in regular prenatal exercise [8, 14]. Importantly, moderate maternal physical activity has not been associated with an elevated risk of preterm birth or small-for-gestational-age infants [8, 14], supporting the safety of exercise when appropriately prescribed.

Some studies have suggested potential indirect benefits for the neonate through improved maternal cardiovascular fitness, metabolic regulation, and reduced incidence of gestational

complications such as diabetes or hypertensive disorders [8, 28]. These maternal adaptations may create a more favorable intrauterine environment, although evidence for direct neonatal advantages, such as enhanced growth or neurodevelopment, remains limited [8, 14, 29].

Overall, the available data support the conclusion that regular moderate physical activity during pregnancy is safe for the fetus and does not compromise neonatal outcomes. While direct benefits for neonatal parameters are not consistently demonstrated, promoting maternal exercise may still provide indirect advantages by improving maternal health and reducing pregnancy-related complications that could otherwise negatively affect neonatal outcomes [8, 14, 29].

3.5 Current Recommendations for Physical Activity During Pregnancy

International guidelines emphasize the importance of regular physical activity during pregnancy for women without medical or obstetric contraindications [5, 6]. According to the World Health Organization (WHO), pregnant women should aim for at least 150 minutes of moderate-intensity aerobic activity per week, ideally distributed across most days [5]. Recommended activities include a combination of aerobic, strengthening, and flexibility exercises, which can be tailored to individual preferences and physical condition.

Similarly, the American College of Obstetricians and Gynecologists (ACOG) advises that women with uncomplicated pregnancies engage in moderate aerobic and strength-conditioning exercises before, during, and after pregnancy [6]. Typical examples include walking, stationary cycling, swimming, low-impact aerobics, resistance training using light weights or elastic bands, stretching, and water-based exercises [6, 9]. These activities have been extensively studied and are generally considered safe when performed with appropriate modifications and under medical supervision [2, 7, 9].

Women who were physically active prior to pregnancy can generally continue their routines, adjusting intensity, frequency, and duration as necessary to accommodate physiological changes associated with gestation [6, 9]. Conversely, previously sedentary women are encouraged to start with low-intensity exercises and gradually increase both duration and frequency over time [2, 6]. Ensuring proper hydration, balanced nutrition, and monitoring for warning signs—such as dizziness, vaginal bleeding, or severe pain—is essential for maintaining safety during prenatal exercise [2, 6, 9]. Regular consultation with healthcare providers can facilitate adherence and allow timely adjustments to exercise programs.

While physical activity is broadly recommended, not all pregnant women can safely engage in unrestricted exercise. Certain medical and obstetric conditions may represent absolute or relative contraindications. Absolute contraindications include severe cardiovascular or respiratory diseases, significant placental abnormalities, or conditions associated with a high risk of preterm birth. Relative contraindications include milder clinical conditions such as anemia, poorly controlled hypertension, or musculoskeletal limitations that require individualized modification of exercise type and intensity.

In these cases, physical activity should not be universally discouraged but rather adapted and supervised according to the woman's clinical status. Personalized exercise prescriptions, taking into account gestational age, baseline fitness, and overall health, are essential to maximize maternal and fetal safety while maintaining the benefits of physical activity.

Overall, adherence to current international recommendations supports maternal cardiovascular, metabolic, and musculoskeletal health, reduces the risk of pregnancy complications, and promotes favorable neonatal outcomes [2, 5, 6]. Integrating structured physical activity into routine prenatal care is therefore a key component of evidence-based maternal health promotion, emphasizing both safety and individualized adaptation.

3.6 Types of Prenatal Exercise Programs Investigated in Research

Research examining physical activity during pregnancy has investigated a wide variety of exercise programs, differing in type, intensity, and level of supervision [1, 12, 13]. Most randomized controlled trials have focused on moderate-intensity aerobic exercise, which is generally safe and well tolerated by the majority of pregnant women [1, 9, 13]. Common activities include walking, stationary cycling, swimming, and low-impact aerobics, aiming primarily to improve cardiovascular fitness, overall endurance, and maternal well-being [1, 9, 13].

Water-based or aquatic exercise programs have also been widely studied. The buoyancy provided by water reduces mechanical stress on joints and the spine, which may be particularly beneficial during the later stages of pregnancy [11, 13]. Women participating in structured aquatic programs often report reduced musculoskeletal discomfort, lower fatigue levels, and improved adherence compared with inactive participants [11, 13].

In addition to aerobic training, several studies have explored resistance and strength-conditioning exercises, often incorporating light weights, resistance bands, or body-weight exercises to maintain muscular strength, postural stability, and core control [1, 9, 12]. Targeted strengthening of the core and pelvic floor muscles is particularly relevant for childbirth, as these muscle groups support the pelvis, improve posture, and may facilitate more effective pushing during the second stage of labor [1, 9, 12].

Prenatal yoga, stretching, and mind-body programs have also gained increasing attention. These activities combine gentle physical movement with controlled breathing and relaxation techniques, potentially reducing maternal stress, anxiety, and tension while enhancing psychological preparedness for labor [19, 25, 30]. Some evidence suggests that yoga may improve maternal coping strategies during childbirth, reduce perceived pain, and support overall maternal well-being [19, 25].

Overall, the diversity of exercise programs investigated in current research highlights that multiple forms of moderate physical activity can be safely performed during pregnancy when appropriately supervised and individualized to the woman's fitness level and clinical status [1, 9, 12, 13, 25]. These findings reinforce the importance of offering personalized prenatal exercise options as part of routine care, allowing women to select programs that are both safe and enjoyable, thereby promoting adherence and long-term maternal and neonatal health benefits.

4. Discussion

This narrative review summarizes the current evidence linking prenatal physical activity with shorter labor duration, lower cesarean section rates, and higher likelihood of spontaneous vaginal delivery [10, 13, 21]. Although the magnitude of these effects varies across studies, the overall trend observed in randomized trials and systematic reviews is consistent, supporting the beneficial role of moderate exercise during pregnancy.

Several physiological mechanisms may contribute to these associations. Regular exercise improves cardiovascular efficiency and increases muscular strength and endurance, particularly in muscles involved in posture maintenance and pelvic support [9, 13, 24]. Enhanced aerobic capacity may improve maternal stamina during labor, while stronger core and pelvic muscles facilitate more effective pushing during the second stage [13, 24]. Improved

musculoskeletal stability and flexibility may further support optimal labor mechanics, potentially contributing to shorter labor duration and reduced need for obstetric interventions.

Prenatal exercise is also associated with metabolic benefits, such as improved insulin sensitivity, better glycemic control, and reduced excessive gestational weight gain [1, 2. These adaptations may lower the risk of fetal macrosomia and other pregnancy complications that are known risk factors for operative delivery [1, 13]. Moreover, improved maternal metabolic health may contribute indirectly to favorable neonatal outcomes.

Psychological benefits are equally noteworthy. Women who participate in structured exercise programs may feel better prepared for childbirth, demonstrate improved coping strategies, and exhibit higher pain tolerance during labor [18, 19, 25]. Physical activity may also positively influence stress hormone regulation and stimulate endorphin release, contributing to enhanced mood, resilience, and overall psychological well-being during pregnancy [18, 19].

Another potential mechanism involves placental and vascular function. Moderate physical activity has been shown to improve endothelial function and circulation, enhancing oxygen and nutrient delivery to both maternal tissues and the developing fetus [1, 11, 13]. Adequate placental perfusion is essential for optimal fetal growth and may also support efficient uterine activity during labor [11].

Despite these promising findings, several limitations should be considered. Studies vary widely in terms of exercise type, intensity, duration, and supervision, which complicates direct comparisons [1, 13]. Many rely on self-reported physical activity levels, introducing potential recall and reporting bias [1, 13]. Confounding factors such as pre-pregnancy body mass index, socioeconomic status, and baseline fitness are not consistently controlled, potentially influencing outcomes [1, 20]. Additionally, the lack of standardized exercise protocols across studies limits the ability to draw definitive conclusions regarding optimal training parameters.

Selection bias is another important consideration. Women who voluntarily engage in exercise programs may differ from inactive women in terms of health awareness, education, motivation, and access to healthcare, all of which may independently impact pregnancy outcomes [1, 20, 29]. Furthermore, the potential dose–response relationship between physical activity and labor outcomes remains insufficiently explored. While most studies focus on moderate-intensity exercise, it is unclear whether higher frequency, intensity, or duration provides additional benefits. Preliminary evidence suggests that adherence to current physical activity

recommendations may be sufficient to achieve measurable improvements, with further increases yielding diminishing returns.

Future research should prioritize well-designed randomized trials that include objective measurements of physical activity, standardized labor outcome definitions, and rigorous control of confounding variables [20, 31, 32]. Investigating the optimal "dose" of prenatal exercise in terms of type, frequency, intensity, and duration will allow for more precise, individualized recommendations in clinical practice.

From a public health perspective, promoting prenatal physical activity represents a low-cost, accessible strategy with the potential to improve maternal and obstetric outcomes at a population level. Increasing awareness among both pregnant women and healthcare providers remains critical to translating evidence-based recommendations into routine prenatal care.

Overall, the current evidence supports the integration of moderate physical activity into standard prenatal care. Exercise appears to be safe, feasible, and beneficial for improving maternal fitness, supporting efficient labor, reducing the risk of cesarean delivery, and maintaining neonatal safety [1, 13, 14, 29]. These findings reinforce the importance of incorporating structured, personalized exercise programs as a key component of evidence-based maternal health promotion.

5. Conclusions

Prenatal physical activity appears to be a safe and potentially beneficial modifiable factor that can positively influence both maternal and neonatal outcomes [3, 10, 12, 13, 16, 17, 20, 21, 22, 26, 27, 28, 29, 33, 34, 35, 36]. Current evidence suggests that regular moderate-intensity exercise during pregnancy is associated with shorter labor duration, lower rates of cesarean delivery, and an increased likelihood of spontaneous vaginal birth, although the magnitude of these effects varies across studies [12, 13, 20, 21, 33].

Several physiological mechanisms may contribute to these associations. Regular exercise improves cardiovascular efficiency, increases muscular strength and endurance, and enhances core and pelvic floor function, which can facilitate more effective pushing during the second stage of labor [9, 13, 24]. Improved aerobic capacity may support maternal stamina during prolonged labor, while musculoskeletal stability, flexibility, and optimal posture may contribute to efficient labor mechanics [4, 9, 13, 24]. These adaptations potentially explain

observed reductions in labor duration and the lower need for obstetric interventions among physically active women [12, 13, 20].

Prenatal exercise is also associated with metabolic benefits, including improved insulin sensitivity, better glycemic control, and reduced excessive gestational weight gain [1, 2, 12]. These adaptations may lower the risk of fetal macrosomia and other pregnancy complications that are known risk factors for operative delivery [1, 12, 13]. Enhanced maternal metabolic health may indirectly support favorable neonatal outcomes by creating a more optimal intrauterine environment [8, 11, 14, 28].

Psychological benefits of prenatal exercise are equally important. Women participating in structured exercise programs often report feeling better prepared for childbirth, demonstrating improved coping strategies, greater pain tolerance during labor, and reduced stress [18, 19, 25]. Physical activity may also stimulate endorphin release and positively modulate stress hormone responses, contributing to improved mood, resilience, and overall psychological well-being during pregnancy and childbirth [18, 19, 25].

Placental and vascular adaptations may also play a role. Moderate physical activity has been shown to enhance endothelial function and circulation, supporting efficient oxygen and nutrient delivery to both maternal tissues and the developing fetus [1, 11, 12]. Adequate placental perfusion is crucial for optimal fetal growth and may also facilitate effective uterine activity during labor [11].

Neonatal outcomes remain comparable between infants of physically active and inactive mothers, with no increased risk of low birth weight, preterm birth, or small-for-gestational-age infants [11, 14, 29]. Apgar scores, umbilical cord pH, neonatal body composition, and early feeding outcomes are generally unaffected by maternal exercise, supporting the safety of prenatal physical activity [8, 14, 26, 27, 29]. Some evidence suggests that improved maternal cardiovascular and metabolic function may indirectly enhance neonatal resilience through optimized placental perfusion and nutrient delivery [11, 14, 29].

Current international guidelines from the World Health Organization (WHO) and the American College of Obstetricians and Gynecologists (ACOG) recommend at least 150 minutes of moderate-intensity aerobic activity per week for women with uncomplicated pregnancies [5, 6]. Recommended activities include walking, swimming, low-impact aerobics, resistance training with light weights or elastic bands, and prenatal yoga, all of which can be tailored to

individual fitness levels, gestational age, and clinical considerations [6, 9, 13, 25]. Women who were physically active prior to pregnancy can generally continue their routines with appropriate modifications, whereas previously sedentary women are encouraged to start with low-intensity exercises and gradually progress [2, 6, 9]. Proper hydration, balanced nutrition, and monitoring for warning signs (e.g., dizziness, vaginal bleeding, severe pain) are essential for safe exercise [2, 6, 9].

Integrating structured exercise programs into routine prenatal care offers multiple benefits: improving maternal physical fitness, supporting physiological labor progression, reducing the need for obstetric interventions, and maintaining neonatal safety [12, 13, 20, 21, 29]. Psychological benefits, including reduced maternal stress, improved coping strategies, and enhanced well-being, further reinforce the value of prenatal physical activity [18, 19, 25].

Despite these promising findings, limitations remain. Studies vary in terms of exercise type, intensity, frequency, duration, supervision, and outcome definitions, which complicates direct comparisons [1, 12, 13, 20]. Many rely on self-reported activity levels, introducing potential recall and reporting bias, and not all studies control for confounding variables such as pre-pregnancy BMI, socioeconomic status, or baseline fitness [1, 12, 20]. Selection bias is another consideration, as women who voluntarily engage in exercise may differ from inactive women in health awareness, education, and motivation [1, 12, 20, 29]. Dose–response relationships between activity and outcomes are also insufficiently explored, with most evidence focused on moderate-intensity exercise [12, 20, 31, 32].

Future research should prioritize well-designed randomized trials with objective physical activity measurements, standardized labor outcome definitions, and rigorous control of confounding factors [20, 31, 32]. Clarifying the optimal type, frequency, intensity, and duration of exercise will allow for individualized recommendations and maximize the benefits of prenatal physical activity across diverse populations. Identification of subgroups that may derive the greatest benefit from tailored exercise interventions should also be a research priority [20, 31, 32].

In conclusion, moderate prenatal physical activity should be regarded as a key component of holistic maternal care. When appropriately prescribed and supervised, it provides measurable benefits for both mother and child, supports efficient labor progression, reduces the risk of cesarean and instrumental deliveries, and maintains neonatal safety [1, 13, 14, 18, 19, 20, 21,

25, 29, 38]. Its integration into standard prenatal care represents an accessible, low-cost, and evidence-based strategy to optimize maternal and neonatal health outcomes.

Disclosure

The authors report no disclosures.

Author's contribution

Conceptualization: Kornelia Nieradka, Dominika Krakowiak
Methodology: Kornelia Nieradka, Dominika Krakowiak, Patrycja Kwitowska, Emilia Muraszewska, Łukasz Muraszewski
Resources: Kornelia Nieradka, Dominika Krakowiak, Patrycja Kwitowska
Data curation: Patrycja Kwitowska, Emilia Muraszewska, Łukasz Muraszewski
Formal analysis: Kornelia Nieradka, Patrycja Kwitowska, Emilia Muraszewska
Investigation: Kornelia Nieradka, Dominika Krakowiak, Patrycja Kwitowska, Emilia Muraszewska, Łukasz Muraszewski
Supervision: Dominika Krakowiak, Patrycja Kwitowska
Writing-rough preparation: Kornelia Nieradka, Dominika Krakowiak, Patrycja Kwitowska, Emilia Muraszewska, Łukasz Muraszewski

All authors have read and agreed to the published version of the manuscript.

Funding Statement:
This research received no external funding.

Institutional Review Board Statement:
Not applicable.

Informed Consent Statement:
Not applicable.

Data Availability Statement:
Not applicable.

Acknowledgments:
Not applicable.

Conflict of Interest Statement:
The authors declare no conflict of interest.

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