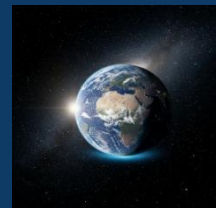




QUALITY IN SPORT

eISSN 2450-3118 · Open Access · Peer-reviewed

apcz.umk.pl/QS Nicolaus Copernicus University in Toruń



Cite as: PADULA, Natalia, PLUSZYŃSKI, Tomasz, PIOTROWSKI, Karol, JERCZAK, Małgorzata, PIÓRKOWSKA, Iga, POLEWKA, Mikołaj, POLAŃSKA, Aleksandra, PACZOSA, Kacper and PRZYBYŁ, Filip. The Impact of Physical Activity During Pregnancy on Maternal and Fetal Outcomes: A Literature Review. *Quality in Sport*. 2026;57:72480. <https://doi.org/10.12775/QS.2026.57.72480>

ARTICLE TIMELINE

Received: 24.05.2026. Revised: 30.05.2026. Accepted: 31.05.2026. Published: 10.06.2026.

The journal has been awarded 20 points in the parametric evaluation by the Polish Ministry of Higher Education and Science (Annex to the announcement of 05.01.2024, No. 32553). Unique Journal Identifier: 201398. Scientific disciplines: Medical Sciences; Health 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: Nauki medyczne; Nauki o zdrowiu. © The Authors 2026.

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Short Article

The Impact of Physical Activity During Pregnancy on Maternal and Fetal Outcomes: A Literature Review

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Abstract

Background. Physical activity during pregnancy is widely recognized as a key determinant of maternal and fetal health. Levels and patterns of physical activity often change across trimesters due to physiological, metabolic, and psychological adaptations. Given the dynamic nature of pregnancy, a comprehensive synthesis of current evidence on the effects and safety of physical activity across all trimesters is warranted to support trimester-specific recommendations and optimize maternal and neonatal outcomes.

Aim. The aim of this review is to synthesize current evidence on physical activity throughout the entire course of pregnancy. Particular attention is given to trimester-specific patterns of physical activity, associated maternal and fetal health outcomes.

Material and Methods

A systematic literature review was conducted across international databases, encompassing meta-analyses, randomized controlled trials, cohort studies, and official guidelines from scientific societies. Key publications evaluating the physiological, biomechanical, and epigenetic effects of physical exertion were selected.

Results. The accumulated evidence unequivocally demonstrates that regular physical exertion lowers the risk of gestational diabetes (by approx. 38%), pregnancy-induced hypertension (by approx. 58%), and fetal macrosomia, without negatively affecting the hemodynamic parameters of the umbilical artery. Studies from 2024-2025 confirm the safety of high-intensity training and submaximal resistance training. Furthermore, maternal exercise has been shown to have a stimulating effect on fetal epigenetic programming and neurogenesis, as well as a fundamental role of early mobilization in reducing symptoms of postpartum depression and pelvic floor dysfunction.

Conclusion. Physical activity during pregnancy and the postpartum period is not only safe but constitutes a key prophylactic and therapeutic mechanism.

Keywords: pregnancy, postpartum, physical activity, resistance training

1. Introduction

Physical activity is a crucial component of a healthy pregnancy. Contemporary research consistently demonstrates that regular, moderate physical activity during pregnancy is associated with numerous benefits for both the mother and the child. An increasing number of studies indicate that maintaining an active lifestyle reduces the incidence of adverse obstetric outcomes, such as gestational diabetes mellitus, pregnancy-induced hypertension, and excessive gestational weight gain. Current recommendations from international scientific societies advise performing at least 150 minutes per week of moderate-intensity aerobic activity, provided there are no medical contraindications. These guidelines also emphasize the importance of complementing aerobic exercises with resistance training and exercises that improve mobility and functional fitness (Angelino et al., 2026).

Growing attention is being paid to the role of individualized exercise programs. Tailoring physical activity to a pregnant woman's fitness level, needs, and goals can significantly enhance motivation and adherence to the recommendations. Literature highlights that consistency and maintaining activity throughout pregnancy are key factors in achieving beneficial health outcomes (Cilar Budler & Budler, 2022).

2. Pregnancy

2.1. Physical Activity in the First Trimester.

The perinatal period, spanning the time from conception to the end of the postpartum, is characterized by the most dynamic physiological, endocrinological, biomechanical, and psychological changes in a woman's ontogeny. These changes, while entirely natural, pose a massive adaptive challenge to the mother's body, testing the capacity of the cardiovascular and respiratory systems, as well as metabolic reserves. (Shen et al., 2025)

The first trimester is a period of intense hormonal and hemodynamic changes, as well as placental development. Increased progesterone levels, nausea, and concerns about pregnancy loss are associated with reduced physical activity during early pregnancy. Despite these factors, current WHO guidelines do not recommend discontinuing moderate physical activity in healthy pregnancies, including during the first trimester. Numerous studies indicate that maintaining an adequate level of physical activity in the first trimester reduces the risk of gestational diabetes mellitus and abnormal screening results (Ehrlich et al., 2021), decreases the risk of hypertensive disorders of pregnancy (Lu et al., 2023), may lower the risk of preterm birth (Zhang et al., 2024), and reduces anxiety levels, especially when combined with cognitive behavioral therapy (Mei et al., 2024). Unfortunately, research shows that only about 21.4% of women maintain the recommended level of physical activity during pregnancy (Santos et al., 2022).

The main reasons for discontinuing physical activity include lack of time, pregnancy-related discomfort, anxiety, limited resources, and conflicting advice (Angelino et al., 2026). Considering the high prevalence of inactivity in the first trimester, it is important that recommendations focus on promoting physical activity. The most commonly chosen activity is walking, and factors associated with increased physical activity include being under 25 years of age, having less than a higher education, and a high level of pre-pregnancy activity. Factors

associated with reduced physical activity included vaginal bleeding in early pregnancy and poor sleep quality. Key facilitators were spousal support and policies that encouraged or enabled exercise during pregnancy.(Zhou et al., 2025)

2.2. Fetal Safety and Hemodynamic Adaptation to Maternal Exercise.

The development of Doppler imaging techniques allows us to check the blood flow in the umbilical cord and the baby's heart rate.. Research conducted on active female has provided fascinating data. The assessment of fetal heart rate (FHR) during moderate and even high-intensity exercise has shown no fetal bradycardia and fetal heart rate did not change throughout the duration of each exercise. Doppler analysis of umbilical artery flows shows that parameters evaluating vascular resistance not only do not pathologically deteriorate but very often significantly drop after exertion. The drop in these indicators testifies to a reduction of resistance in the fetal placenta, facilitating the free flow of blood rich in oxygen and nutrients. Adequate perfusion is maintained compensatorily by an increase in maternal stroke volume and accelerated breathing. Proof of ultimate safety is the fact that exercise does not increase the risk of intrauterine fetal growth restriction or the risk of premature birth; in fact, it protects the child against the adverse phenomenon of macrosomia and supports proper genetically determined development. (Moolyk et al., 2025)

2.3. Physical Activity and Hypertensive Disorders of Pregnancy.

Spectacular data regarding the prevention of arterial hypertension and preeclampsia were provided by a meta-analysis published in the prestigious "British Journal of Sports Medicine" in 2025 (Prevett et al.). It analyzed 50 studies encompassing a massive cohort of 47,619 participants. It was demonstrated that implementing training, with particular emphasis on the resistance training (RT) component, leads to a highly significant reduction in the probability of pregnancy-induced hypertension. The odds ratio (OR) was 0.42 (95% CI 0.27-0.66), meaning that in women strength training, this risk is lowered by a staggering 58%. The likely mechanism underlying this phenomenon is the stimulation of angiogenesis in the placenta, improvement of vascular endothelial cell function (increased nitric oxide - NO production), and a general reduction in peripheral resistance. Despite such a massive protective impact on the vascular system, the meta-analysis did not show a statistically significant, direct reduction in the occurrence of fully developed preeclampsia itself (OR 0.74, 95% CI 0.40 to 1.35) , which illustrates that although the pathophysiology of preeclampsia has a strong vascular component, its genetically and immunologically determined etiology remains a multifactorial phenomenon.(Prevett et al., 2025)

2.4. Physical Activity in the Third Trimester and Metabolic Adaptation.

In the third trimester, physiological insulin resistance naturally develops, stimulated by human placental lactogen and cortisol, aiming to secure a continuous stream of glucose to the placenta. In women leading a sedentary lifestyle, this mechanism easily decompensates, turning into pathological gestational diabetes mellitus (GDM), which threatens both the mother and the child (risk of macrosomia, postnatal hypoglycemia). A systematic review and quasi-experimental studies have shown that implementing an exercise-based intervention during pregnancy results in a reduction of the risk of developing gestational diabetes by approx. 36-40% compared to the control population. A significant decrease in the physiological, undesirable increase in insulin concentration in

late pregnancy is observed, as well as lower levels of circulating triglycerides (TG), total cholesterol (TC), and the atherogenic LDL fraction. (He et al., 2026)

3. Postpartum

3.1. Pelvic Floor Dysfunction and Pelvic Floor Muscle Training.

During pregnancy and physiological childbirth, the pelvic diaphragm undergoes massive deformations and microstructural damage, often exceeding the biological limits of fascial elasticity. Pelvic Floor Dysfunctions (PFD), such as urinary incontinence (UI), anal incontinence (AI), or Pelvic Organ Prolapse (POP), affect almost 1 in 3 women after delivery, becoming one of the main and most severe reasons for completely abandoning sports due to shame, pain, and discomfort. (Schulz & Thornton, 2024) A solution supported by solid EBM is structured Pelvic Floor Muscle Training (PFMT), the effectiveness and universality of which were examined in a 2025 systematic review published in the "British Journal of Sports Medicine". The compilation of studies proved that conscious training involving contractions engaging the support system of the urethra and bladder lowers the risk and incidence of stress urinary incontinence by up to 37%, while the risk of clinically perceptible organ prolapse is reduced by an astonishing 56%. This intervention relies on increasing the thickness of the muscle bellies, improving the recruitment rate of fast-twitch fibers in response to sudden increases in intra-abdominal pressure (coughing, running, jumping), and stimulating extracellular connective tissue repair. (Beamish et al., 2025)

3.2. Physical Activity and Postpartum Mental Health.

Obstetrics in the 21st century is paying increasingly close attention to phenomena in the field of perinatal psychiatry. About 10% of women experience postpartum depression, with nearly 25% still in treatment after 1 year. (Lee et al., 2021) Recent research and consensus clearly advocate for the introduction of regular exercise habits as a first-line non-pharmacological therapy rescuing the mothers' nervous system. According to the 2025 Canadian Society for Exercise Physiology guidelines, accumulating about 120 minutes (MVPA) weekly, combined with adherence to sleep hygiene frameworks and procedures, protects the mother from a mood collapse in nearly half of the studied variants. Notably, studies demonstrate the power of the so-called early mobilization phenomenon – initiating activity (including light walking) even before the critical 4th trimester expires (<12 weeks postpartum) generated statistically higher gains in psychosocial health parameters, simultaneously accelerating the resolution of symptoms in those where depression had managed to develop and produce somatic symptoms. (Davenport et al., 2025)

Conclusion

The evidence synthesized in this review confirms that physical activity during pregnancy and the postpartum period represents a fundamental determinant of maternal and fetal health. Across all trimesters, regular, appropriately prescribed exercise contributes to improved metabolic control, reduced incidence of gestational diabetes and hypertensive disorders, optimized fetal growth patterns, and maintenance of maternal cardiovascular efficiency without compromising fetal safety. Trimester-specific adaptations highlight the importance of individualized exercise prescription, taking into account physiological, biomechanical, and psychological changes occurring throughout pregnancy. Importantly, resistance training and higher-intensity modalities, when properly supervised and medically indicated, appear safe and confer additional protective benefits, particularly in the prevention of pregnancy-induced hypertension and excessive fetal growth. In the postpartum period, early mobilization and structured exercise interventions, including pelvic floor muscle training, play a critical therapeutic role. They significantly reduce the risk of pelvic floor dysfunction, facilitate functional recovery, and contribute to the prevention and alleviation of postpartum depressive symptoms. Taken together, contemporary evidence supports a paradigm shift in obstetric care: physical activity should not be viewed merely as a lifestyle recommendation, but as an evidence-based preventive and therapeutic strategy integrated into routine prenatal and postnatal care. Future research should focus on refining trimester-specific exercise protocols and further elucidating the molecular and epigenetic mechanisms underlying maternal–fetal adaptations to physical exertion.

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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

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

Acknowledgement

Not applicable.

Conflict of Interest

The authors declare no conflict of interest.

Declaration of the use of generative AI and AI

In preparing this work, the authors used Google Gemini for the purpose of improving language and readability. After using this tool, the authors reviewed and edited the content as necessary and accept full responsibility for the substantive content of the publication.

References

Cilar Budler, L., & Budler, M. (2022). Physical activity during pregnancy: a systematic review for the assessment of current evidence with future recommendations. *BMC sports science, medicine & rehabilitation*, 14(1), 133. <https://doi.org/10.1186/s13102-022-00524-z>

- Angelino, A., Colacurci, D., Borrelli, P., Tramontano, A. L., Niccolini, L., Giudice, M., Calvanese, M., Mennitti, C., Scudiero, O., Mappa, I., Derme, M., Rizzo, G., Guida, M., Maruotti, G. M., & Sarno, L. (2026). Adherence to physical activity during the first trimester of pregnancy: a study from Southern Italy. *Archives of gynecology and obstetrics*, 313(1), 49. <https://doi.org/10.1007/s00404-026-08320-7>
- Santos, P. C., Leirós-Rodríguez, R., Abreu, S., Ferreira, M., Alves, O., & Mota, J. (2022). Physical activity during pregnancy and its effects on neonatal outcomes. *Placenta*, 128, 9–17. <https://doi.org/10.1016/j.placenta.2022.08.009>
- Ehrlich, S. F., Ferrara, A., Hedderson, M. M., Feng, J., & Neugebauer, R. (2021). Exercise During the First Trimester of Pregnancy and the Risks of Abnormal Screening and Gestational Diabetes Mellitus. *Diabetes care*, 44(2), 425–432. <https://doi.org/10.2337/dc20-1475>
- Lu, Q., Yan, S. J., Chen, H. J., Pan, X. F., Ye, Y. X., Song, X. Y., Wang, R. X., & Lyu, C. Z. (2023). The relationship between physical activity in early pregnancy and hypertensive disorders of pregnancy: a cohort study in Chinese women. *World journal of emergency medicine*, 14(3), 204–208. <https://doi.org/10.5847/wjem.j.1920-8642.2023.047>
- Zhang, J., Xiao, Y., Bai, S., Lin, S., Du, S., & Wang, Z. (2024). The Association Between Exercise During Pregnancy and the Risk of Preterm Birth. *International journal of women's health*, 16, 219–228. <https://doi.org/10.2147/IJWH.S447270>
- Mei, Q., Chen, X., Liu, L., & Xiao, G. (2024). An investigation into the correlation between early-to-mid pregnancy exercise combined with cognitive behavioral therapy and anxiety levels and quality of life in patients. *The journal of obstetrics and gynaecology research*, 50(3), 381–388. <https://doi.org/10.1111/jog.15858>

- Zhou, T., Lin, Y., Ding, Y., & Wang, N. (2025). Exploring Factors Influencing Physical Inactivity During the First Trimester of Pregnancy: A Convergent Mixed-Methods Study. *Nursing open*, 12(11), e70310. <https://doi.org/10.1002/nop2.70310>
- Shen, Y., Wang, Y., & Huang, P. (2025). Effects of exercise during pregnancy on maternal and newborn outcomes. *BMC pregnancy and childbirth*, 25(1), 1158. <https://doi.org/10.1186/s12884-025-08285-6>
- He, Z., Yuan, Y., Zhang, L., Niu, W., Liu, L., Chen, B., & Wang, X. (2026). The metabolic implications of maternal exercise: effects on pregnant women and their offspring. *Frontiers in Nutrition*.
- Prevett, C., Gingerich, J., Sivak, A., & Davenport, M. H. (2025). Resistance training in pregnancy: systematic review and meta-analysis of pregnancy, delivery, fetal and pelvic floor outcomes and call to action. *British journal of sports medicine*, 59(16), 1173–1182. <https://doi.org/10.1136/bjsports-2024-109123>
- Moolyk, A. N., Wilson, M. K., Matenchuk, B. A., Bains, G., Gervais, M. J., Wowdzia, J. B., & Davenport, M. H. (2025). Maternal and fetal responses to acute high-intensity resistance exercise during pregnancy. *British journal of sports medicine*, 59(3), 159–166. <https://doi.org/10.1136/bjsports-2024-108804>
- Schulz, J. M., & Thornton, J. S. (2024). Infographic. Return to activity/sport postpartum: a summary of current recommendations. *British journal of sports medicine*, 58(9), 511–512. <https://doi.org/10.1136/bjsports-2023-107856>

Beamish, N. F., Davenport, M. H., Ali, M. U., Gervais, M. J., Sjwed, T. N., Bains, G., Sivak, A., Deering, R. E., & Ruchat, S. M. (2025). Impact of postpartum exercise on pelvic floor disorders and diastasis recti abdominis: a systematic review and meta-analysis. *British journal of sports medicine*, 59(8), 562–575. <https://doi.org/10.1136/bjsports-2024-108619>

Lee R, Thain S, Tan LK, Teo T, Tan KH. Asia-Pacific consensus on physical activity and exercise in pregnancy and the postpartum period. *BMJ Open Sport & Exercise Medicine*. 2021;7:e000967. <https://doi.org/10.1136/bmjsem-2020-000967>

Davenport, M. H., Ruchat, S. M., Jaramillo Garcia, A., Ali, M. U., Forte, M., Beamish, N., Fleming, K., Adamo, K. B., Brunet-Pagé, É., Chari, R., Lane, K. N., Mottola, M. F., & Neil-Sztramko, S. E. (2025). 2025 Canadian guideline for physical activity, sedentary behaviour and sleep throughout the first year post partum. *British journal of sports medicine*, bjsports-2025-109785. Advance online publication. <https://doi.org/10.1136/bjsports-2025-109785>