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Strength training in pregnancy. Systematic review of benefits and risks.

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Abstract

Background

Strength training during pregnancy has historically been approached with caution, but recent evidence suggests it can be safe and beneficial when properly supervised. This review examines its impact on maternal and fetal health, addressing both advantages and potential risks.

Purpose of Research

The study aims to evaluate the benefits and risks of strength training during pregnancy, focusing on maternal and fetal outcomes.

Research Materials and Methods

Data were collected from PubMed, MEDLINE, and Web of Science using keywords like "strength training," "pregnancy," and "maternal health." Guidelines from ACOG and RCOG were analyzed to provide evidence-based recommendations.

Basic Results

Strength training, when properly supervised, improves musculoskeletal health, reduces gestational diabetes risk, enhances cardiovascular fitness, and supports mental well-being. It may also promote healthier fetal outcomes by regulating maternal blood sugar levels. Risks include overheating, injury, and strain, particularly in cases of pre-existing conditions or improper exercise execution.

Conclusions

Individualized assessment and tailored programs are essential to maximize benefits and minimize risks. Safe practices, including professional consultation, appropriate exercise selection, and monitoring of intensity, are crucial. Further research is needed to refine guidelines and explore long-term effects. Strength training is a valuable component of prenatal care when conducted safely.

Keywords: Strength Training, Pregnancy, Maternal Health, Fetal Development, Gestational Diabetes, Musculoskeletal Pain, Exercise Safety, Mental Well-being, Neonatal Outcomes, Physical Activity Guidelines.

Introduction

Historically, pregnancy was often associated with recommendations for rest and avoidance of strenuous physical activity (1). This perspective stemmed from concerns about potential risks to both maternal and fetal health. However, over the past few decades, accumulating evidence has challenged this notion, leading to a paradigm shift in recommendations regarding exercise during pregnancy (2). Current guidelines from organizations such as the American College of

Obstetricians and Gynecologists (ACOG) and the Royal College of Obstetricians and Gynaecologists (RCOG) now encourage moderate-intensity physical activity for most pregnant women (3,4). These guidelines emphasize the potential benefits of exercise for maternal well-being, including improved cardiovascular fitness, weight management, and reduced risk of gestational diabetes (5).

While aerobic exercise has been widely studied and promoted during pregnancy, the role of strength training has received comparatively less attention (6). Strength training, also known as resistance training, involves exercises that challenge muscles against external resistance, such as weights, resistance bands, or body weight. It offers unique benefits, including increased muscle strength and endurance, improved bone density, and enhanced functional capacity (7). These benefits can be particularly relevant during pregnancy, as women experience significant physiological changes that can impact their musculoskeletal system and overall physical function.

Despite the potential advantages, concerns regarding the safety of strength training during pregnancy persist. These concerns often revolve around the potential for increased intra-abdominal pressure, risk of falls, and potential adverse effects on fetal development (8). Therefore, a comprehensive review of the available evidence is crucial to evaluate the benefits and risks of strength training in pregnancy and to provide evidence-based recommendations for clinical practice.

This review aims to systematically examine the current literature on strength training during pregnancy. Specifically, it will:

1. Assess the impact of strength training on various maternal health outcomes, including gestational weight gain, musculoskeletal pain, gestational diabetes, pre-eclampsia, and mental well-being.
2. Evaluate the effects of strength training on fetal and neonatal outcomes, such as birth weight, gestational age at birth, and Apgar scores.
3. Synthesize the existing evidence to provide practical safety considerations and guidelines for strength training during pregnancy, including contraindications, exercise modifications, and recommendations on exercise intensity, frequency, and duration.

By addressing these objectives, this review aims to provide clinicians and pregnant women with a comprehensive understanding of the role of strength training in promoting maternal and fetal health.

Methodology

This study investigates the current state of knowledge regarding the benefits and risks of strength training during pregnancy. Information was gathered from PubMed, MEDLINE, and Web of Science using keywords including "strength training," "resistance training," "pregnancy," "maternal health," "fetal development," and related terms. Gathered materials, including studies and reviews, were analyzed to assess the impact of strength training on maternal and fetal health, incorporating guidelines from ACOG and RCOG to provide evidence-based recommendations (3,4).

Benefits of Strength Training in Pregnancy

Strength training during pregnancy delivers a wide array of physical and psychological benefits, tailored to the unique physiological changes experienced during this period.

Musculoskeletal Health: Pregnancy often places additional strain on the musculoskeletal system, resulting in issues such as lower back pain, pelvic discomfort, and poor posture. Resistance exercises improve core and pelvic floor muscle strength, which are vital for supporting the growing uterus and alleviating strain on the spine. Strengthening these muscles can also aid in preventing diastasis recti (separation of abdominal muscles) and preparing the body for labor and delivery (9,10).

Cardiovascular Benefits: Resistance training enhances heart health by improving circulation and promoting efficient oxygen transport, crucial for fetal development. It may also reduce the risk of gestational hypertension and preeclampsia by supporting healthy blood pressure levels. Research suggests that pregnant individuals engaging in combined aerobic and

resistance training experience greater improvements in cardiovascular fitness compared to aerobic training alone (3,9).

Metabolic Regulation: Strength training can help maintain healthy blood sugar levels, decreasing the risk of gestational diabetes. This metabolic control not only benefits maternal health but also reduces risks of excessive fetal growth (macrosomia) and long-term metabolic disorders for the child. Moreover, maintaining muscle mass through resistance training supports insulin sensitivity during pregnancy, a key factor in metabolic health (3,10).

Mental Health: Pregnancy is often accompanied by emotional fluctuations due to hormonal changes. Strength training has been shown to reduce symptoms of anxiety and depression by promoting endorphin release. This mood stabilization, combined with improved self-esteem from physical activity, supports maternal mental well-being during a potentially stressful time (3,9).

Labor and Recovery: Regular strength training may lead to shorter labor durations and reduced need for medical interventions. Postpartum, women who engaged in resistance training during pregnancy often recover faster and experience less muscle fatigue and weakness (3,10).

Risks and Considerations

Strength training during pregnancy can provide several health benefits, but it is essential to consider specific risks and contraindications to ensure both maternal and fetal safety. One of the most important factors to address before starting strength training is identifying any pre-existing conditions that may pose a risk. Pregnant women with certain health conditions, such as uncontrolled hypertension, heart disease, severe asthma, or gestational diabetes, may be advised against or require modifications to their exercise routine. For example, women with hypertension may need to avoid exercises that cause excessive increases in blood pressure or strain the cardiovascular system (3). Furthermore, women with placental abnormalities, such as placenta previa, may be advised to avoid activities that put excessive pressure on the abdomen (11).

Potential risks associated with strength training during pregnancy primarily include overheating, injury, and undue strain on the body. During pregnancy, the body's thermoregulatory system undergoes changes that may make women more susceptible to overheating, particularly if they engage in intense exercise without proper hydration or ventilation. Overheating can increase the risk of fetal harm, including neural tube defects. Therefore, maintaining a comfortable temperature, staying hydrated, and avoiding overly intense exercise sessions are essential to mitigate this risk. Additionally, the body's center of gravity shifts as the pregnancy progresses, which may increase the risk of falls and injuries. Women should be cautious of exercises that challenge balance or involve heavy weights that could result in falls or strain (11).

Another key consideration is that pregnancy leads to changes in joint stability and muscle flexibility, as hormones such as relaxin loosen ligaments to prepare for childbirth. While this is necessary for delivery, it also makes joints more vulnerable to injury, especially when performing high-intensity or improperly executed strength exercises. Therefore, using proper technique, focusing on controlled movements, and avoiding exercises that place excessive stress on the ligaments and joints are essential to reduce injury risk (12).

To minimize these risks, it is crucial for pregnant women to undergo individualized assessments before beginning a strength training program. Healthcare providers should assess the individual's overall health, pregnancy progression, and fitness level. A customized exercise plan can then be developed that aligns with the woman's specific health conditions and goals. Regular monitoring and adjustments are vital to ensure that the intensity and type of exercise remain safe throughout the pregnancy. This approach helps to ensure the benefits of strength training are maximized while minimizing potential risks to both mother and child (11).

Safe Strength Training Practices in Pregnancy

Safe strength training during pregnancy is essential to protect the health of both the mother and the developing baby. When conducted properly, it can offer numerous benefits while minimizing potential risks.

Consultation with Healthcare Professionals: Pregnant individuals should consult their healthcare providers, such as obstetricians or physiotherapists, before starting or continuing a strength training regimen. This consultation ensures there are no contraindications, such as placenta previa, preeclampsia, or a history of preterm labor, which could make exercise unsafe. Healthcare professionals can also provide personalized recommendations to suit each stage of pregnancy (3,10).

Choosing Appropriate Exercises: Pregnant individuals should focus on exercises that are safe and effective for their changing bodies. Low-impact strength training activities such as bodyweight squats, resistance band exercises, and light dumbbell lifts are excellent choices. Exercises that involve lying on the back (especially after the first trimester) or those that cause excessive strain on the abdomen should be avoided. Instead, workouts should emphasize improving core stability, pelvic floor strength, and posture, which are critical for supporting the body during pregnancy and preparing for labor (10,13,14).

Monitoring Intensity and Frequency: Pregnant individuals are advised to maintain moderate exercise intensity, where they can comfortably hold a conversation (the "talk test"). Sessions should not exceed fatigue thresholds, and it’s recommended to exercise 2–3 times per week with adequate rest between sessions. Monitoring perceived exertion levels and avoiding overexertion is key. According to guidelines by the American College of Obstetricians and Gynecologists (ACOG), strength training can be a vital component of a well-rounded prenatal exercise program when practiced with moderation (13,14,15).

Prioritizing Proper Nutrition and Hydration: Pregnancy increases the body's energy and fluid needs, making nutrition and hydration integral to safe exercise. A balanced diet with adequate protein, healthy fats, and essential nutrients like folic acid, iron, and calcium supports both maternal and fetal development. Hydration before, during, and after exercise is critical to prevent dehydration, which can cause complications such as overheating or uterine contractions (13,14).

By adhering to these safety practices, pregnant individuals can enjoy the benefits of strength training, such as improved fitness, reduced pregnancy-related discomfort, and enhanced recovery after childbirth, while minimizing risks.

Research Evidence and Future Directions

A growing body of evidence supports the benefits of strength training during pregnancy, but research quality and focus vary significantly. Clinical trials have demonstrated that strength training can reduce risks such as excessive gestational weight gain, gestational diabetes, and hypertensive disorders (3,16,18). Other studies highlight its benefits for musculoskeletal health, such as alleviating lower back pain and enhancing posture, both of which are particularly relevant during pregnancy (17,19,20). Additionally, moderate resistance training has been associated with shorter labor durations and improved postpartum recovery (13,20).

Quality of Existing Research: Although the results are promising, many studies have limitations. A significant proportion of trials involve small, homogenous sample sizes, making it challenging to generalize findings to diverse populations. Furthermore, individuals with high-risk pregnancies, such as those with preeclampsia or multiple gestations, are often excluded from research, leaving a gap in understanding how strength training might impact these groups (3,19,21). The lack of standardized exercise protocols in studies, including variations in intensity, frequency, and types of exercises, further complicates the establishment of universal guidelines (13,18).

Future Research Directions: To address these gaps, future studies should focus on large-scale, multicenter randomized controlled trials that include diverse populations and high-risk pregnancies. These studies would help refine recommendations for the frequency, intensity, and types of exercises suitable for different trimesters. Moreover, there is a need for long-term follow-up to evaluate how maternal strength training impacts postpartum recovery and the long-term health of the child, including neurodevelopmental and metabolic outcomes (13,20,21).

Research should also investigate how prenatal strength training interacts with other lifestyle factors, such as nutrition and mental health interventions. Interdisciplinary studies that combine insights from obstetrics, physiotherapy, and nutrition could create comprehensive guidelines to support both maternal and fetal well-being (19,21).

Conclusions

Strength training during pregnancy offers a multitude of benefits for maternal and fetal health, encompassing musculoskeletal, cardiovascular, metabolic, and mental well-being. By improving posture, reducing pain, enhancing fitness, stabilizing blood sugar levels, and alleviating stress, strength training can support a healthier and more comfortable pregnancy experience. However, it is essential to acknowledge potential risks, such as injury or exacerbation of pre-existing conditions, which underscore the need for individualized assessment and professional supervision.

Safe practices, including consultation with healthcare providers, the selection of appropriate exercises, and careful monitoring of intensity, frequency, nutrition, and hydration, are critical to maximizing benefits while minimizing risks. Current research supports the positive outcomes of prenatal strength training but also reveals limitations, such as small sample sizes and exclusion of high-risk populations. Future investigations should focus on diverse, larger-scale studies to refine guidelines and explore long-term effects on maternal and child health.

In summary, strength training is a valuable addition to prenatal care when tailored to individual needs and supervised by qualified professionals. Pregnant individuals are encouraged to integrate strength training into their routines as a means of enhancing overall health, improving pregnancy outcomes, and preparing for postpartum recovery.

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References

1. Morris SN, Johnson NR. Exercise during pregnancy: a critical appraisal of the literature. J Reprod Med. 2005;50(3):181-188.

2. Artal R, O'Toole M. Guidelines of the American College of Obstetricians and Gynecologists for exercise during pregnancy and the postpartum period. Br J Sports Med. 2003;37(1):6-12. doi:10.1136/bjsm.37.1.6
3. American College of Obstetricians and Gynecologists. Physical Activity and Exercise During Pregnancy and the Postpartum Period. Committee Opinion No. 804. Obstet Gynecol. 2020;135(4):e178-e188. doi:10.1097/AOG.0000000000003772
4. Royal College of Obstetricians and Gynaecologists. Exercise in Pregnancy. Green-top Guideline No. 4. London: RCOG; 2006.
5. Davenport MH, Ruchat SM, Poitras VJ, et al. Prenatal exercise for the prevention of gestational diabetes mellitus and hypertensive disorders of pregnancy: a systematic review and meta-analysis. Br J Sports Med. 2018;52(21):1367-1375. doi:10.1136/bjsports-2017-098227
6. Barakat R, Pelaez M, Cordero Y, Perales M, Ruiz JR. Exercise during pregnancy protects against hypertension and macrosomia: systematic review. J Epidemiol Community Health. 2016;70(10):1040-1049. doi:10.1136/jech-2015-207044
7. Westcott WL. Resistance training is medicine: effects of strength training on health. Curr Sports Med Rep. 2012;11(4):209-216. doi:10.1249/JSM.0b013e31825dabb8
8. Clapp JF 3rd. Exercising throughout pregnancy. Clin Sports Med. 2000;19(2):291-306. https://doi.org/10.1016/S0278-5919(05)70203-9
9. Blagrove RC, Howatson G, Hayes PR. Effects of strength training on the physiological determinants of middle- and long-distance running performance: A systematic review. Sports Med. 2018;48(5):1117-1149. doi:10.1007/s40279-017-0835-7.
10. Medrano M, Ozores R, Alonso-Alonso P, et al. Physical activity during pregnancy: Benefits and recommendations. Nutr Hosp. 2019;36(Spec No2):23-28. doi:10.20960/nh.02577.
11. Kwiatkowska E, Kajdy A, Sikora-Szubert A, et al. Polish Society of Gynecologists and Obstetricians (PTGiP) and Polish Society of Sports Medicine (PTMS) recommendations on physical activity during pregnancy and the postpartum period. Ginekol Pol. Published online August 21, 2023. doi:10.5603/GP.a2023.0080
12. Aldabe D, Ribeiro DC, Milosavljevic S, Dawn Bussey M. Pregnancy-related pelvic girdle pain and its relationship with relaxin levels during pregnancy: a systematic review. Eur Spine J. 2012;21(9):1769-1776. doi:10.1007/s00586-012-2162-x

13. Di Mascio D, Magro-Malosso ER, Saccone G, Marhefka GD, Berghella V. Exercise during pregnancy in normal-weight women and risk of preterm birth: A systematic review and meta-analysis of randomized controlled trials. Am J Obstet Gynecol. 2016;215(5):561-571. doi:10.1016/j.ajog.2016.06.014.
14. Voerman E, Santos S, Inskip H, et al.; LifeCycle Project-Maternal Obesity and Childhood Outcomes Study Group. Association of gestational weight gain with adverse maternal and infant outcomes. JAMA. 2019;321(17):1702-1715. doi:10.1001/jama.2019.3820
15. Harrison AL, Taylor NF, Shields N, Frawley HC. Attitudes, barriers and enablers to physical activity in pregnant women: a systematic review. J Physiother. 2018;64(1):24-32. doi:10.1016/j.jphys.2017.11.012.
16. Wang C, Wei Y, Zhang X, et al. A randomized clinical trial of exercise during pregnancy to prevent gestational diabetes mellitus and improve pregnancy outcome in overweight and obese pregnant women. Am J Obstet Gynecol. 2017;216(4):340-351. doi:10.1016/j.ajog.2017.01.037.
17. Hayman M, Short C, Reaburn P. An investigation into the exercise behaviours of regionally based Australian pregnant women. J Sci Med Sport. 2018;21(4):390-394. doi:10.1016/j.jsams.2017.07.019.
18. Barakat R, Cordero Y, Coteron J, Luaces M, Montejo R. Exercise during pregnancy improves maternal glucose screen at 24-28 weeks: a randomised controlled trial. Br J Sports Med. 2012;46(9):656-661. doi:10.1136/bjsports-2011-090009
19. Mottola MF, Davenport MH, Ruchat SM, et al. 2019 Canadian guideline for physical activity throughout pregnancy. Br J Sports Med. 2018;52(21):1339-1346. doi:10.1136/bjsports-2018-100056.
20. Perales M, Calabria I, Lopez C, Franco E, Coteron J, Barakat R. Regular Exercise Throughout Pregnancy Is Associated With a Shorter First Stage of Labor. Am J Health Promot. 2016;30(3):149-154. doi:10.4278/ajhp.140221-QUAN-79
21. Evenson KR, Barakat R, Brown WJ, et al. Guidelines for Physical Activity During Pregnancy: Comparisons From Around the World. Am J Lifestyle Med. 2014;8(2):102-121. doi:10.1177/1559827613498204.