Majalah Ilmiah Fisioterapi Indonesia
Indonesian Scientific Journal of Physiotherapy

**Literature Reviews**
**ISSN (Print): 2303-1921**
**ISSN (Online): 2722-0443**
**Volume 13, Number 02, Pages 327–333 (2025)**
**DOI: https://doi.org/10.24843/mifi.000000449**

# Effectiveness of Physiotherapy in Alleviating Musculoskeletal Pain During Pregnancy: A Literature Review

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Received 08 May 2025; Received in revised form 21 April 2025; Accepted 23 April 2025; Published 01 May 2025


## Abstract

**Introduction:** Pregnancy leads to anatomical and physiological changes that frequently cause musculoskeletal complaints, particularly in the third trimester. Common issues include low back pain and pelvic girdle pain, which may interfere with daily activities and reduce the quality of life and psychological well-being of pregnant women. Physiotherapy offers targeted interventions to reduce pain and improve physical function during pregnancy.

**Methods:** This study is a literature review based on searches conducted in PubMed, Google Scholar, PEDro, and Scopus databases. The keywords used included “pregnancy,” “musculoskeletal,” “low back pain,” “pelvic girdle pain,” and “carpal tunnel syndrome.” The PRISMA flow diagram was used to guide the selection process. Inclusion criteria consisted of randomized controlled trials (RCTs) involving pregnant women over 18 years of age experiencing musculoskeletal pain and receiving physiotherapy interventions. Studies were excluded if they were non-RCTs, involved non-pregnant participants, or lacked full-text access. Eligible articles were analyzed using a synthesis matrix.

**Results:** The review found that physiotherapy interventions, including Pilates, aerobic exercise, aquatic therapy, stabilization, strengthening, and stretching exercises, effectively reduced musculoskeletal pain and disability while improving mobility and physical function. Most studies reported significant improvements following consistent physiotherapy during pregnancy.

**Conclusion:** Physiotherapy is effective in managing musculoskeletal pain among pregnant women. Interventions such as Pilates, aerobic, and aquatic exercises reduce discomfort and enhance functional capacity. These therapies should be considered for integration into antenatal care programs to support maternal health and quality of life.

**Keywords:** Pregnancy, musculoskeletal, low back pain, pelvic girdle pain, lumbopelvic pain, carpal tunnel syndrome

## Introduction

Pregnancy is a physiological condition in which a woman carries and nurtures a fetus in her uterus for approximately nine months. Various physiological and anatomical changes occur during this period, often leading to discomfort, particularly in the third trimester. These discomforts most commonly manifest as low back pain and shortness of breath, primarily due to a shift in the center of gravity and increased pressure on musculoskeletal structures resulting from fetal growth.[1]

Throughout pregnancy, the body undergoes complex adaptations to support fetal development. As the fetus grows, the center of gravity shifts forward, increasing the load and stretch on muscles and ligaments, particularly those around the spine and pelvis.[2] This leads to lower back pain, often the most prevalent complaint during the later stages of pregnancy. A survey conducted at BPM Surabaya on October 2, 2019, based on maternal health books (KIA) from 39 women in their third trimester, found that approximately 87% experienced low back pain.[3] These findings reflect a high prevalence of musculoskeletal pain among pregnant women in Indonesia and highlight the urgent need for effective management strategies.

In addition to back pain, pregnant women may experience other physical complaints such as nausea and vomiting, constipation, varicose veins, urinary disturbances, hemorrhoids, swelling in the legs and feet, and lower back pain. These symptoms not only affect physical well-being but can also have a psychological impact, especially when not managed optimally.[4]

Significant musculoskeletal changes occur due to weight gain and the anterior shift in the center of gravity caused by uterine enlargement. The increasing need for relaxation and mobility throughout pregnancy may lead to sacroiliac joint instability and increased lumbar lordosis. These biomechanical changes can cause pain resulting from muscular imbalances around the pelvis and lower back, and overstretching of the previously toned abdominal muscles.[5]

Musculoskeletal problems during pregnancy deserve attention because they have the potential to reduce quality of life, limit mobility, and increase the risk of both physical and psychological complications, some of which may persist postpartum.[6] Therefore, effective management is crucial to ensure pregnant women experience a more comfortable and safer gestation period.

Physiotherapy plays a vital role in both prenatal and postnatal phases. It helps prevent and treat musculoskeletal disorders and contributes to psychological balance, cardiovascular fitness, and weight control through interventions such as pregnancy exercise programs.[7] Moreover, physiotherapy can reduce anxiety and stress experienced by pregnant women through structured and evidence-based approaches.

Musculoskeletal physiotherapy provides interventions tailored to the individual needs of each pregnant woman. These are implemented through subjective and objective assessment, evaluation, and physiotherapy planning. The goal is to facilitate optimal movement, alleviate physical discomfort, and enhance overall comfort during pregnancy.[8] Common interventions include Pilates, antenatal exercise, relaxation techniques, and manual therapy.

This literature review aims to evaluate the effectiveness of physiotherapy interventions in reducing musculoskeletal complaints in pregnant women, particularly low back and pelvic pain, and to provide evidence-based recommendations for appropriate and safe management during pregnancy. The central question addressed in this review is: To what extent are physiotherapy interventions effective in reducing musculoskeletal pain in women during the third trimester of pregnancy?

## Methods

This study employed a systematic literature review design to analyze relevant scientific articles addressing musculoskeletal issues in pregnant women and their management through physiotherapy interventions. A comprehensive literature search was conducted across several prominent databases, including PubMed, Google Scholar, PEDro, and Scopus. The keywords used in the search included “pregnancy,” “musculoskeletal,” “low back pain,” “pelvic girdle pain,” “lumbopelvic pain,” and “carpal tunnel syndrome.” The search was limited to articles published within the past ten years (2013–2023). Additional filters were applied to include only articles written in English or Indonesian and those designed as Randomized Controlled Trials (RCTs).

The selection of articles followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram and was conducted systematically based on predefined inclusion and exclusion criteria. The inclusion criteria were as follows: (1) pregnant women aged over 18 years; (2) presence of musculoskeletal complaints; (3) undergoing physiotherapy treatment; and (4) study design being a Randomized Controlled Trial (RCT). The exclusion criteria included studies with inadequate methodology, small sample sizes, non-physiotherapy interventions, and articles not available in full text. Article selection was conducted independently by two reviewers. Any discrepancies in article selection were resolved through discussion to reach consensus.

The methodological quality of the included studies was assessed using an appropriate tool—the Cochrane Risk of Bias tool for RCTs. This instrument was employed to ensure that the articles analyzed had sufficient internal validity and met acceptable scientific standards. All eligible articles were included in a synthesis matrix. Data extracted from each study included population characteristics, types of musculoskeletal complaints, physiotherapy interventions (e.g., Pilates, aerobic exercises, stretching), and measured outcomes (e.g., pain levels, mobility function, quality of life). Studies were then categorized based on the type of physiotherapy intervention, type of musculoskeletal complaint, and outcomes measured. A narrative synthesis approach was used to draw comprehensive conclusions regarding the effectiveness of physiotherapy in managing musculoskeletal complaints during pregnancy.

## Results

Eight articles were identified through systematic PubMed and Google Scholar searches using keywords related to musculoskeletal conditions, physiotherapy treatment, and pregnancy. All study populations consisted of pregnant women. Inclusion criteria commonly involved pregnant women experiencing musculoskeletal complaints such as low back pain, pelvic girdle pain, and wrist discomfort. Several studies employed control groups without interventions, while others compared different physiotherapy interventions.

Pain intensity was most frequently measured using the Visual Analog Scale (VAS), although some studies utilized the Numeric Rating Scale (NRS) and the McGill Pain Questionnaire. Disability was typically assessed using the Oswestry Disability Index (ODI) and the Roland-Morris Disability Questionnaire (RMDQ). The majority of studies reported that physiotherapy interventions were effective in reducing pain and disability associated with musculoskeletal disorders during pregnancy. However, a few studies found no statistically significant differences in pain prevalence reduction. The study selection process is illustrated in Figure 1 (PRISMA Flow Diagram), and a summary of the included studies is presented in Table 1.

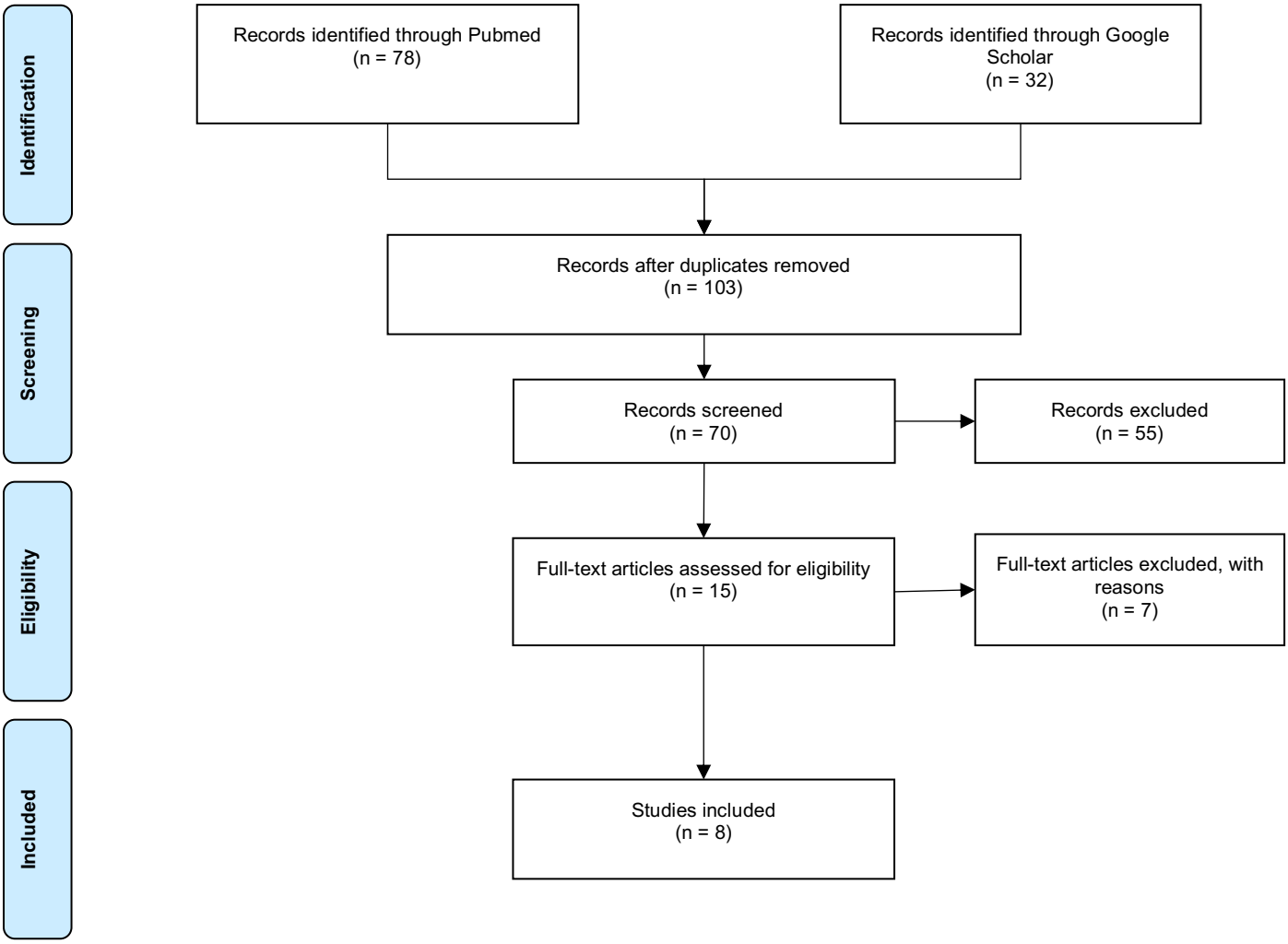


**Figure 1.** PRISMA Flow Diagram

**Table 1.** Study Synthesis (Data Extraction)

| Author | Population | Intervention | Comparison/ Control | Outcomes | Outcome Measures | Study Design | Key Findings | Conclusion |
|---|---|---|---|---|---|---|---|---|
| Yıldırım et al., 2022 | Pregnant women (mean age 29.7±6.2 years; range 18–40), second trimester (weeks 14–24) | Prenatal Pilates, twice weekly, 60 minutes per session for 12 weeks | Pregnant women with no intervention but free to exercise | Effect of Pilates on disability, pain, mood, and sleep quality in pregnancy-related low back pain | Disability: RMDQ; Pain: VAS; Mood: HADS-A & HADS-D; Sleep: PSQI | RCT | Significant improvements in RMDQ, VAS, HADS-A, and HADS-D ($p<0.05$) | Pilates is a promising therapy for pregnancy-related low back pain |
| Aparicio et al., 2023 | Pregnant women | Combined exercise (aerobic + resistance), 60 minutes, 3 times/week | Pregnant women exercising at their discretion | Effect of combined physical activity on pregnancy-related low back and sciatic pain | Pain: VAS; Disability: ODI | RCT | Combined exercise effectively reduced low back and sciatic pain | Combined training programs can relieve pregnancy-related low back and sciatic pain |

**Continuation Table 1.** Study Synthesis (Data Extraction)

| Author | Population | Intervention | Comparison/ Control | Outcomes | Outcome Measures | Study Design | Key Findings | Conclusion |
|---|---|---|---|---|---|---|---|---|
| Haakstad et al., 2015 | Pregnant women | Lumbar stabilization exercise, twice weekly, 50 minutes/session for 6 weeks | Stretching exercises, twice weekly, 50 minutes/session for 6 weeks | Comparison of lumbar stabilization vs. stretching for gestational low back pain | Pain: VAS; McGill Pain Questionnaire | RCT | Significant pain reduction on VAS and McGill Pain Questionnaire ($p<0.05$) | Both stabilization and stretching reduce pain, improve postural balance and muscle activity in pregnant women |
| Haugland et al., 2006 | Pregnant women with pelvic pain (weeks 18–32) | Stretching, stabilization, relaxation, body ergonomics, pain management, and education | Women receiving self-chosen interventions | Effect of group intervention program on pelvic pain in pregnancy | Pain intensity: VAS | RCT | No significant difference between intervention and control groups | Pelvic pain improves over time regardless of intervention type |
| Kordi et al., 2013 | Pregnant women with pelvic pain | Lumbopelvic belt plus home-based pelvic stabilization exercises | Pelvic stabilization exercises without belt | Effects of belt-assisted stabilization on QoL and function | Pain: VAS; QoL: WHOQOL-BREF | RCT | Significant reductions in VAS and ODI scores in the belt group ($p<0.001$) | Lumbopelvic belts are effective for reducing pregnancy-related pelvic pain |
| Granath et al., 2006 | Pregnant women | Prenatal water aerobics | Land-based physical exercises | Comparison of water aerobics vs. land-based exercise for back/pelvic pain | Pain classification: PLBP or PPP | RCT | Water aerobics significantly reduced pregnancy-related low back pain | Aquatic exercise is effective and recommended for pregnant women |
| Fontana et al., 2020 | Sedentary pregnant women | Regular group exercise ≥2 times/week, 30 minutes/session for 12 weeks | Standard prenatal care | Evaluation of group exercise in preventing/treating pelvic and low back pain | Structured interviews for LBP and PGP | RCT | No significant difference in pelvic (PGP) or low back pain (LBP) post-intervention | Regular group exercise did not affect the proportion of women with PGP or LBP |
| Eggen et al., 2012 | Pregnant women | Weekly group-based exercise for 16–20 weeks, 30 minutes/session | No intervention | Effect of group exercise on LBP and PGP prevalence and intensity | Pain: NRS; Disability: RMDQ | RCT | No significant effect on PGP or LBP prevalence (OR = 1.03 and OR = 0.77) | Minimal effect of group exercise on reducing pregnancy-related pain severity and prevalence |

## Discussion

All eight sources reviewed in this study exhibit similar characteristics, including the types of conditions addressed, measurement methods, and physiotherapy treatments employed, highlighting the effectiveness of physiotherapy in managing pregnancy-related issues. These studies were included in the analysis to deepen understanding of the efficacy of such interventions.

A study by Pelin et al. (2018) focused on pregnancy-related low back pain during the second trimester (weeks 14–24). Participants were divided into two groups: one received scheduled Pilates sessions, while the control group did not receive any structured exercise program, though exercise was not restricted. The results demonstrated that Pilates can serve as an effective prenatal intervention for reducing pregnancy-related back pain.[9] This finding is supported by Oktaviani I, who also reported a significant reduction in pain levels. The presumed mechanism involves reduced relaxin hormone levels, which, while facilitating pelvic ligament loosening for childbirth, may also relax ligaments supporting the spine, contributing to pregnancy-related pain.

Similarly, a study conducted by Sureeporn Phrompaet et al. in Thailand showed that Pilates can improve flexibility and control of trunk and pelvic mobility. Pilates is known to enhance spinal stability through the activation of core stabilizing muscles. Pilates reduces spinal load and pain by strengthening the abdominal, back, and pelvic muscles, which serve as spinal support structures. Moreover, the method increases body awareness and posture correction, reducing musculoskeletal strain and discomfort.[10]

### Aerobic Exercise

To address research gaps, Virginia et al. examined the effects of a combined aerobic and resistance exercise program on lower back and sciatic pain and disability at the end of pregnancy. By integrating both exercise types, they aimed to exploit different pain-relieving mechanisms. The study holds potential to provide new insights into how concurrent exercise programs manage pain and improve functional outcomes in pregnant women [11]

Kelly et al. supported the analgesic effect of aerobic exercise across various pain types, even among individuals without chronic pain. One mechanism involves activating the endogenous opioid system, where aerobic exercise increases beta-endorphin release, positively modulating pain sensitivity.[12] Similarly, Kangyong Zheng reported that improved tissue oxygenation from aerobic activity may reduce peripheral and central sensitization, thereby lowering pain intensity.[13]

### Group Interventions

Kari et al. implemented a group-based intervention for pelvic pain during pregnancy. Participants were divided into an intervention group that received structured sessions and a control group that was allowed to seek other treatments. These group sessions often include education on anatomy, pain mechanisms, and self-management strategies. Similarly, Lene et al. observed no statistically significant changes, but noted high self-reported usefulness of the intervention among participants.[14]

Ostgaard et al. found that individualized care focusing on education, posture, and exercise reduced sick leave during pregnancy, but only among women with back pain, not pelvic girdle pain.[15] Kihlstrand et al. also reported significant reductions in pain intensity and sick leave in pregnant women participating in aquatic exercise compared to a non-intervention group.[16]

In addition to exercise, pain reduction can be achieved using a lumbopelvic belt. Ramin Kordi et al. found that such belts significantly decreased pain levels compared to stabilization exercises, although stabilization yielded positive outcomes.[17] Targeted exercise may enhance the strength of muscles surrounding the pelvic girdle, thus improving stability and reducing pain.[17] Stuge et al. demonstrated the efficacy of core stabilization exercises in postpartum pelvic pain management.[18] Noren L et al. suggested that ergonomic education and proper movement guidance, when combined with pelvic belts, effectively alleviate pelvic pain during pregnancy by enhancing pelvic stability.[19]

### Aquatic Aerobics

Aquatic aerobic exercise is another common physiotherapeutic approach. Aina B's study on water aerobics for back pain in pregnant women found that buoyancy in water reduces gravitational strain and resistance, easing movement.[20] Exercises included light jogging, sit-ups, and pelvic mobility drills. The intervention reduced pain and the need for medical leave.[21] Mari Kihlstrand also confirmed that aquatic exercises alleviate back pain and reduce sick leave during pregnancy. Additionally, Clapp J.F. reported that infants born to physically active mothers were better able to tolerate labor and showed fewer stress indicators during and after delivery.[22]

### Exercise Therapy

Two studies, including one from Norway by Lene A.H., showed no significant improvements. The average sick leave due to pelvic girdle pain (PGP) was 12 weeks, with a 32% prevalence. The study involved sedentary pregnant women, and results indicated that regular group fitness classes did not reduce the prevalence of PGP or back pain due to poor exercise adherence. Physical activity increases blood flow to tissues, delivering oxygen and nutrients, while consistent exercises such as stretching or strength training improve posture and strengthen supporting musculature.[23]

A 2013 Cochrane Review concluded that physiotherapy, acupuncture, pelvic belts and cushions, aquatic exercises, and stabilization programs were more effective than standard prenatal care in relieving back and pelvic pain.[24] However, there is no clear consensus on the best method. Moseley GL emphasized that keeping an exercise diary improves adherence to home-based programs by increasing awareness of exercise frequency and progress.[25]

Adriana P et al. compared lumbar stabilization and stretching to identify further effective physiotherapy modalities for managing lower back pain. Both groups had equal training duration and intensity. Both interventions effectively reduced pain and improved postural balance (measured via COP sway velocity) and abdominal muscle activity, particularly the external oblique (EAO).[26]

According to Jaap H, pain adaptation influences muscle recruitment by modulating nociceptor projections to alpha motoneurons through excitatory and inhibitory interneurons. Thus, both interventions reduce pain and improve trunk activation after six weeks of biweekly training.[27] Fábio Renovato et al. suggested that these exercises may also enhance the viscoelastic properties of muscle fibers through repetitive motion.[28]

Furthermore, Marit et al. assessed whether group-based strengthening and stretching programs could reduce the prevalence and severity of low back and pelvic pain in pregnant women. Their findings support that group exercise alleviates spinal tension and opens the hips, improving comfort during pregnancy.[29] Mørkved et al. also found that group training programs specifically designed for pregnant women reduced low back pain prevalence, although they did not differentiate between LBP and PGP.[30]

## Conclusion

The literature indicates that physiotherapy is a practical approach for alleviating pain in pregnant women. Several treatments or exercise modalities highlighted in the reviewed studies, such as Pilates, aerobic exercise, aquatic therapy, and other physical therapies, including stabilization training, strengthening, and stretching, have demonstrated beneficial outcomes. Pilates and aerobic exercises were particularly prominent, showing greater efficacy in reducing pain in pregnant women. This is primarily attributed to their emphasis on core muscle strengthening and flexibility enhancement.

However, the effectiveness of these therapies is significantly influenced by factors such as the participants' adherence to exercise protocols and the intensity of the interventions. Although physiotherapy interventions generally yield positive results, several limitations should be considered when interpreting these findings. These include methodological heterogeneity among studies, small sample sizes, and uncontrolled variables such as underlying health conditions.

Future research should include randomized controlled trials with larger and more diverse populations. Comparative studies evaluating specific types of exercise interventions, such as Pilates versus aerobic versus aquatic exercise, are also needed to identify the most effective approach for managing pain in pregnancy. Furthermore, future investigations should explore additional variables that may influence therapeutic outcomes, such as the duration of therapy and adherence levels to physiotherapy programs.

## Acknowledgments

The authors would like to express their sincere gratitude to the Physiotherapy Study Program at Universitas Muhammadiyah Surakarta for providing the facilities, resources, and institutional support that contributed to the successful completion of this study. The academic environment and encouragement from faculty members played a vital role in the research process. Their contributions are deeply appreciated.

## Conflict of Interest Statement

The authors declare that there are no conflicts of interest related to this study.

## Funding Sources

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

## Ethics Statement

This study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Ethical approval was not required as the study involved only non-invasive procedures (blood pressure measurement and questionnaire surveys) and posed minimal risk to participants. Informed consent was obtained from all participants prior to their inclusion in the study, and confidentiality was strictly maintained.

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