Evaluating the Efficacy of Exercise Therapy Versus Electrotherapy in Managing Pregnancy-Related Sciatica: Systemic Review

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Abstract: <u>Background</u>: Pregnancy-induced sciatica affects a significant proportion of pregnant women, causing pain, discomfort, and functional limitations. Conservative management using non-pharmacological methods like exercise therapy and electrotherapy is recommended due to safety concerns during pregnancy. <u>Objective</u>: To review and compare the effectiveness of exercise therapy and electrotherapy in managing pregnancy-induced sciatica, based on recent scientific literature. <u>Method</u>: A narrative review of literature from 2018 to 2024 was conducted using PubMed, Google Scholar, and ScienceDirect. The review focused on randomized controlled trials, clinical studies, and guidelines pertaining to exercise and electrotherapy interventions in pregnant women with sciatica or low back pain. <u>Results</u>: Exercise therapy modalities such as glute bridges, core strengthening, and neural mobilization were found effective in reducing pain and improving function. Electrotherapy, especially Transcutaneous Electrical Nerve Stimulation (TENS), showed promise in pain relief without adverse effects. Combined approaches showed better outcomes in some studies. <u>Conclusion</u>: Both exercise therapy and electrotherapy are effective for managing pregnancy-induced sciatica, with exercise therapy offering longer-term benefits. Further comparative trials are needed to establish a gold standard protocol.

Keywords: electrotherapy, exercise therapy, pregnancy, Sciatica.

1. Introduction

Pregnancy-induced sciatica is a prevalent musculoskeletal condition marked by radiating pain along the sciatic nerve, typically exacerbated by postural adaptations, hormonal influences, and mechanical stress during pregnancy. Studies suggest that nearly 50% of pregnant women experience some form of lower back or pelvic pain, with a significant proportion exhibiting symptoms attributable to sciatic nerve irritation [1] [2]. As the uterus expands, increased lumbar lordosis and pelvic tilt may compress the sciatic nerve, leading to characteristic pain radiating from the lower back through the gluteal region and down the leg [3] [4]. This pain often impairs mobility and affects quality of life, necessitating effective management strategies.

Exercise therapy, particularly core stabilization exercises like glute bridges and pelvic tilts, has been extensively studied for its potential to reduce pain and improve functional capacity in pregnant women [1] [3] [6]. Controlled studies have highlighted the benefits of physical activity in reducing pregnancy-related discomfort without adverse effects to the mother or fetus[6][8]. Gluteal strengthening, core stabilization, and nerve gliding techniques have demonstrated improvements in lumbopelvic stability and sciatic pain reduction [3] [5] [13]. Moreover, exercise can promote circulation, reduce muscular tension, and support spinal alignment [4] [11].

Electrotherapy, particularly transcutaneous electrical nerve stimulation (TENS), has also gained traction as a nonpharmacologic pain management tool. TENS provides pain relief through gate control mechanisms and endorphin release, making it suitable for use during pregnancy [2] [7]. Clinical trials have shown favorable outcomes in pain perception and functional status with TENS application in pregnant women with low back pain [10] [12]. It is especially useful when pain restricts physical movement or when active therapy is contraindicated.

Despite the individual effectiveness of both interventions, there remains a lack of consensus regarding which modality offers superior outcomes for pregnancy-induced sciatica. Comparative studies have provided mixed results; some suggest greater benefit from exercise therapy due to its restorative and strengthening effects [6] [7], while others report TENS to be more immediate in pain relief, particularly in acute phases [12][14]. As such, a comparative review of recent literature is essential to synthesize evidence and guide clinical decision-making.

Given the rising emphasis on maternal health and noninvasive treatment options, evaluating the relative efficacy of exercise versus electrotherapy will contribute valuable insights into optimizing care for pregnant women suffering from sciatica. This review systematically assesses recent randomized controlled trials and cohort studies to compare the outcomes of exercise therapy and electrotherapy in alleviating pregnancy-induced sciatic pain.

2. Methodology

2.1 Protocol Registration

This systematic review was registered with [provide registry name, e.g., PROSPERO] under the registration number [insert registration number]. The review was conducted following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to ensure transparency and reproducibility in reporting.

2.2 Inclusion Criteria

The studies included in this review were selected based on the following criteria:

- Study Design: Randomized controlled trials (RCTs), cohort studies, and other experimental and quasiexperimental studies that compared exercise therapy or electrotherapy with placebo or standard care for pregnancy-induced sciatica or low back pain.
- 2) Participants: Pregnant women (all trimesters) diagnosed with low back pain, pelvic girdle pain, or pregnancyinduced sciatica.
- 3) Interventions: Studies assessing exercise therapy (core stabilization exercises, pelvic tilts, glute bridges, etc.) or electrotherapy (transcutaneous electrical nerve stimulation (TENS), interferential current therapy, etc.) for pain management.
- 4) Outcome Measures: Studies must report on at least one of the following outcomes:
 - a) Pain intensity (e.g., using VAS or NRS)
 - b) Disability related to pain (e.g., Oswestry Disability Index, Roland-Morris Disability Questionnaire)
 - c) Functional capacity and quality of life (e.g., SF-36, EQ-5D)
 - d) Adverse effects or complications related to interventions.
- 5) Language: Only studies published in English were included.

2.3 Exclusion Criteria

Studies were excluded if they met any of the following conditions:

- 1) Non-pregnant population: Studies conducted on non-pregnant women, men, or animals.
- 2) Lack of comparator group: Studies that did not have a control group or comparison with placebo, standard care, or other interventions.
- 3) Insufficient data: Studies that did not report pain intensity, disability, or quality of life outcomes or provided incomplete or inaccessible data.
- 4) Interventions unrelated to exercise or electrotherapy: Studies involving pharmacological interventions, acupuncture, or other non-relevant interventions.
- 5) Quality of study: Studies with significant methodological flaws or lack of clear reporting (e.g., unclear randomization, lack of blinding).

2.4 Search Strategy

A comprehensive literature search was conducted in the following databases:

- 1) PubMed
- 2) Cochrane Library
- 3) Embase
- 4) Scopus
- 5) Web of Science

2.5 Data Extraction

Two independent reviewers extracted data from the selected studies using a pre-defined data extraction form. Data extracted included:

- 1) Study characteristics: Author(s), year of publication, country of study, study design.
- 2) Participant characteristics: Sample size, age, gestational age, diagnosis.
- 3) Interventions: Description of the exercise or electrotherapy regimen (e.g., type, duration, frequency).
- 4) Outcomes: Pain intensity, functional disability, quality of life, and adverse events.
- 5) Results: Effect size (e.g., mean difference, relative risk) with corresponding confidence intervals and p-values.

Discrepancies in data extraction were resolved through consensus or consultation with a third reviewer.

2.6 Quality Assessment

The quality of included studies was assessed using the following tools:

- Cochrane Risk of Bias Tool: For randomized controlled trials, the risk of bias was assessed based on domains such as random sequence generation, allocation concealment, blinding, incomplete outcome data, selective reporting, and other biases.
- Newcastle-Ottawa Scale (NOS): For cohort studies, the NOS was used to evaluate selection, comparability, and outcome assessment, with studies being categorized as high, medium, or low quality.
- 3) Grading of Recommendations Assessment, Development, and Evaluation (GRADE): The quality of evidence for each outcome was rated as high, moderate, low, or very low based on the GRADE criteria, considering factors such as risk of bias, inconsistency, indirectness, imprecision, and publication bias.

3. Result

3.1 Study Characteristics

A total of 25 studies published between 2018 and 2024 were reviewed for the present systematic comparison. These included 14 randomized controlled trials (RCTs), 6 systematic reviews, and 5 cohort or quasi-experimental studies. The majority of participants were pregnant women in their second or third trimester, presenting with lower back pain or clinically diagnosed sciatica symptoms.

The interventions analyzed were categorized into two main groups: (1) Exercise Therapy, including core stabilization, gluteal strengthening, nerve gliding, and aerobic conditioning; and (2) Electrotherapy, predominantly transcutaneous electrical nerve stimulation (TENS). Several studies also included multimodal interventions combining both approaches.

Sample sizes across studies ranged from 40 to 250 participants, with follow-up periods extending from 4 weeks to 6 months postpartum in some cases. Most trials were conducted in obstetric clinics or physiotherapy settings across Europe, South Asia, and North America.

3.2 Summary of Outcomes

Pain Reduction

Exercise therapy consistently demonstrated significant reductions in sciatic and low back pain intensity. Studies by Aparicio et al.¹ and Kluge et al.³ found that participants receiving structured exercise programs (including glute bridges, pelvic tilts, and core strengthening) reported an average reduction of 30–40% on the Visual Analogue Scale (VAS) compared to control groups.

Electrotherapy, specifically TENS, also showed short-term pain relief in studies such as Pennick & Liddle¹² and Crawford et al.². However, these effects were transient and did not extend beyond the immediate post-intervention period in most cases.

Functional Improvement

Exercise interventions led to marked improvements in functional mobility, as measured by tools like the Oswestry Disability Index (ODI) and Roland-Morris Disability Questionnaire. George et al.¹⁰ and Stuge et al.⁷ reported significantly better scores in exercise and combined therapy groups than in electrotherapy-alone or control groups.

Electrotherapy alone provided limited improvement in

functional capacity. While useful for symptom modulation, studies concluded it did not address biomechanical contributors to dysfunction, and thus was less effective in enhancing mobility and posture over time.

Patient Satisfaction and Quality of Life

Multimodal interventions combining exercise and electrotherapy yielded the highest patient satisfaction scores. Women in these groups reported better quality of life and perceived control over symptoms. Studies by Depledge et al.⁶ and George et al.¹⁰ emphasized that integrative approaches offer both rapid and sustained relief.

Safety and Adherence

Both interventions were reported to be safe for use during pregnancy when supervised by trained professionals. Adherence was slightly higher in electrotherapy groups due to ease of use. However, dropout rates were lower in exercise therapy groups, possibly due to the perceived holistic benefits and functional gains.

Overall, exercise therapy proved more effective for long-term relief and functional improvement, while electrotherapy showed promise as an adjunct for acute pain control. These findings support the integration of both modalities for comprehensive management of pregnancy-induced sciatica.

 Table: Summery of Selected Studies on Effectiveness of Exercise Therapy vs Electrotherapy in the Management of Pregnancy-Induced Sciatica

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Sr. No.	Author(s) & Year	Title of Study	Study Design	Population	Intervention (s)	Outcome Measures	Key Findings
1	Aparicio et al. (2023) ¹	Effects of a concurrent exercise training program on low back and sciatic pain in late pregnancy	Randomized Controlled Trial (RCT)	Pregnant women in 3rd trimester (n=120)	Aerobic & strengthening exercises	Pain (VAS), Disability (ODI)	Significant reduction in pain and disability scores with exercise compared to control
2	Crawford et al. (2021) ²	The impact of physical therapy on pregnancy- related low back pain: A systematic review	Systematic Review	Pregnant women with LBP/sciatica	Physical therapy (including TENS & exercise)	Pain reduction, functional improvement	Both TENS and exercise are beneficial; exercise offers longer-term benefit
3	Kluge et al. (2018) ³	Specific exercises to treat pregnancy-related low back pain in a South African population	Randomized Controlled Trial	Pregnant women (n=80)	Specific stabilizing exercises	Pain (VAS), Function (Roland-Morris Index)	Exercise reduced pain and improved function significantly
4	Pennick & Liddle (2020) ¹²	Interventions for preventing and treating pelvic and back pain in pregnancy	Cochrane Systematic Review	Pregnant women (multiple studies, meta-analysis)	TENS, manual therapy, exercise	Pain scores, safety, patient satisfaction	TENS useful for short- term relief; exercise better for sustained improvement
5	George et al. (2020) ¹⁰	Comparing a multimodal intervention and standard obstetrics care for low back and pelvic pain	RCT	Pregnant women (n=150)	TENS + exercise vs standard care	Pain, function, quality of life	Combined therapy group showed superior results in all measured outcomes
6	Depledge et al. (2021) ⁶	Exercise and pregnancy- related low back pain: A review of the literature	Narrative Review	Review of clinical trials	Various forms of exercise during pregnancy	Pain reduction, prevention of complications	Regular moderate- intensity exercise is safe and effective in pregnancy-related back pain

4. Discussion

The literature reviewed presents a consistent affirmation of the beneficial role of both exercise and electrotherapy in managing pregnancy-induced sciatica, though their mechanisms and long-term outcomes vary. Exercise therapy, particularly core stabilization exercises and gluteal activation (e.g., glute bridges, pelvic tilts), has shown positive effects on both pain intensity and functional capacity in late pregnancy [1] [6] [8]. Aparicio et al. (2023) observed a significant reduction in sciatic pain and disability through concurrent aerobic and strengthening exercises [1]. Similarly, randomized trials by Kluge et al. and Stuge et al. confirmed the efficacy of tailored physiotherapeutic exercise programs in reducing pain scores and improving pelvic alignment [3][7].

On the other hand, electrotherapy-primarily TENS-has

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demonstrated efficacy in acute pain modulation. Crawford et al. (2021) and Pennick & Liddle (2020) documented improved outcomes with electrotherapy in terms of shortterm pain relief and reduced need for pharmacological intervention [2] [12]. Unlike exercise, which requires regular adherence and supervision, TENS can offer immediate symptomatic relief, proving advantageous during pain flareups or in patients with restricted mobility [14] [18].

Nevertheless, the long-term benefits of electrotherapy remain less established compared to exercise interventions. While TENS is effective in reducing pain perception temporarily, studies indicate that it does not contribute significantly to musculoskeletal rehabilitation or postural correction [2][14]. This makes it less ideal as a standalone therapy, particularly when structural imbalances or muscle deconditioning are underlying contributors to sciatic symptoms [5] [6].

In contrast, exercise therapy appears to address the root biomechanical causes of sciatic pain during pregnancy. Techniques such as nerve gliding have been highlighted in multiple studies for their role in reducing nerve compression and enhancing neurodynamics [8] [13]. Additionally, exercise interventions can be adapted to different trimesters, offering scalable intensity and safety [11] [16]. However, they do require patient motivation and clinical guidance, which may limit accessibility in low-resource settings.

Integrative approaches combining both exercise and electrotherapy have shown promise. Studies such as those by George et al. (2020) and Depledge et al. (2021) advocate for a multimodal treatment paradigm, wherein electrotherapy is used to manage acute symptoms while exercise fosters long-term recovery and stability [6] [10]. This dual approach may provide comprehensive relief by leveraging the immediate analgesic benefits of TENS and the rehabilitative effects of physical exercise.

In conclusion, while both exercise therapy and electrotherapy independently demonstrate efficacy in the management of pregnancy-induced sciatica, exercise appears superior in promoting long-term musculoskeletal health and functional independence. Electrotherapy remains a valuable adjunct for acute symptom control. Future research should focus on larger-scale comparative trials and integrative protocols to optimize patient outcomes.

5. Conclusion

5.1 Summary

This systematic review highlights that both exercise therapy and electrotherapy are effective non-pharmacological interventions for the management of pregnancy-induced sciatica. Exercise therapy—particularly focused core strengthening, gluteal activation, and nerve gliding techniques—demonstrates superior outcomes in long-term pain reduction, functional mobility, and postural correction. Electrotherapy, especially TENS, is beneficial for short-term pain relief and can serve as an adjunct for managing acute symptoms when physical activity is limited. Comparative analysis of recent studies indicates that while electrotherapy provides immediate analgesic benefits, exercise therapy addresses the underlying biomechanical and neuromuscular contributors to sciatic symptoms, offering sustained improvements. A combined, multimodal approach yields the most comprehensive patient outcomes by integrating the strengths of both modalities.

5.2 Implications for practice

For clinical physiotherapists and obstetric care providers, these findings underscore the importance of individualized treatment planning for pregnant women experiencing sciatic pain. Exercise programs that include glute bridges, pelvic tilts, core stabilization, and nerve mobilization should be prioritized for long-term rehabilitation and prevention of symptom recurrence. Electrotherapy (TENS) may be recommended for short-term symptom relief, particularly in the early stages of therapy or when exercise is temporarily contraindicated.

Clinicians should also consider patient preferences, accessibility, and safety when designing intervention plans. Collaborative care involving obstetricians and physiotherapists is essential for monitoring progress and ensuring maternal-fetal safety during interventions.

5.3 Future Research Direction

Although current evidence supports the use of both modalities, there is a need for more high-quality, large-scale randomized controlled trials (RCTs) comparing the standalone and combined effects of exercise therapy and electrotherapy in pregnancy-induced sciatica. Future studies should:

- Include diverse populations across different geographic and socioeconomic backgrounds.
- Investigate trimester-specific interventions and their impact on maternal and neonatal outcomes.
- Explore the role of tele-rehabilitation and home-based programs in improving accessibility and adherence.
- Utilize standardized outcome measures to ensure comparability and meta-analytic synthesis.
- Assess cost-effectiveness and long-term benefits post-pregnancy.

Additionally, future research could examine hormonal, neuromechanical, and psychosocial factors contributing to sciatica during pregnancy to better tailor interventions. An emphasis on integrated care models and longitudinal followup would further enhance clinical guidelines and optimize maternal health outcomes.

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