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Effects of TENS along with Labor Exercises on Pain Intensity in Pregnant Women

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DECLARATIONS

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ABSTRACT

Background: Labor pain is usually very severe, especially for first-time mothers, and many women struggle to deal with it. Non-pharmacological methods like transcutaneous electrical nerve stimulation and labor exercises are considered safe and can sometimes reduce the need for medicines. **Objective:** To assess the effects of TENS, along with basic labor exercises, on pain intensity during labor and to compare it with routine labor care. **Methodology:** A randomized trial was carried out, and a total of 60 primigravida women in the active first stage of labor were randomly allocated into two equal groups (n=30 each) using a computer-generated randomization sequence. Women with high-risk pregnancies, obstetric complications, pre-existing medical conditions, or contraindications to TENS were excluded. The intervention group received transcutaneous electrical nerve stimulation and selected labor exercises, while the control group received routine labor care only. Labour exercises included upright positions, pelvic rocking, gentle bouncing on a birthing ball, and guided breathing techniques. Pain was checked by using numeric pain rating scale (0-10) before starting the intervention and again after 60 minutes. Participant safety and adherence were monitored throughout the study. Any adverse events, such as skin irritation or fatigue, were promptly addressed. Between-group comparisons for continuous variables were performed using independent t-tests. Repeated measures of pain scores were analyzed using repeated-measures ANOVA. **Results:** Pain increased as labor moved forward in both groups, but after intervention, the improvement was greater in the intervention group. Their first mean pain score was 6.4 ± 1.1, and in the control group it was 6.3 ± 1.0. After 60 minutes, the pain reduced to 4.9 ± 1.2 in the intervention group, while in the control group it reduced only to 5.8 ± 1.3. This difference after intervention was significant ($p<0.05$), indicating better pain relief with transcutaneous electrical nerve stimulation and exercises compared with routine care. **Conclusion:** Transcutaneous electrical nerve stimulation, along with labor exercises, showed better results in reducing labor pain than routine care alone. Since this approach is simple, non-invasive, and safe for mother and baby, it can be considered a helpful method for pain management during the first stage of labor.

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INTRODUCTION

Labour pain is one of the most severe and challenging forms of physiological pain that women experience.[1,2] It is influenced by multiple factors, including physical, hormonal, emotional, and cultural factors, making each woman's experience unique.[3] First-time mothers often report heightened anxiety and fear during labour, which can intensify the perception of pain and affect confidence in coping with contractions.[4] Effective management of labour pain is therefore critical not only to reduce discomfort but also to improve the overall childbirth experience and maternal satisfaction.[5] While pharmacological interventions such as epidural analgesia and opioids are commonly available, their use may be limited by side effects, cost, and availability.[6] Moreover, some women prefer minimal medical intervention for a more natural birth experience. This has prompted a growing interest in safe, non-pharmacological strategies that are feasible for routine clinical practice, especially in low-resource settings.[7]

Transcutaneous electrical nerve stimulation (TENS) is increasingly recognized as a non-invasive method to alleviate labour pain.[8] TENS involves applying low-voltage electrical impulses through electrodes placed on the lumbosacral region, which helps block pain transmission to the central nervous system and may stimulate the release of endorphins.[9] Clinical trials in Asia and the Middle East have demonstrated that TENS can significantly reduce pain intensity during the first stage of labour and improve maternal comfort.[10,11] Some studies have further reported that TENS applied at specific acupuncture points may provide enhanced analgesic effects.[12] Additionally, research comparing different TENS frequencies suggests that higher-frequency stimulation can provide superior pain relief for labouring women.[11] Overall, TENS is valued for being non-invasive, simple to administer, and compatible with maternal mobility, which is beneficial for labour progression.[8]

Alongside TENS, labour exercises are recommended to support comfort, mobility, and effective labour outcomes.[12] Common interventions include the use of a birthing ball for pelvic rocking, upright postures, walking, gentle bouncing, and controlled breathing techniques.[5] These exercises may enhance pelvic alignment, promote foetal descent, and reduce musculoskeletal tension, thereby facilitating a smoother labour experience.[10] Studies conducted in India and Turkey have shown that women performing such exercises report lower pain scores and improved satisfaction during labour compared to those receiving routine care.[7,9]

Breathing and relaxation techniques also reduce anxiety, improve oxygenation, and contribute to a sense of control, which can positively influence labour perception.[12] Although both TENS and labour exercises have demonstrated effectiveness individually, limited research examines the combined use of these interventions.[10] Integrating TENS with exercises may be particularly beneficial because the methods operate through complementary mechanisms, TENS directly modulating pain signals and exercises improving mobility, comfort, and uterine efficiency.[8,12] This combined approach is practical, low-cost, and can be integrated easily into routine labour care, especially in hospitals with limited access to pharmacological analgesia.

Despite global interest in non-pharmacological interventions, many maternity units in Asia still rely predominantly on drug-based pain relief, leaving a gap for safe, effective, and mother-centered alternatives.[7] Considering the increasing need for supportive labour practices, this study aims to evaluate the effects of TENS along with labour exercises on pain intensity in pregnant women. Evidence from this research may encourage the adoption of combined non-pharmacological interventions in routine practice, enhance maternal comfort, and contribute to more positive childbirth experiences in resource-constrained settings.

METHODOLOGY

This is a randomized controlled trial study at the Gynecological Department of Nawaz Sharif Social Security Hospital, Lahore, from January 2024 to September 2024. The purpose of the study was to evaluate the effects of TENS combined with labour exercises on pain intensity in pregnant women during the first stage of labour. Ethical approval was obtained from the ethical review board of Lahore Medical and Dental College, and informed written consent was obtained from all participants before enrolment. Participants were assured that they could withdraw from the study at any time without affecting their medical care. A total of 95 women were assessed for eligibility, of whom 60

primigravida women met the inclusion criteria and were enrolled in the study. The participants' ages ranged from 22 to 35 years, with singleton pregnancies, cephalic presentation, and gestational age between 37 and 41 weeks. Women with high-risk pregnancies, obstetric complications, pre-existing medical conditions, or contraindications to TENS were excluded.

Eligible participants were randomly allocated into two equal groups (n=30 each) using a computer-generated randomization sequence. The intervention group received both TENS and guided labour exercises, while the control group received routine care, including standard monitoring and supportive nursing, without TENS or structured exercises. TENS was administered using a portable unit with electrodes placed on the lower back, specifically the lumbosacral region. Stimulation was applied during the first stage of labour, with intensity adjusted according to participant comfort. Labour exercises included upright positions, pelvic rocking, gentle bouncing on a birthing ball, and guided breathing techniques.

Participants in the intervention group were instructed and supervised by a trained physiotherapist and midwife team to ensure correct performance of exercises during contractions and rest periods. Exercises were continued until the end of the first stage of labour or until the participant requested to stop. Pain intensity was measured using the Numeric Pain Rating Scale (NPRS) at predefined intervals: upon admission, at 3 cm cervical dilation, at 5 cm dilation, and at 7-8 cm dilation. The NPRS is a 0-10 validated scale, where 0 indicates no pain and 10 indicates the worst imaginable pain. Additional maternal observations included duration of the first stage of labour, maternal mobility, comfort levels, and any adverse effects related to TENS or exercises. Data were recorded by trained research assistants who were blinded to group allocation during assessment to reduce bias.

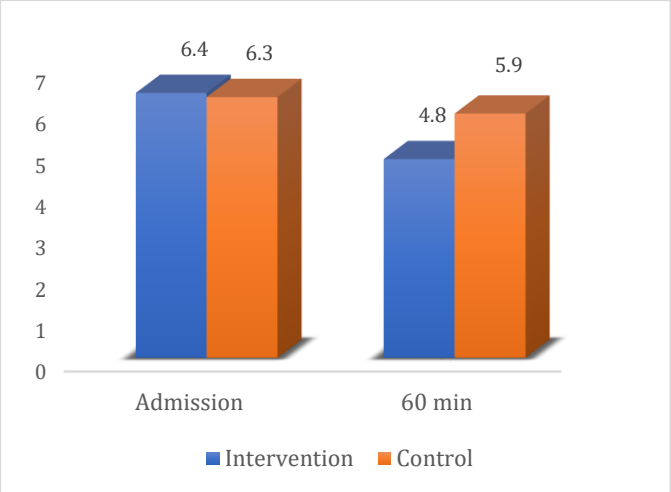
All data were entered and analyzed using SPSS version 25. Continuous variables, such as age, pain scores, and labour duration, were expressed as mean and standard deviation, while categorical variables, such as maternal posture and comfort, were presented as frequencies and percentages. Between-group comparisons for continuous variables were performed using independent t-tests. Repeated measures of pain scores were analyzed using repeated-measures ANOVA. A p-value of <0.05 was considered statistically significant. Participant safety and adherence were monitored throughout the study. Any adverse events, such as skin irritation from electrodes or fatigue from exercises, were promptly addressed. The study design ensured minimal interference with routine care while evaluating the combined effect of TENS and labour exercises on maternal comfort and pain intensity.

RESULTS

A total of 60 primigravida women aged 22 to 35 years were enrolled and randomly allocated into two groups: 30 women in the TENS and labour exercises (intervention) group and 30 women in the control group. Baseline characteristics, including age, gestational age, and cervical dilation at admission, were comparable between the two groups, indicating successful randomization. Table 1 presents the baseline characteristics of participants. The mean age of women in the intervention group was 28.3 ± 3.4 years, similar to 27.9 ± 3.2 years in the control group (p=0.58). Gestational age and cervical dilation at admission were also comparable between groups (p>0.05), confirming that the groups were homogeneous before the intervention.

Pain intensity, assessed using the NPRS, is summarized in Table 1. At admission, both groups had similar pain scores (6.4 ± 1.1 vs 6.3 ± 1.0; p=0.72). After 60 minutes, the intervention group showed a significant reduction in pain to 4.8 ± 1.2, whereas the control group decreased to 5.9 ± 1.3 (p<0.001). These findings demonstrate that combining TENS with labour exercises provides more rapid and effective pain relief compared with routine care. Table 2 shows labour duration and

Figure 1: Mean pain scores



maternal mobility. The mean duration of the first stage of labour was significantly shorter in the intervention group compared with the control group. Maternal mobility during labour, such as using upright positions or the birthing ball, was observed in 70% of women in the intervention group versus 40% in the control group (p=0.01). Neonatal outcomes, assessed by Apgar scores ≥8 at 5 minutes, were similar between groups (97% vs 93%; p=0.56), indicating that the intervention is safe for both mother and baby.

Figure 1 visually demonstrates the reduction in pain scores over time. The intervention group achieved a greater decrease in NPRS scores compared with the control group, highlighting the effectiveness of TENS combined with labour exercises. The combination of TENS and labour exercises significantly reduced pain intensity, shortened the first stage of labour, and improved maternal mobility without adverse effects. Neonatal outcomes remained unaffected, confirming the safety and efficacy of the intervention in primigravida women.

DISCUSSION

The results of this randomized controlled trial demonstrate that combining TENS with labour exercises significantly reduced pain intensity, increased mobility during labour, and shortened the first stage of labour among primigravida women. These findings support the growing body of evidence in non-pharmacological pain relief during labour and add to the understanding of how complementary methods can be used together. Numerous studies from India and the Middle East have shown that labour exercises, upright positions, and birthing ball protocols improve comfort, reduce pain, and facilitate labour progress. For example, a randomized trial in India found that women encouraged to adopt upright positions during the first stage of labour had a significantly shorter first stage and fewer instrumental deliveries compared to routine care.[13]

Another Turkish RCT reported that use of a birth ball or squatting position lowered labour pain perception and increased maternal satisfaction.[14] These exercise-based interventions align closely with our exercise component, offering further support for the mobility-based mechanism. Regarding TENS alone, meta-analyses show modest but statistically significant reductions in labour pain intensity and a delay in the need for pharmacologic analgesia.[15] A Spanish RCT comparing different TENS frequencies found that higher-frequency, higher-pulse width applications produced clinically meaningful reductions in pain

Table 1: Baseline characteristics of participants

Variables		Intervention (n=30)	Control (n=30)	p-value
Age	Years	28.3 ± 3.4	27.9 ± 3.2	0.58
Gestational age	Weeks	38.5 ± 0.8	38.4 ± 0.7	0.42
Cervical dilation (cm)	At admission	3.1 ± 0.5	3.2 ± 0.6	0.34
NPRS	At admission	6.4 ± 1.1	6.3 ± 1.0	0.72
	At 60 min	4.8 ± 1.2	5.9 ± 1.3	<0.001

Table 2: Labour and neonatal outcomes

Outcome	Intervention (n=30)	Control (n=30)	p-value
First stage duration (mins)	320 ± 45	355 ± 50	0.02
Mobility during labour (%)	70% (21/30)	40% (12/30)	0.01
Apgar ≥ 8 at 5 min (%)	97% (29/30)	93% (28/30)	0.56

scores (−2.9 points on a 10-point scale). Such findings mirror our results and validate the use of TENS in labour pain management.[16] In the Pakistani context, non-pharmacological methods remain under-utilised, and mothers often rely solely on medication or epidural analgesia when demanded.

A recent Pakistani study evaluating mixed non-drug methods (TENS, massage, aromatherapy) reported high subjective satisfaction and modest pain reductions, illustrating local feasibility.[17] Our study extends this context by combining TENS with labour exercises and demonstrating measurable benefits. The combined intervention may work through complementary pathways: TENS modulates pain signal transmission and may increase endorphin release, while labour exercises optimise maternal posture, enhance pelvic mobility, reduce muscular tension, and facilitate foetal descent. Together, they not only reduce pain but also improve the maternal sense of control and mobility, which is a key psychological component of labour pain perception.[18]

The shortening of the first stage of labour observed in the intervention group reflects the exercise component's impact on maternal biomechanics and uterine efficiency. Research from India has shown that maternal mobility and upright positions improve labour outcomes and reduce duration.[13] In our study, the addition of TENS may also have helped by reducing pain-related inhibition of maternal movement, allowing the exercises to be more effective. This synergy may explain why combining the two methods yielded better results than either alone.[19]

Strengths of the present study include its randomized controlled design, focus on primigravida women (at higher risk of intense labour pain and anxiety), and implementation in a real-life Pakistani hospital setting. We used validated pain scales and standardised protocols for the intervention, enhancing internal validity.[20] Although the sample size (n=60) is modest, it still provides meaningful results; future studies with larger multicentre samples would strengthen generalizability. Blinding participants was not feasible due to the nature of the intervention, which introduces the risk of performance bias. Also, we did not assess long-term maternal satisfaction or post-partum outcomes such as postpartum pain or breastfeeding initiation, which could provide further insight.

Clinically, the findings suggest that midwives and obstetric teams in Pakistani maternity wards should consider offering a combined TENS and labour exercise protocol as part of routine supportive care for primigravida women. This can be particularly valuable in settings where pharmacological analgesia is limited or women prefer minimal intervention.[21] Training physiotherapists and midwives in guiding labour exercises and TENS application could help integrate these methods effectively. Further research should explore the cost-effectiveness, long-term maternal experience, and neonatal outcomes of combined interventions, and examine whether similar benefits occur in multiparous women and high-risk labour settings.[22]

CONCLUSION

This study demonstrates that combining Transcutaneous Electrical Nerve Stimulation with labour exercises is an effective and safe strategy for managing pain during the first stage of labour in primigravida women. Participants who received the combined intervention experienced significantly lower pain intensity, increased mobility, and shorter first-stage labour compared to those receiving routine care. No adverse maternal or neonatal outcomes were observed, highlighting the safety of this approach. These findings support the integration of non-pharmacological interventions such as TENS and guided labour exercises into routine obstetric care, particularly in resource-limited settings where pharmacological analgesia may be unavailable or undesired. Adoption of this combined strategy can improve maternal comfort, enhance the childbirth experience, and empower women with greater control over their labour process. Further multicentre studies with larger samples are recommended to validate these results and assess long-term maternal satisfaction and post-partum outcomes.

DECLARATIONS

Consent to participate: Written consent had been obtained from patients. All methods were performed following the relevant guidelines and regulations.

Availability of Data and Materials: Data will be made available upon request. The corresponding author will submit all dataset files.

Competing interests: None

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CONSORT Guidelines: All methods were performed following the relevant guidelines and regulations.

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