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Effectiveness Of Combination Of Interferential Current (Ifc) Intervention And Core Stability Exercise In Reducing Pain And Improving Functionality In Patients With Non-Specific Lbp

Ririn Amisa[1], Chrismis Novalinda Ginting[2], Linda Chiuman[3], Imti Tsalil Amri[4]
[1] Master of Biomedical Science Study Program, Prima Indonesia University, Medan
[2] PUI Phytodegenerative and Lifestyle Medicine, Prima Indonesia University, Medan
[3] PUI Phytodegenerative and Lifestyle Medicine, Prima Indonesia University, Medan
[4] Faculty of Engineering and Computer Science, Adiwangsa Jambi University, Jambi

*E-mail : ririnamisa@gmail.com

ABSTRACT
Non-specific-low back pain (LBP) is a highly prevalent musculoskeletal disorder and a leading cause of global disability, characterized by pain, postural imbalance, and functional limitations. Interferential current (IFC) effectively reduces pain through medium-frequency electrical stimulation, while core-stability exercises enhance postural control and lumbopelvic stability. However, the effectiveness of combining IFC with core-stability compared with transcutaneous electrical nerve stimulation (TENS) plus core-stability has been rarely examined. This quasi-experimental pretest–posttest control-group study compared the two combinations in 100 patients aged 20–60 years with Non-specific-LBP, randomly allocated to IFC+core (n=50) or TENS+core (n=50). Interventions were delivered three times per week for two weeks. Pain intensity was measured with the Visual Analogue Scale (VAS) and function with the Oswestry Disability Index (ODI). Paired and independent t-tests were used (α=0.05). Both groups showed significant improvements on VAS and ODI; greater reductions in pain and disability occurred in the IFC+core group ($p<0.05$). These findings support integrating IFC with core-stability exercises in Non-specific-LBP rehabilitation.
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Keywords: *Low Back Pain, Interferential Current, TENS, Core Stability Exercise, Disability*

INTRODUCTION
Non-specific low back pain (LBP) is one of the most common musculoskeletal disorders and a leading cause of disability worldwide. It often lacks a clear anatomical cause and is influenced by factors such as age, occupation, excess weight, long sitting hours, and stress. These factors can lead to postural imbalance, reduced stability, and impaired movement, all of which affect daily function and quality of life. The 2021 Global Burden of Disease report projects that Non-specific LBP cases will rise from 619 million in 2020 to 843 million by

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2050, emphasizing its growing public health impact.

Modern rehabilitation combines pain management with active exercise. Interferential current (IFC) therapy uses medium-frequency electrical stimulation that penetrates deep tissues, offering strong yet comfortable pain relief and enhancing natural inhibitory mechanisms. Studies suggest IFC may provide better outcomes than transcutaneous electrical nerve stimulation (TENS). Meanwhile, core-stability exercises—targeting muscles like the transversus abdominis and multifidus—improve lumbopelvic control and reduce pain.

However, few studies have explored the combined effects of IFC and core-stability training. Most research has examined these interventions separately or compared IFC and TENS without structured exercise. This study investigates whether pairing IFC with core-stability training yields greater pain reduction and functional improvement than the commonly used TENS-plus-core program. Pain and disability are assessed using the Visual Analogue Scale (VAS) and Oswestry Disability Index (ODI). We hypothesize that IFC combined with core-stability exercises will provide superior outcomes, supporting more effective, exercise-centered rehabilitation for Non-specific LBP.

LITERATURE REVIEW

Non-specific low back pain (LBP) is highly prevalent and a leading contributor to disability worldwide, with projections indicating growth in global cases through 2050 (GBD 2021 LBP Collaborators, 2023). Non-specific LBP arises from multifactorial risks and presents with pain, postural imbalance, and functional limitations that impair daily activities.

Electrotherapeutic modalities are grounded in pain-gating and endogenous inhibitory mechanisms. Interferential current (IFC)—two medium-frequency currents intersecting in tissue—stimulates large-diameter afferents, modulates nociceptive transmission, and augments endorphin release, yielding deep, comfortable, and longer-lasting analgesia; randomized evidence has shown IFC can outperform TENS in chronic LBP (Demirel et al., 2017). Transcutaneous electrical nerve stimulation (TENS) activates large-diameter cutaneous afferents (Aβ), triggers descending inhibitory pathways, and reduces hyperalgesia via peripheral and central mechanisms; classic descriptions include paresthetic sensations under the electrodes (Walsh et al., 2009) and opioid-mediated effects at higher frequencies.

Complementing analgesia, core-stability exercise targets the transversus abdominis and multifidus to restore neuromuscular control and lumbopelvic stability. Empirical studies report increased activation of deep stabilizers and functional gains after short training cycles (Zou et al., 2021), with advantages over alternative methods noted in related work. Nevertheless, much of the comparative literature has examined modalities in isolation or emphasized TENS' immediate effects without standardized exercise programs (e.g., Chou et al., 2020), while trials directly contrasting IFC and TENS often omit concurrent stabilization training (Demirel et al., 2017).

METHODS

This research employed a quasi-experimental pretest–posttest control group design to compare the effects of two intervention combinations on non-specific low back pain: (1) Interferential Current (IFC) plus core stability exercises and (2) Transcutaneous Electrical Nerve Stimulation (TENS) plus core stability exercises. The design allowed the examination of intra-group changes before and after the intervention and inter-group differences following.

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Setting and Duration

The study was conducted at Baiturrahim Hospital, Jambi, from July 2025 onward, following ethical clearance and participant consent procedures.

Participants

A total of 100 patients aged 20–60 years diagnosed with non-specific LBP were recruited. Inclusion criteria included pain intensity >3 on the Visual Analogue Scale (VAS), no history of lumbar surgery, and absence of specific spinal pathology (e.g., herniated nucleus pulposus, fractures, infections). Exclusion criteria encompassed neurological disorders or other causes of specific LBP

Participants were randomly assigned using block randomization to one of two groups:

a. Experimental group (n=50): IFC + core stability exercise
b. Control group (n=50): TENS + core stability exercise

Intervention Protocol

Both interventions were administered three times per week for two weeks (total six sessions).

a. IFC Therapy: Delivered via four electrodes using medium-frequency current for 20 minutes per session, adjusted to each patient's tolerance
b. TENS Therapy: Applied through two electrodes using low-frequency current for 20 minutes per session, also based on comfort level
c. Core Stability Exercises: Conducted progressively through three stages—activation, static stabilization, and dynamic functional training—targeting deep trunk stabilizers (transversus abdominis and multifidus). Each session lasted approximately 30 minutes

Outcome Measures

a. Pain intensity was assessed using the Visual Analogue Scale (VAS), an ordinal 10-cm scale reflecting subjective pain perception.
b. Functional disability was evaluated using the Oswestry Disability Index (ODI), a validated measure of LBP-related disability. Measurements were recorded at baseline (pre-test) and after the sixth session (post-test) by a blinded assessor to minimize bias.

RESULTS

This study included 100 participants (50 per group) diagnosed with non-specific low back pain, aged 20–60 years. No participants withdrew from the study. Both the Interferential Current (IFC) + Core Stability and Transcutaneous Electrical Nerve Stimulation (TENS) + Core Stability groups showed notable improvements in pain and function after six treatment sessions.

Kelompok	Variabel	Pre-test Mean (SD)	Post-test Mean (SD)	Δ Perubahan
IFC + Core Stability	VAS	6,40 (0,95)	3,62 (0,89)	−2,78
IFC + Core Stability	ODI	26,93 (4,46)	15,12 (4,01)	−11,81
TENS + Core Stability	VAS	6,38 (0,97)	4,10 (0,92)	−2,28
TENS + Core Stability	ODI	26,70 (4,38)	17,20 (4,27)	−9,50

Figure 1. Descriptive Summary of VAS and ODI Scores

The IFC group demonstrated slightly greater reductions in both pain (ΔVAS = –2.78) and disability (ΔODI = –11.81) than the TENS group (ΔVAS = –2.28; ΔODI = –9.50).

Nomor ISSN: 3124-1115

Inferential Statistics
Normality and Homogeneity

Shapiro–Wilk test: Most variables were normally distributed ($p > 0.05$) except for pre-intervention ODI in the TENS group ($p = 0.029$); however, with $n \geq 30$, parametric analysis remained valid.

Levene's test: Homogeneous variance was confirmed for both VAS ($p = 0.169$) and ODI ($p = 0.666$).

Group	Variable	t-value	p-value	Interpretation
IFC	VAS	32.43	< 0.001	Significant pain reduction
IFC	ODI	39.36	< 0.001	Significant functional improvement
TENS	VAS	18.81	< 0.001	Significant pain reduction
TENS	ODI	21.78	< 0.001	Significant functional improvement

figure 2. Within-Group Analysis (Paired t-test)

Variable	Mean IFC (SD)	Mean TENS (SD)	t-value	p-value	Interpretation
VAS Post-test	4.36 (0.98)	5.48 (0.81)	–6.14	< 0.001	IFC more effective in pain reduction
ODI Post-test	17.68 (4.29)	24.43 (4.42)	–7.68	< 0.001	IFC more effective in functional improvement

figure 3. Between-Group Analysis (Independent t-test)

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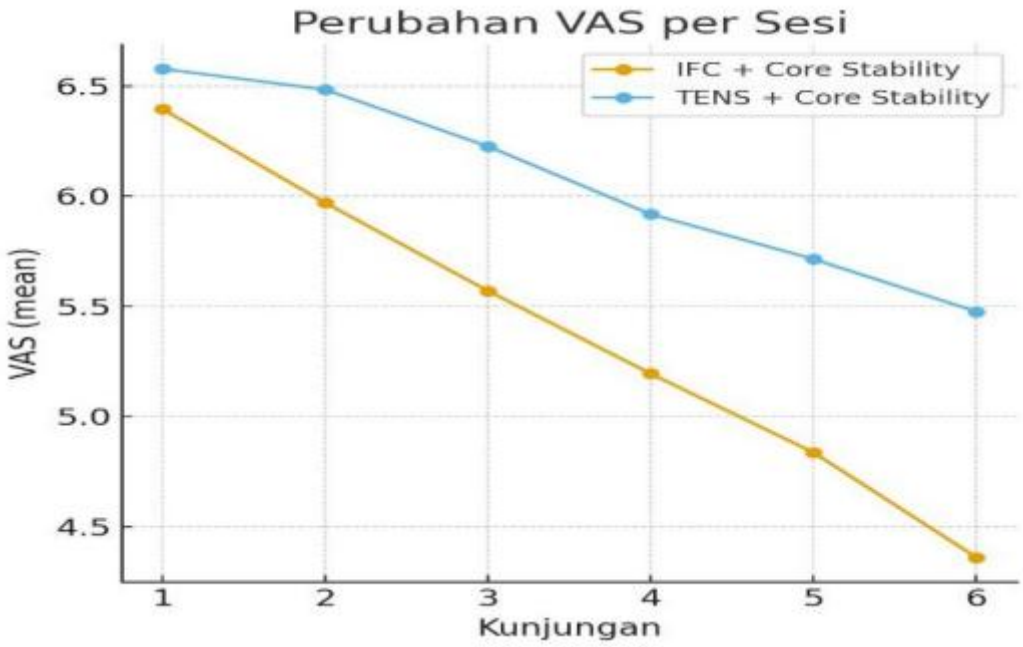

figure 4. Faster and more consistent pain reduction in the IFC group

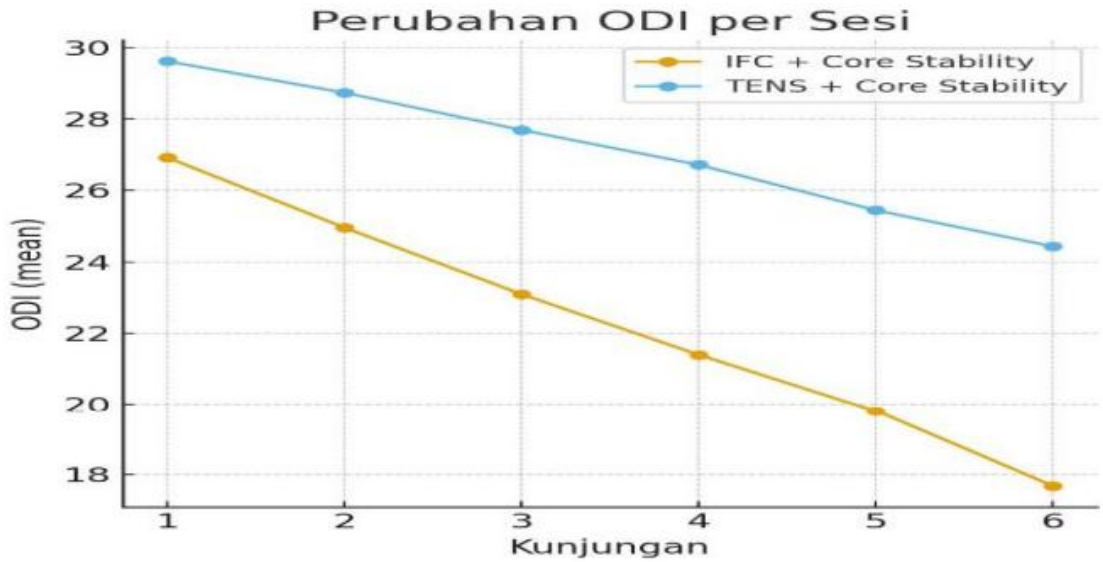

figure 5. The IFC group experienced a sharper increase in function compared to TENS

DISCUSSION

The present study investigated the comparative effectiveness of Interferential Current (IFC) combined with core stability exercise versus Transcutaneous Electrical Nerve Stimulation (TENS) combined with core stability exercise in reducing pain and improving function among patients with non-specific low back pain. The findings demonstrated that both interventions yielded significant pre–post improvements in pain intensity (VAS) and functional disability (ODI); however, the IFC + core stability group achieved markedly greater reductions, confirming the study hypothesis.

Interpretation of Findings

Nomor ISSN: 3124-1115

The superior outcomes in the IFC group can be attributed to the biophysical mechanisms of interferential therapy, which delivers medium-frequency current through intersecting channels to produce low-frequency amplitude modulation deep within tissues. This facilitates stimulation of Aβ afferent fibers, modulation of nociceptive transmission via the gate control theory, and enhancement of endogenous opioid release, producing analgesia that is more profound and sustained than that achieved with TENS (Demirel et al., 2017). Moreover, the comfortable sensory perception of IFC likely enhanced patient compliance, allowing participants to perform the subsequent core-stability exercises more effectively and with less discomfort.

In contrast, TENS—though effective in reducing pain through superficial stimulation—tends to generate shorter-term analgesic effects (Chou et al., 2020). This limited duration of relief may constrain exercise performance and neuromuscular adaptation, explaining the comparatively lower improvements observed in the TENS + core group.

Integration with Previous Research

The current findings corroborate prior studies emphasizing the role of core-stability exercise in restoring lumbopelvic control and reducing recurrence risk in LBP (Zou et al., 2021; Andriani, 2020). Strengthening the transversus abdominis and multifidus enhances dynamic stability, improves load distribution, and reduces compensatory postural asymmetry. When combined with IFC, the resulting synergy between deep-tissue analgesia and neuromuscular retraining leads to an accelerated improvement in function.

These outcomes align with the multimodal rehabilitation framework highlighted by Patil et al. (2022), which recommends integrating passive electrotherapy with active motor-control training for optimal recovery in musculoskeletal disorders. The present study advances this evidence base by providing a controlled evaluation of IFC plus core-stability, a combination rarely tested in prior experimental designs.

Clinical Implications

Clinically, the integration of IFC with core-stability training can be recommended as a first-line conservative management strategy for NSLBP, particularly in patients who experience difficulty engaging in exercise due to pain. The approach supports early mobilization, promotes neuromuscular reactivation, and may reduce dependence on pharmacological pain control.

Limitations and Future Directions

Despite its strengths, this study has limitations. The intervention period was limited to two weeks, restricting observation of long-term effects and recurrence rates. Furthermore, outcome measures were confined to VAS and ODI; additional parameters such as electromyographic activity, muscle endurance, or gait symmetry could yield deeper insight into functional recovery mechanisms. Future studies are encouraged to adopt longitudinal designs (8–12 weeks) and incorporate kinematic or neuromotor measures to evaluate sustained benefits and prevent relapse.

Summary

In summary, the study substantiates that combining IFC with core-stability exercise produces greater reductions in pain and disability than combining TENS with core-stability exercise among NSLBP patients. This synergy underscores the clinical value of pairing deep analgesic modalities with targeted neuromuscular retraining to achieve comprehensive rehabilitation outcomes (Demirel et al., 2017; Zou et al., 2021; Andriani, 2020; Patil et al., 2022).

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CONCLUSION

The findings of this study demonstrate that both Interferential Current (IFC) combined with core-stability exercise and Transcutaneous Electrical Nerve Stimulation (TENS) combined with core-stability exercise effectively reduce pain and improve functional ability in patients with non-specific low back pain. However, the IFC + core-stability combination produced significantly greater improvements in both pain intensity and functional performance compared with TENS + core-stability. This indicates that the integration of medium-frequency electrotherapy with structured neuromuscular training provides synergistic benefits through deeper analgesic effects, improved patient comfort, and enhanced muscular activation during exercise.

Consequently, IFC-assisted rehabilitation can be recommended as a superior physiotherapeutic intervention for NSLBP management. Its ability to deliver comfortable, long-lasting analgesia supports early functional restoration and adherence to exercise programs. Future research should extend the intervention duration and include biomechanical and neuromotor parameters to evaluate long-term efficacy and recurrence prevention.

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