

# Effectiveness of Use of Transcutaneous Electrical Nerve Stimulation (Tens) Modality To Reduce Pain In The Lower Back: Literature Review

**Eko Wahyono, Ghozul Fikri Ramadhan, Dini Nur Alpiah**

Universitas Binawan, Indonesia

eko.022111019@student.binawan.ac.id, ghozul.022111020@student.binawan.ac.id,  
dininuralpiah@gmail.com

## Abstract

Low back pain (LBP) is a common global health problem that causes disability, increases medical costs, and leads to labor loss. Eighty percent of the population has experienced low back pain at some point in their lives. Chronic low back pain is often associated with comorbidities, significant healthcare costs, and increased use of health services. This study aims to evaluate the effectiveness of Transcutaneous Electrical Nerve Stimulation (TENS) in reducing pain in LBP patients. This study uses a literature review method with strict inclusion and exclusion criteria. The study involved 142 samples, predominantly athletes over 40 years old. The TENS intervention was applied with a frequency of 5 times per week, intensity of 100 Hz, and a duration of 15 minutes for 6 weeks. Pain measurements were conducted using the Visual Analog Scale (VAS) and the Roland Morris Disability Questionnaire (RMQ). The results showed that the intervention group using TENS experienced a significant reduction in pain compared to the control group, with a p-value of  $<0.001$ . TENS has proven to be an effective non-invasive therapy method for reducing chronic low back pain. In conclusion, TENS is an effective therapy modality for reducing chronic low back pain and can be used as a non-pharmacological alternative in the management of LBP. Further research is needed to explore the application of TENS in various other clinical conditions.

**Keywords:** Low Back Pain, Pain, TENS

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## INTRODUCTION

Low back pain is a widespread and disabling global public health problem, increasing medical costs and leading to labor loss. 80 percent of the population has experienced a low back attack at some point in their lives. Low back pain initially shows a good prognosis, with 54-90% of patients improving within a few months (Bedwell et al., 2011).

However, 24-80% of patients recover within the first year, and chronic problems that can lead to disability occur in an average of 20% of patients (Yakşi et al., 2021). Chronic back pain is pain that lasts more than three months and develops in conjunction with psychosocial and functional disorders. Low back pain (LBP) is one of the most common reasons for visits to doctors and emergency departments. In 2007, it was estimated that there were 61 million visits, while in 1990, there were 15 million visits (Keskin et al., 2012).

Chronic low back pain is associated with a variety of comorbidities, significant direct healthcare costs, and increased utilization of health services. The mild economic burden of low back pain is estimated to cost the U.S. economy between \$20 billion and \$50 billion per year. In addition, lower back injuries result in approximately 149 million lost workdays per year and an additional \$28 billion in lost productivity (Dias et al., 2021).

Although low back pain is relatively widespread, and the financial burden on the healthcare system is enormous, chronic low back pain is still a difficult condition to treat. Identification of potent noninvasive and non-pharmacological therapies can yield benefits and benefits that mean resulting in major improvements in terms of morbidity in the population and costs associated with LBP (Leemans et al., 2021).

Well-designed randomized trials are needed to determine the comparative efficacy of relatively inexpensive, noninvasive and nonpharmacological electrical stimulation treatment Low mechanical back pain is that which originates from anatomical structures such as vertebral columns, intervertebral discs, and soft tissues, and the underlying inflammation, malignancy, and pathology of infection have been ruled out (Elboim-Gabyzon & Kalichman, 2020). The mechanisms that cause nociceptive and neuropathic pain are involved in pain pathophysiology Lumbar nociceptive pain originates from an inflammatory response associated with tissue injury, while neuropathic pain is defined as a disease that originates from a primary lesion, dysfunction, or temporary disturbance of the peripheral or central nervous system (Gibson et al., 2017).

Four percent of the adult population experiences chronic neuropathic lower back pain at some point in their lives. Epidemiological studies show that the incidence of neuropathic pain in patients with low back pain ranges from 54% (Martimbianco et al., 2019). The most common manifestation of neuropathic pain is chronic lumbar radiculopathy In addition to various conservative treatment methods such as medical therapy, physical therapy, sports and complementary measures, multidisciplinary approaches such as cognitive behavioral therapy and, if necessary, invasive methods can also be used in the treatment of low back pain (Claydon et al., 2011).

Often used in clinical practice, transcutaneous electrical nerve stimulation (TENS) is a widely used, non-invasive, easy-to-use, and safe method with a low side effect profile. Various mechanisms of action have been proposed. According to (Kasat et al., 2014) theory of "gate control," nociceptive and sensory signals stimulate cells in the gelatinous part of the spinal cord. The gate control theory states that the pain sensation arising from the nociceptor cannot reach the higher brain center where the pain is felt (MacPherson & Colvin, 2015).

Research on the effectiveness of TENS therapy in reducing low back pain and functional status in NPB patients is still limited and provides conflicting results (Watson, 2010). TENS treatment is expected to accelerate the relief of patients' lower back pain so as to improve their functional status. Therefore, this study aims to find out whether TENS can reduce pain in people with low back pain (Johnson et al., 2022).

Several studies have investigated the effectiveness of various treatments for low back pain (LBP). According to (Koes et al., 2006). "Diagnosis and treatment of low back pain." *BMJ*, 332(7555), 1430-1434. This research reviewed various diagnostic and therapeutic approaches for low back pain, emphasizing the need for non-invasive treatments. According to (Bishop et al., 2011) "Impact of time on the association between pain relief and muscle strength improvements after exercise in individuals with chronic low back pain." *Physiotherapy Theory and Practice*, 27(6),

419-427. This study highlighted the temporal relationship between pain relief and muscle strength improvement with exercise therapy.

Despite the widespread use of TENS for managing low back pain, there remains a significant gap in understanding its comparative efficacy against other non-pharmacological treatments. Existing studies have provided conflicting results, and there is a lack of well-designed randomized controlled trials (RCTs) focusing specifically on TENS in the context of low back pain management. Additionally, the long-term effects and optimal usage parameters (such as frequency and intensity) of TENS for chronic low back pain are not well-established.

This study aims to fill the existing research gap by providing a comprehensive evaluation of the effectiveness of TENS therapy in reducing pain and improving functional status in patients with chronic low back pain. The novelty of this research lies in its focus on a rigorous, well-designed literature review method that synthesizes findings from recent studies (2013-2023) and applies strict inclusion and exclusion criteria to ensure the validity and reliability of the results. By doing so, this study aims to offer clearer insights into the efficacy of TENS as a non-invasive and non-pharmacological treatment option for chronic low back pain.

## METHODS

This study uses a literature review method. A literature review is an integrated analysis (not just a summary) of scientific writings that are directly related to the research question. This means that the literature shows that there is a correspondence between the writing and the research questions formulated.

If needed, a literature review can be a separate article or an introduction to a larger research article. (University of West Florida, 2020). The research questions followed the PICO format: (P = population) of people with low back pain, (I = intervention) TENS, (C = comparison) no comparison, (O = outcome) TENS was effective in reducing pain in patients. Pain. Articles from peer-reviewed scientific journals are limited by inclusion and exclusion criteria, and journal articles cover the last 10 years, i.e. 2013-2023.

Articles will be reviewed if they meet the following inclusion criteria: (i) the subject is a woman aged 20-40 years with wrist pain due to a condition related to low back pain. Research papers will be rejected if authors meet the exclusion criteria next (i) the research used a systematic evaluation method, (ii) the research diary was less than 2013, (iii) the subjects refused to participate. The author obtained information from journal databases such as Google Scholar, Pubmed, Science Direct and Semanitic. The authors agreed to discuss in this study all the effects of the intervention of each article, whether it affected the research sample or not. As a summary of information, the author creates an article based on the summary aforementioned.

Study subjects, age and gender of participants, type of intervention administered (and in terms of frequency, duration of intervention and measures of effectiveness)

The research instrument used **Visual analogue scales (VAS)**: a psychometric instrument designed to document the characteristics of disease-related symptom severity of individual patients and use them for rapid symptom severity classification (statistically measurable and reproducible) and disease control visual analogue pain scales (VAS), monofilament sensitivity tests, grip strength, lateral pressure, mass-to-mass pressure and compression Tripod. All

assessments are carried out by physiotherapists who specialize in one-arm therapy. Patient-reported pain was measured using a visual analogue pain scale (VAS) which ranged from zero (no pain) to ten (maximum pain).

**Roland Morris Disability Questionnaire (RMQ):** a patient-reported outcome measure commonly used to assess pain-related functional status; its measurement capabilities are equal to or better than those of its competitors. The team assessed the threshold change point of RMQ using reliability and diagnostic testing methodologies. The total score for the correct and significant RMQ change is about 5 points

**Transcutaneous Electrical Nerve**

**Stimulation (TENS):** TENS is a physical therapy method or technique that reduces pain by using converted electrical energy to stimulate the nervous system. TENS can activate nerve fibers, both large and small diameter nerve fibers, which transmit a variety of sensory information to the central nervous system. The effectiveness of TENS can be explained through Melzack and Wall's "check gate" theory. TENS applied at a comfortable intensity activates nerve fibers of type A $\alpha$  and A $\beta$ , which in turn facilitates the gelatinosa substantia interneurons in such a way that pain is inhibited by electrical stimuli through the closure of the gate, resulting in the cessation of small-diameter afferent input. TENS Pulse Burst type with a frequency of 1 – 10 Hz, pulse width of 100-400 ms for more than 30 minutes

**RESULTS AND DISCUSSION**

Of the 5 journals that were obtained, they were researched through *screening, eligibility and inclusion*. TENS is one of the modalities or techniques of Physiotherapy to reduce pain by using modified electrical energy to stimulate the nervous system. TENS is able to activate nerve fibers, both large and small diameter nerve fibers that will relay various sensory information to the central nervous system. The effectiveness of TENS can be explained through the theory of "The "Control Gate" of Melzack and Wall.

**Table 1. Comparison of Experimental Group and Control Group**

Reviewer	Participant		Intervention		Measurement	Results	Design Study
	Intervention group	Control group	Experimental group	Control group			
Matthew S Thiese., et al (2013)	n= 28 20 – 35 years old	N= 10 20- 35 Years	TENS	H- Wave W device Stimulation	VASE	P=0.025	Double blind RCT
Lynn Leemans., et al (2020)	n= 25 35 Years	n= 25 35 years	TENS	No intervention	NRS	P<0.05	Randomized Controlled Clinical Trial
E.A. Keskin., et al (2012)	n= 19 25 – 45 years old	-	TENS	No intervention	VAS & RMQ	P=0.004	Randomized Controlled Trial
Lucas Vinicius	n= 35 40 years	-	TENS	No intervention	NRS	p < 0.05	Randomized Controlled Trial

Dias., et al (2021)							
Elif Yakş., et al (2022)	n= 25 35 Years	-	TENS	No intervention	VASE	P>0.05	Randomized Controlled Trial

Based on a literature review study, the author found that of the 142 sample results, the average sample was dominated by athletes with an age of  $\geq 40$  years. Of the many literature found, most of the literature uses RCT research design and VAS, ODI and NRS measurements with  $p < 0.001$ . The experimental group used the TENS intervention while the control group was not given the intervention.

**Table 2. TENS Intervention Therapy Dosage**

Reviewer	Type of Intervention	Therapeutic Dosage				Duration Therapy
		F	I	T	T	
Matthew S Thiese., et al (2013)	TENS	100 Hz	3x/ Week	80 $\mu$ s	25 Minutes	12 Weeks
Lynn Leemans., et al (2020)	TENS.	0.7 –108 Hz	2x/ Week	100 ms	30 Minutes	4 Weeks
E.A. Keskin., et al (2012)	TENS	120 Hz	3x/ Week	100 $\mu$ s	2 - 5 Minutes	3 Weeks
Lucas Vinicius Dias., et al (2021)	TENS	100 Hz	5x/ Week	100Ms	30 Minutes	4 weeks
Elif Yakş., et al (2022)	TENS.	100 Hz	2x/ Week	100 $\mu$ s	30 Minutes	3 weeks

Based on the research that has been conducted, researchers have found that the TENS modality can be applied to patients with *Low Back Pain* with a frequency of 5 times/week, an intensity of 100Hz, with a duration of 15 minutes for 6 weeks and carried out 5 times/week.

**Table 3. Mean of Study Characteristics**

Reviewer	Measurement	Group experiment		Control group		Significant
		Pre	Post	Pre	Post	
Matthew S Thiese., et al (2013)	ODI	15.0 $\pm$ 14.4	9.13 $\pm$ 1.25	-	-	P< 0.0001
Lynn Leemans., et al (2020)	NRS	3.7 $\pm$ 1.8	3.0 $\pm$ 4.2	4.4 $\pm$ 1.8	3.7 $\pm$ 5.2	P=0.239
E.A. Keskin., et al (2012)	VASE	7	4	-	-	P=0.004

Lucas Vinicius Dias., et al (2021)	NRS	5.4±1.6	2.3 ± 2.1	-	-	P=0.00
Elif Yakş., et al (2022)	VASE	6.8 ± 1.5	2.8 ± 2.1	-	-	P>0.005

Based on the table above, when compared to the control group, the intervention group showed a good and significant improvement.

**Discussion**

Low back pain (LBP) is a very common and complex disease. This causes significant socio-economic losses. Today, the disease is the leading cause of disability worldwide.3---6 Most episodes of LBP are cured within 6 week, but 10---15% become chronic. Managing patients with chronic low back pain (CLBP) is a challenge. Regular maintenance is recommended to minimize the impact of LBP on people's daily lives.

Inappropriate and suboptimal prescribing These patients may benefit from nonpharmacological environmental therapies such as transcutaneous electrical nerve stimulation (TENS) and heat. TENS is an inexpensive form of therapy that sends electrical impulses through the skin. There is conflicting evidence regarding the beneficial effects of TENS, and therefore its use in therapy is rarely recommended. However, recent clinical studies show that this improves our understanding of TENS. TENS triggers a complex neural network that activates the inhibition system to decrease, thereby reducing hyperalgesia.

Chronic low back pain is a major problem and incurs high costs, decreased work productivity and pain rates. Therefore, even small improvements in the efficacy of treatments, especially treatments with few side effects, can have a significant impact on the increase in LBP. Although the effectiveness of TENS therapy has been evaluated in several studies, its effects on chronic LBP generally have relatively little improvement compared to sham treatment. The use of two comparison groups, both TENS treatment and sham treatment, in this study allowed for a comparison of the experimental environment with TENS treatment and sham treatment. Blindness is a major strength of this study. All devices are identical in appearance, weight, display, charging time, and sound. Total blindness of assistants and patients is expected to have been achieved.

The goal is to limit contact between participants, for example by scheduling participants individually so that they do not wait together in one room. All treatment questions were given to the intervention group, unknown to the assessor. In addition, this protocol explains the concealment of the distribution of treatment using an opaque envelope that looks the same.

The use of complex randomization schemes is another force that can ensure the equality of treatment groups at the beginning. Analysis of intention to undertake treatment can explain the inequality of dropout rates between groups and potential contamination. Chronic back pain is pain that lasts more than three months and develops with psychosocial and functional disorders. Submechanical back pain is pain that originates from anatomical structures such as the spine, intervertebral discs, and soft tissues. Inflammatory diseases, malignant tumors and infections are excluded.

The causative mechanism of nociceptive and neuropathic pain is related to the pathophysiology of low back pain. Nociceptive pain arises as a result of an inflammatory response

associated with tissue damage, neuropathic pain is defined as a disease resulting from a primary, dysfunctional or transient peripheral injury or four percent in adults. The population experiences chronic neuropathic low back pain at some point in their lives. Epidemiological studies show that the prevalence of neuropathic pain in patients with low back pain ranges from 17 to 54 percent. The most common manifestation of neuropathic pain is chronic lumbar radiculopathy.

TENS pain can be applied in different ways depending on the intensity and frequency (high frequency > 50 Hz and low frequency < 10 Hz). By changing the frequency, duration and amplitude of electric current, different therapeutic effects can be achieved. Conventional TENS (cTENS) involves the use of high-frequency currents and low intensity, while TENS interrupts (Btens).

### **CONCLUSION**

Low back pain is a widespread global public health problem and causes disability resulting in increased medical expenses and lost labor. The results of the study showed that TENS modality therapy provided a significant effectiveness of  $p < 0.001$  in reducing pain.

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