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Effectiveness of Various Non-Pharmacological Interventions for the Management of Non-Specific Chronic Low Back Pain: A Systematic Review of Randomized Controlled Trials

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KEYWORDS

Non-Specific Chronic Low Back Pain, NSCLBP, Non-Pharmacological Interventions, Randomized Controlled Trials.

ABSTRACT

Low back pain (LBP) is a major public health concern, with non-specific chronic low back pain (NSCLBP) accounting for 90% of cases globally. NSCLBP significantly impacts productivity, mobility, and quality of life, imposing a substantial economic burden on society. Effective management strategies are crucial to address this widespread issue. This study systematically evaluates the effectiveness of non-pharmacological interventions for NSCLBP by reviewing randomized controlled trials (RCTs) to identify evidence-based approaches that could improve patient outcomes and inform clinical practice. A comprehensive literature search was conducted across PubMed, Cochrane Library, and ScienceDirect using specific keywords and MeSH terms: "non-pharmacological treatment," "non-specific chronic low back pain," "NSCLBP," and "randomized controlled trials." The search was limited to English-language articles published in the past 10 years. From 119 potential studies, 5 RCTs met the inclusion criteria and were analyzed. Eight non-pharmacological interventions were identified, but heterogeneity in study designs and treatments presented challenges in evaluating their individual effectiveness. Despite this, the review highlights the potential benefits of non-pharmacological treatments for NSCLBP. However, variations in methodologies and patient populations limit the generalizability of findings. The study emphasizes the need for standardized research protocols and consistent outcome measures in future studies to strengthen the evidence base. Implementing evidence-based non-pharmacological strategies could improve patient care, reduce dependency on pharmacological treatments, and lessen the economic burden on healthcare systems globally.

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INTRODUCTION

Low back pain (LBP) is a major public health concern, affecting a significant portion of the global population. An estimated 619 million people currently live with LBP, making it the leading cause of disability worldwide. This condition is associated with decreased productivity, limited mobility, and imposes a substantial economic burden on individuals and societies (Inayat et al., 2024). Despite its high prevalence, effective management remains a significant challenge.

Chronic low back pain, particularly non-specific chronic low back pain (NSCLBP), which persists for more than 12 weeks without any identifiable anatomical cause, accounts for approximately 90% of LBP cases globally. Recent studies indicate an increasing prevalence of chronic LBP, especially among vulnerable demographics such as women and the elderly. This growing trend raises concerns regarding the long-term impact on public health systems and the quality of life of affected individuals (Rahimi et al., 2019). The limitations caused by NSCLBP significantly hinder daily activities and overall well-being, leading to diminished quality of life. The chronic nature of the condition and its widespread impact not only create personal health challenges but also contribute to a substantial societal

economic burden. This emphasizes the urgency of developing and optimizing effective treatment strategies.

Given the significant public health implications and economic consequences of NSCLBP, there is a critical need for comprehensive research to identify effective, accessible, and sustainable treatment options (Kahere et al., 2022). Although various therapeutic approaches exist, gaps remain in understanding the comparative effectiveness of non-pharmacological, non-transcutaneous interventions, which are increasingly preferred due to their minimal side effects and focus on long-term management.

This review aims to bridge that research gap by evaluating and summarizing existing literature on non-pharmacological, non-transcutaneous interventions for NSCLBP. The primary objective of this study is to determine the effectiveness of these interventions, offering insights that can improve clinical practices and patient outcomes (Bombard et al., 2018). The findings are expected to benefit healthcare professionals by providing evidence-based recommendations, while also supporting patients in accessing more effective and less invasive treatment options, ultimately contributing to improved quality of life and reduced societal healthcare costs.

The novelty of this research lies in its focused examination of non-pharmacological, non-transcutaneous interventions, an area that remains underexplored in existing literature. By specifically analyzing these alternative treatment approaches, this study provides fresh perspectives on pain management strategies that prioritize patient safety and long-term efficacy.

The benefits of this research extend to multiple stakeholders: healthcare practitioners will gain a clearer understanding of evidence-based interventions to enhance treatment plans, patients will have access to safer and potentially more effective therapies, and policymakers will obtain valuable insights to inform public health strategies aimed at reducing the socioeconomic burden of NSCLBP. Ultimately, this research contributes to the advancement of holistic, patient-centered approaches to managing chronic low back pain.

METHOD

A systematic literature search of randomized controlled trials was conducted across multiple scientific databases in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) guidelines. This comprehensive literature search was performed across databases namely PubMed, Cochrane Library, and Science Direct using the following specific keywords and MeSH terms: “non-pharmacological treatment”, “non-specific chronic low back pain”, “NSCLBP” and “randomized controlled trials”. The Search was limited to articles written in English and published in the last 10 years.

Data extracted from studies obtained include number of participants, sex ratio, age of participants, types of interventions, duration of intervention, control, and outcome measurement tool used in the studies. A Statistical analysis of the effectiveness of the interventions compared to control were also obtained. The statistical significance of interventions done in the RCTs included were categorized as ‘Significant’ or ‘Not significant’ based on the data provided in the artiles (Ferrari et al., 2019). An intervention is said to be significant when it has a P-Value of < 0.05.

RESULT AND DISCUSSION

Upon completion of the search across all three databases, a total of 119 studies were identified. Duplicated entries were removed, leaving a total of 109 papers to be screened. The screening was done primarily based on the title and abstracts, after which 59 papers were retrieved (Wohlin et al., 2020). Further screening of these papers revealed 54 papers containing contents of excluding factors, such as

non-chronic LBP (n=9), specific LBP (n=1), studies scoring below 3 points on Jadad scale (n=21), and paid access to full text (n=23). Five studies fulfilled the inclusion criteria and were therefore included in the review.

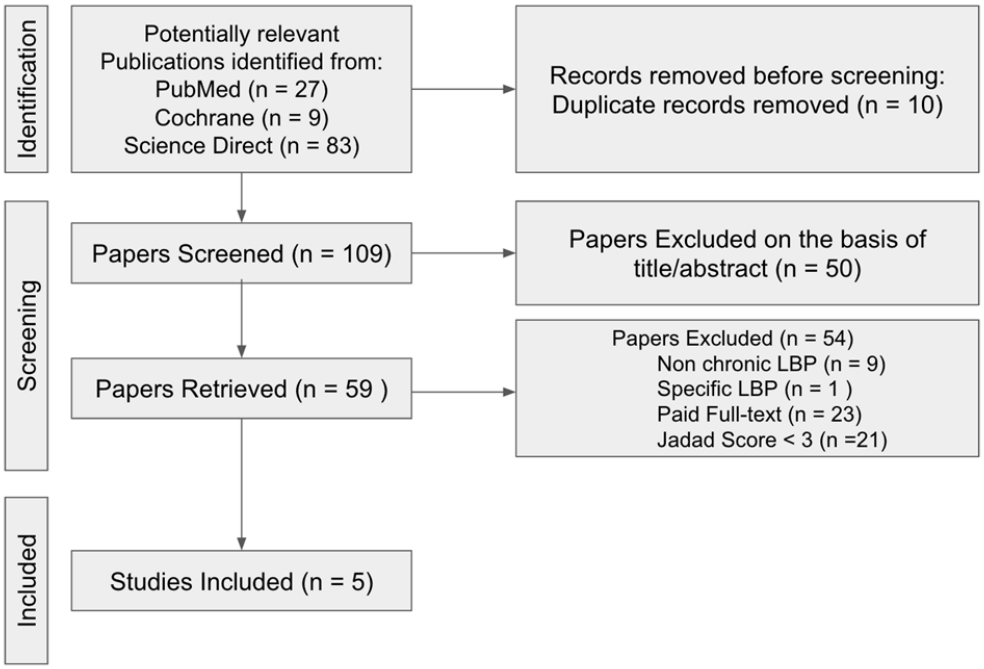

Figure 1. Flow chart of the study in accordance to the PRISMA guideline

Table 1. Characteristics of Studies Included

Study (Publication Year)	Duration of Study	Intervention (n)	Control (n)	Number of Participants (Males/Females)	Age Range	Outcome Measure	Statistical Significance
Tantawy SA, et al. (2020)	4 weeks	Interferential therapy (30)	Placebo (31)	61 (30/31)	25-60	Visual Analogue Scale (VAS), lumbar range of motion (ROM) in terms of flexion & extension and the Short Form-36 (SF-36) health questionnaire to evaluate the quality of life (QOL).	Significant
Zheng F, et al. (2024)	52 weeks	self-compassion therapy (SCT) combined	CSE alone (10)	52 (10/42)	35.3 (32-38)	Changes in functional limitations (measured by Roland and	Significant

Study (Publication Year)	Duration of Study	Intervention (n)	Control (n)	Number of Participants (Males/Females)	Age Range	Outcome Measure	Statistical Significance
		with core stability exercise (CSE) (42)				Morris Disability Questionnaire scores (RMDQ)) and self-reported back pain (measured by the Numeric Pain Rating Scale(NRS))	
Bemani S, et al. (2023)	22 weeks	multidimensional physiotherapy (35)	Usual physiotherapy (35)	70 (35/35)	18-50	Pain intensity was measured as the primary outcome. Disability, quality of life, pain Catastrophizing, kinesiophobia, fear Avoidance Beliefs, active lumbar range of motion, and brain function were measured as secondary outcomes.	Significant
Pino C, et al. (2023)	12 weeks	Laser-Guided & Pain Neuroscience Education (PNE) (30)	Supervised Exercise (SE) and PNE (30)	60 (no description)	18-45	Primary outcome: Pain intensity measured by NPRS. Secondary outcome: Pressure pain threshold, . Disability related to low back pain was assessed using the Roland–Morris Disability Questionnaire (RMDQ),	Significant

Study (Publication Year)	Duration of Study	Intervention (n)	Control (n)	Number of Participants (Males/Females)	Age Range	Outcome Measure	Statistical Significance
						Pain catastrophizing was assessed with The Pain Catastrophizing Scale (PCS), Kinesiophobia using The TSK-11, assessment of Lumbar repositioning error (LRE).	
Huber D, et al. (2019)	120 days	mountain hiking tours and balneotherapy in thermal water containing MgCa(SO)4	No intervention	80 (35/45)	19-65	Duration of pain, , chronicity, pain, physical and psychological impairment and disability using validated questionnaires (Oswestry Low Back Disability Index, Medical Outcomes Study Short Form 36, modified Visual Analogue Scale, World Health Organization Well-Being Index)	Significant

Studies included in this review span between the year of 2019 to 2024, encompassing a total of 323 participants diagnosed with NSCLBP. The age of participants included in this review ranged from 18 to 65 years old. Four studies show a predominance of females (153 participants), with one study not describing the sex characteristics of its participants (Sugimoto et al., 2019).

Duration of study amongst these included studies varies between 4 to 52 weeks, with diverse duration and amount of follow up points. Interventions varied across studies. A total of 8 non-pharmacological interventions were reviewed, namely: Interferential therapy, self-compassion therapy

(SCT) combined with core stability exercise (CSE), multidimensional physiotherapy, Laser-Guided & Pain Neuroscience Education (PNE), mountain hiking tours and balneotherapy in thermal water containing MgCa(SO).

All studies use pain as their primary outcome indicator. Secondary outcome indicators used include disability or changes in functional limitation across 4 studies, changes in lumbar ROM across 3 studies, and quality of life in 3 studies (Sugimoto et al., 2019). One study uses all four common outcome predictors (pain, disability, lumbar ROM, and QOL). A variety of tools were used to measure the outcome of the studies; VAS, modified VAS, or NPRS to measure pain; RMDQ and OLBDI to measure level of disability; SF-36 and WHOWBI to measure QOL. All studies showed statistical significance in reducing pain.

Table 2. Jadad Scoring of Included Studies

Study	Study described as randomized?	Method to generate randomization described and appropriated?	Study described as double-blind?	Method of double-blinding described and appropriated ?	Description of withdrawals and dropouts?	Score
Tantawy SA, et al. (2020)	1	1	0	0	1	3
Zheng F, et al. (2024)	1	1	0	0	1	3
Bemani S, et al. (2023)	1	1	0	0	1	3
Pino C, et al. (2023)	1	1	0	0	1	3
Huber D, et al. (2019)	1	1	0	0	1	3

Table 3. Outcome predictors and measurement tools use

Study (Publication Year)	Outcome Predictors	Measurement Tool
Tantawy SA, et al. (2020)	Pain	VAS
	Lumbar ROM	Flexion & Extension ROM
	QOL	SF-36
Zheng F, et al(2024)	Pain	NPRS
	Changes in functional limitation/ disability	RMDQ
Bemani S, et al. (2023)	Pain	NRS
	Disability	ODI
	QOL	SF-36
	Pain catastophizing	PCS
	Kinesiophobia	TSK
	Avoidance belief	FABQ
	Lumbar ROM,	Flexion ROM
Pino C, et al. (2023)	Pain	NPRS
	Disability	RMDQ
	Pain catastophizing	PCS
	Kinesiophobia	TSK11
	Lumbar ROM	JPS
Huber D, et al(2019)	Pain	VAS modified
	Disability	OLBDI
	QOL	WHO WBI

Methodological considerations

The methodological quality of the studies included in this systematic review varied, with some trials exhibiting longer durations of trials and more numerous follow-ups. All five RCTs incorporated control groups and randomization, which is crucial in minimizing bias and ensuring the reliability of results (Deaton & Cartwright, 2018). However, several methodological limitations were noted, including lack of blinding and variations in the methods, duration, and intensity of the non-pharmacologic interventions. The heterogeneity in the interventions themselves, such as differences in types of therapies (e.g., physical therapy, cognitive-behavioral therapy, and interferential therapy), as well as the lack of uniformity in outcome measures used to assess pain and function, further complicate the interpretation of results. These methodological differences highlight the need for future studies to

standardize intervention protocols and outcome measures to improve comparability across trials (Kirby et al., 2017).

Limitations

A major limitation of this systematic review is the heterogeneity of the data, which limits the ability to conduct a meta-analysis and pool the results across the five included studies (Delgado-Rodríguez & Sillero-Arenas, 2018). The variability in patient populations and intervention types made it difficult to draw strong conclusions regarding the effectiveness of each non-pharmacological treatment reviewed. Additionally, most of the included studies were limited by short follow-up periods, meaning that long-term benefits and sustainability of the interventions could not be adequately assessed. Furthermore, the exclusion of paid access studies and non-English studies and the small number of trials available for inclusion may have led to some level of bias in the review process.

Implications for Research

The findings from this systematic review point to several important areas for future research. Given the heterogeneity in intervention strategies and outcomes, it is critical that future studies standardize intervention protocols and utilize consistent outcome measures to allow for more meaningful comparisons. Furthermore, larger sample sizes with longer follow-up durations are needed to evaluate the long-term effects of non-pharmacologic interventions on pain management and functional improvement in NSCLBP patients. The exploration of patient subgroups based on factors such as age, pain severity, and comorbidities could provide valuable insights into which interventions are most effective for specific populations (Driscoll et al., 2021). Furthermore, more research is needed to explore the cost-effectiveness of these interventions to support their implementation in healthcare settings.

Implications for Practice

The findings of this review suggest that non-pharmacologic interventions can be effective in managing pain for individuals with NSCLBP, although treatment outcomes are variable and depend on the specific intervention and patient characteristics. Healthcare providers should consider individual patient preferences, pain levels, and overall health status when recommending methods of certain non-pharmacologic therapies. Interventions such as physical therapy, exercise programs, and cognitive-behavioral therapy may be beneficial for many patients, but their success may vary depending on the patient's response (Castelnuovo et al., 2017). Clinicians should remain flexible in their treatment approaches, combining different strategies to optimize patient outcomes. Given the heterogeneity in the data, patient-centered care and ongoing assessment are key to ensuring that the most effective interventions are selected for each individual.

CONCLUSION

In conclusion, this systematic review of five randomized controlled trials (RCTs) on non-pharmacologic interventions for non-specific chronic low back pain (NSCLBP) aims to evaluate the effectiveness of various treatment strategies and their impact on patient outcomes. The findings provide valuable insights but are constrained by methodological variability and heterogeneity across the studies. Despite the use of rigorous randomization and control groups, differences in intervention types—such as physical therapy, cognitive-behavioral therapy, and interferential therapy—combined with inconsistent outcome measures, hinder the ability to draw definitive conclusions. The heterogeneity in patient populations and intervention strategies underscores the need for future research to standardize treatment protocols and measurement tools to enhance comparability and reliability. Additionally, future studies should focus on extending follow-up periods to assess the long-term efficacy and sustainability of these interventions. Exploring patient-centered outcomes and integrating

multidisciplinary approaches may also contribute to a more comprehensive understanding of effective management strategies for NSCLBP.

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