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Aquatic Exercise for Pain Reduction in Chronic Low Back Pain: A Systematic Literature Review

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Abstract

Introduction: Chronic low back pain (CLBP) is a prevalent condition that significantly impairs daily functioning and quality of life. Conventional interventions, such as pharmacological treatment and land-based physical therapy, often provide limited relief and carry potential side effects. Aquatic exercise has emerged as a promising alternative intervention for pain management and functional improvement in CLBP patients.

Methods: A systematic literature review was conducted using Google Scholar, PubMed, and ScienceDirect databases with the keywords “aquatic exercise” AND “chronic low back pain” OR “CLBP” AND “pain reduction.” From 543 articles initially retrieved, 264 were screened based on inclusion criteria: English-language, full-text publications from 2014 to 2024, involving CLBP patients. Five studies met all criteria and were included in the review. Outcomes assessed included pain intensity, disability, and quality of life, measured using the Visual Analog Scale (VAS), Roland-Morris Disability Questionnaire (RMDQ), Oswestry Disability Index (ODI), and Oswestry Disability Questionnaire (ODQ). Effectiveness was analyzed by comparing reported outcomes across studies.

Results: Aquatic exercise significantly reduced pain intensity and improved short-term functional outcomes compared with control interventions. Although disability improvement was comparable to land-based exercises, aquatic exercise demonstrated superior enhancement of overall quality of life.

Conclusion: Aquatic exercise represents a safe and effective intervention for CLBP management, providing pain relief and functional benefits while supporting overall patient quality of life.

Keywords

chronic low back pain, aquatic exercise, pain reduction, functional improvement, rehabilitation

Introduction

Low back pain (LBP) is a common musculoskeletal disorder observed in nearly all countries, both developing and developed, affecting individuals across all age groups. Chronic low back pain (CLBP) is defined as pain in the lower back, with or without radiating symptoms to the lower limbs, lasting more than 12 weeks, located between the lower rib cage and the gluteal folds.[1] CLBP is recognized as one of the most frequently reported musculoskeletal complaints, with prevalence increasing annually.[2] This condition imposes a significant economic and social burden. Susanti and Rahmawati reported that back pain syndromes constitute a major health concern, with over 80% of musculoskeletal care costs allocated to managing these complaints.[3]

Globally, the Global Burden of Disease 2014 report identified LBP as the leading contributor to disability, measured by Years Lived with Disability (YLD), and ranked sixth among all diseases in terms of total burden using Disability-Adjusted Life Years (DALY). In Indonesia, the prevalence of musculoskeletal disorders based on healthcare professional diagnosis is 19%, whereas based on diagnosis or symptoms it reaches 24.7%. Eleven provinces report prevalence above the national average, including Central Java at 18.9%.[4] These data indicate that CLBP remains a significant public health issue requiring effective and sustainable management strategies.

Management of CLBP continues to evolve alongside advances in rehabilitation science. Recent studies demonstrate that combining rehabilitative therapy with pharmacological agents such as ultramicronized palmitoylethanolamide can reduce pain and disability while improving patient quality of life.[1] However, international guidelines consistently recommend exercise therapy as the primary intervention for CLBP management.[5] One approach that has received increasing attention is aquatic exercise, which involves physical activity performed in water, leveraging its unique properties to reduce mechanical load, alleviate pain, and enhance exercise efficacy.

Several studies report positive outcomes of aquatic exercise. Silva observed beneficial effects of hydrotherapy in patients with knee osteoarthritis.[6] Pérez-De la Cruz demonstrated functional improvements in chronic stroke patients through water-based exercise.[2] In CLBP patients, multiple studies indicate that aquatic exercise can reduce pain intensity and improve quality of life.[7,8] Nevertheless, inter-study results vary due to differences in exercise protocols,

intervention durations, and evaluation instruments, creating uncertainty regarding the effectiveness of aquatic exercise compared to land-based therapy or control interventions.

Given this context, a systematic literature review is warranted to integrate current evidence on the effectiveness of aquatic exercise in CLBP patients. This study aims to comprehensively evaluate the role of aquatic exercise in reducing pain and enhancing function in CLBP patients. The research framework follows the PICO model as follows:

- Participants: patients with chronic low back pain.
- Interventions: aquatic exercise.
- Comparisons: absence of aquatic exercise or land-based exercise.
- Outcomes: pain reduction and functional improvement.

Methods

This study employed a systematic literature review and meta-analysis design following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Articles were retrieved from three major databases: Google Scholar, PubMed, and ScienceDirect. The search strategy combined keywords using Boolean operators, such as “aquatic exercise” AND “chronic low back pain” AND “pain reduction.” A total of 543 articles were initially identified.

The selection process applied predefined inclusion and exclusion criteria. Inclusion criteria were full-text articles published in English between 2014 and 2024, involving male and female participants with chronic low back pain, and employing experimental designs such as randomized controlled trials (RCTs) or quasi-experimental studies. Exclusion criteria included non-English articles, publications before 2014, and studies reporting only bivariate analyses.

Article selection was guided by the PICOS framework: participants were individuals with chronic low back pain; the intervention was aquatic exercise; the comparison group included individuals not receiving aquatic exercise; the outcome was pain reduction; and the study design consisted of full-text articles employing experimental or quasi-experimental methods. Two researchers independently screened titles, abstracts, and full texts. Discrepancies were resolved through discussion until consensus was reached. From the initial 543 articles, five met all inclusion criteria and were subjected to further analysis.

Data extraction was performed using a pre-designed form, capturing study characteristics, sample size and demographics, types of interventions and comparisons, pain assessment instruments, and study outcomes. Two researchers independently conducted data extraction, which was then compared to ensure consistency. Discrepancies were resolved through joint discussion. Methodological quality and risk of bias were assessed using the Cochrane Risk of Bias Tool for RCTs and the Newcastle–Ottawa Scale (NOS) for quasi-experimental studies. These assessments informed the evaluation of evidence quality and guided interpretation of the findings.

As this study is a systematic literature review and meta-analysis, it did not involve direct human subjects and therefore did not require ethical approval. Nonetheless, all research procedures adhered to academic integrity and ethical research principles.

Results

The literature search and article selection yielded five studies that met the inclusion criteria for analysis. These studies were conducted in various countries, including Egypt, Malaysia, Palestine, China, and India, all employing randomized controlled trial (RCT) designs. Sample sizes ranged from 30 to 113 participants, with intervention durations spanning from 12 weeks to 12 months, as illustrated in Figure 1.

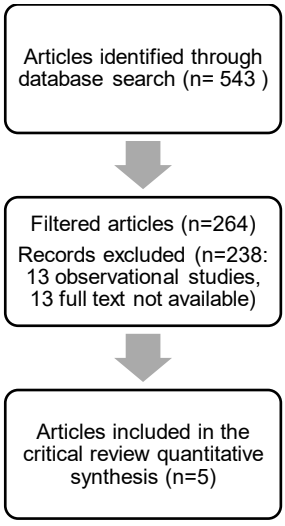

Figure 1. Flowchart of Study Selection

All studies evaluated the effects of aquatic exercise on pain intensity, disability, and functional outcomes in patients with chronic low back pain. Outcome measures varied, including the Visual Analog Scale (VAS) for pain, Oswestry Disability Index (ODI), Roland-Morris Disability Questionnaire (RMDQ), as well as assessments of flexibility and quality of life (SF-36). Table 1 summarizes the study characteristics, primary outcomes, conclusions, and limitations of each analyzed study.

Table 1. Summary of Aquatic Exercise Studies in CLBP

Author (Year)	Country	Study Design	Sample	Intervention Duration	Main Outcomes	Conclusion	Notes/Limitations
Mahfouz et al., 2018	Egypt	RCT	40	12 weeks	Pain ↓ 57.7% (VAS); Function ↑ 58.9%; Lumbar ROM ↑ (Flexion 46.9%, Extension 22.8%)	Aquatic exercise was more effective than conventional therapy for pain, function, and ROM	Small sample, short-term effects
Abadi et al., 2019	Malaysia	RCT	39	12 weeks	Disability ↓ significantly; 84.2% reached minimal disability; Pain ↓	Aquatic exercise effectively reduced pain and disability in obese women	Focus on obesity, short-term effects, improved quality of life
Costantino & Romiti, 2014	Palestine	RCT	56	12 weeks	Pain and disability decreased in both groups; hydrotherapy slightly superior (RMDQ & SF-36 significant)	Hydrotherapy more effective than Back School in elderly CLBP patients	Elderly population, short-to-medium term effects
Peng et al., 2022	China	RCT	113	12 months	Disability ↓ significantly at 3, 6, and 12 months; more participants in aquatic group achieved minimal clinical improvement in pain and disability	Aquatic exercise safely and effectively improved function, pain, and quality of life	Relatively large sample, long follow-up
Sawant & Shinde, 2019	India	RCT	30	Not reported	Pain ↓ significantly (VAS P=0.0182); Muscle function and quality of life improved; ROM & MMT not significant	Hydrotherapy effectively reduced pain and enhanced muscle function	Small sample, unclear intervention duration

Most studies demonstrated that aquatic exercise significantly reduced pain intensity in CLBP patients. Additionally, the majority reported improvements in function, lumbar flexibility, and disability reduction, although effectiveness varied depending on population characteristics, intervention duration, and measured outcomes. Studies with longer follow-up, such as Peng et al., indicated that positive effects of aquatic exercise could persist up to 12 months, whereas studies with 12-week interventions generally assessed short-term improvements.

Several limitations should be noted, including small sample sizes in some studies, differences in outcome measurement instruments, variations in exercise duration and intensity, and focus on specific populations (e.g., elderly or obese women). Nevertheless, the findings consistently support aquatic exercise as a safe and effective intervention for reducing pain, enhancing function, and improving overall quality of life in patients with CLBP.

Discussion

This study aimed to evaluate the effect of aquatic exercise on pain reduction in patients with chronic low back pain (CLBP) through a systematic literature review. Analysis of five included studies consistently demonstrated that aquatic exercise reduced pain intensity, the primary symptom of CLBP, while improving functional outcomes and quality of life. Pain was assessed using the Visual Analog Scale (VAS), which is a validated, reliable, and responsive instrument. The reduction in pain aligns with the findings of Sawant & Shinde, who reported that hydrotherapy decreases load on painful joints, enhances flexibility, range of motion, muscle strength, as well as balance and coordination. [9] These effects enable patients to maintain a neutral spinal position and reduce mechanical stress, thereby supporting improvements in quality of life and reductions in disability.[10]

Beyond pain relief, aquatic exercise was shown to enhance patients' functional capacity. Peng et al. reported that patients participating in aquatic exercise exhibited significant improvements in functional activity, quality of life, sleep quality, and mental health compared to those receiving conventional physical therapy.[11] This is supported by the physiological mechanisms of water, where buoyancy and water resistance reduce spinal and joint load, allowing freer, safer, and more effective movement to improve muscle strength and flexibility.[12,13]

Comparisons with land-based exercise yielded variable results. Some studies did not find significant differences in disability reduction between aquatic exercise and conventional exercise, likely due to variations in exercise protocols, duration, intensity, and small sample sizes. These findings highlight the need for standardized aquatic exercise protocols to consistently optimize effectiveness.

The findings have important practical implications. Aquatic exercise can serve as a safe, enjoyable, and suitable therapy for patients with limited mobility or pain during land-based exercises. The aquatic environment provides adjustable resistance, enhancing patient adherence to rehabilitation programs.

Nonetheless, several limitations must be considered. Small sample sizes in some studies, variations in intervention duration, and differences in outcome measurement instruments may affect the generalizability of the findings. Additionally, literature searches were limited to three databases and English-language publications, which may introduce selection bias. Further research with rigorous methodology, larger sample sizes, longer follow-up, and standardized aquatic exercise protocols is warranted to strengthen the evidence on the effectiveness of this intervention in CLBP.

Overall, this systematic literature review demonstrates that aquatic exercise is an effective intervention for reducing pain, enhancing function, and improving quality of life in patients with CLBP. These findings provide a scientific basis for healthcare professionals to design safer, more enjoyable, and patient-adaptive rehabilitation programs.

Conclusion

Based on a systematic literature review of five RCTs, aquatic exercise has been shown to be a safe and effective intervention for reducing pain and improving function and quality of life in patients with chronic low back pain (CLBP). These findings reinforce the evidence that water-based exercise can serve as an alternative rehabilitation strategy, particularly for patients with limited mobility or pain during land-based exercises. However, these conclusions should be interpreted with caution due to variations in exercise protocols, small sample sizes, and limited long-term data. Further research is needed to evaluate long-term effects, compare outcomes with land-based exercise, and determine optimal aquatic exercise protocols. Overall, these findings support the integration of aquatic exercise into clinical practice as a safe, adaptive adjunct intervention with potential to enhance patient adherence to rehabilitation programs.

Author Contribution

Husna Arwa Salsabil conceptualized and designed the study, performed the literature search, and drafted the manuscript. Etanaulia Marsim contributed to data analysis, interpretation of findings, and manuscript revision. Khairul Imam provided critical guidance on methodology, reviewed the manuscript, and approved the final version. All authors read and approved the final manuscript.

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Conflict of Interest Statement

The authors declare no conflicts of interest related to this work.

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Ethics Statement

This study is a systematic literature review and did not involve direct participation of human or animal subjects; therefore, formal ethical approval was not required. All included studies were referenced appropriately, and proper acknowledgment was given to original authors.

References

1. Scaturro D, Asaro C, Lauricella L, Tomasello S, Varrassi G, Mauro GL. Combination of rehabilitative therapy with ultramicronized palmitoylethanolamide for chronic low back pain: an observational study. Pain Ther. 2020;9(1):319–26.
2. Pérez-de la Cruz S. Influence of an aquatic therapy program on perceived pain, stress, and quality of life in chronic stroke patients: a randomized trial. Int J Environ Res Public Health. 2020;17(13):4796.
3. Susanti Y, Rahmawati R. Pengaruh latihan hidroterapi terhadap pengurangan rasa nyeri serta peningkatan kualitas hidup pada pasien low back pain akibat spondilolistesis. Jurnal Kesehatan Masyarakat. 2023;19(2):123–9.
4. Santoso TB, Fitriani W. Efektivitas dan kenyamanan transcutaneus electrical nerve stimulation (TENS) pulse burst dan arus trabert dalam mengurangi nyeri kronik di lutut pada usia lanjut. Jurnal Kedokteran dan Kesehatan. 2010;12(1):45–52.
5. Cimbiz A, Bayazit V, Hallaceli H, Cavlak U. The effect of combined therapy (spa and physical therapy) on pain in various chronic diseases. Complement Ther Med. 2005;13(4):244–50.
6. Silva LE, Valim V, Pessanha APC, Oliveira LM, Myamoto S, Jones A, et al. Hydrotherapy versus conventional land-based exercise for the management of patients with osteoarthritis of the knee: a randomized clinical trial. Phys Ther. 2008;88(1):12–21.
7. Shi Z, Zhou H, Lu L, Pan B, Wei Z, Yao X, et al. Aquatic exercises in the treatment of low back pain: a systematic review of the literature and meta-analysis of eight studies. Am J Phys Med Rehabil. 2018;97(2):116–22.
8. Sadaak MM, AbdElMageed SF, Ibrahim MM. Effect of aquatic versus conventional physical therapy program on ankle sprain grade III in elite athletes: randomized controlled trial. J Orthop Surg Res. 2024;19(1):58.
9. Sawant RS, Shinde SB. Effect of hydrotherapy based exercises for chronic nonspecific low back pain. Indian J Physiother Occup Ther. 2019;13(1):133.
10. Choo YJ, Chang MC. Effectiveness of orthoses for treatment in patients with spinal pain. Yeungnam Univ J Med. 2020;37(2):84–9.
11. Aisyah S, Effendi Z, Nur Hawalis S. Optimasi pembuatan lilin aromaterapi berbasis stearic acid dengan penambahan minyak atsiri cengkeh (Syzygium aromaticum). Jurnal Hexagro. 2020;4(1):73–82.
12. Oh SJ, Lee SH. Comparing durability of water- and land-based exercise benefits among older adults in South Korea: a randomized controlled trial with 1-year follow-up. J Back Musculoskelet Rehabil. 2021;34(5):745–55.
13. Heywood SE, Mentiplay BF, Rahmann AE, McClelland JA, Geigle PR, Bower KJ, et al. The effectiveness of aquatic plyometric training in improving strength, jumping, and sprinting: a systematic review. J Sport Rehabil. 2022;31(1):85–98.