

Role of Hot Stone Therapy in Reducing Pain and Improving Quality of Life in Individuals with Chronic Low Back Pain

Shashank¹, Channabasava¹, Vinod¹, Javeriya¹, Dr. Parameshwara M.N.²

¹Bachelor of Naturopathy and Yogic Sciences (BNYS) Students

²Associate Professor & HOD Dept of Research Methodology & Recent Advances

Tapovana Medical College of Naturopathy and Yogic Sciences (TMCNYS), Doddabathi, Davangere – 577566, Karnataka, India

(Affiliated to Rajiv Gandhi University of Health Sciences, Bengaluru)

Abstract

Background: Chronic low back pain (CLBP) is one of the most prevalent musculoskeletal disorders worldwide and a leading cause of years lived with disability. Conventional pharmacological management carries significant long-term risks, creating a need for safe, non-pharmacological alternatives. Hot stone therapy, a form of thermotherapy using heated basalt stones, is proposed to reduce pain and improve function through combined thermal and mechanical mechanisms.

Objectives: To evaluate the effectiveness of hot stone therapy in reducing pain intensity and improving functional disability in individuals with chronic low back pain.

Materials and Methods: A single-group, pre–post interventional study was conducted on 10 male participants (mean age 40.4 ± 8.83 years) with CLBP of >3 months duration and baseline VAS ≥ 4 . Hot stone therapy using basalt stones heated to $45\text{--}55^\circ\text{C}$ was administered 5 sessions per week for 2–4 weeks (session duration 20–30 min). Pain was assessed by the Visual Analog Scale (VAS) and functional disability by the Oswestry Disability Index (ODI) before and after the intervention. Data were analysed using paired t-tests.

Results: Mean VAS score decreased significantly from 7.30 ± 2.00 to 2.10 ± 0.74 (mean reduction 5.20 ± 2.57 ; $t = 6.39$, $p < 0.001$; Cohen's $d = 2.02$). Mean ODI score decreased from $67.70 \pm 15.51\%$ to $25.00 \pm 2.87\%$ (mean reduction 42.70 ± 15.20 ; $t = 8.89$, $p < 0.001$; Cohen's $d = 2.81$). All participants shifted from moderate/severe/worst-imaginable pain categories into the mild category, and the majority moved from severe/crippled disability categories into moderate or minimal disability.

Conclusion: Hot stone therapy produced statistically significant and clinically meaningful reductions in pain intensity and functional disability in individuals with chronic low back pain. It appears to be a safe, low-cost, non-pharmacological option suitable for integration into naturopathic management protocols. Larger controlled trials are warranted to confirm these findings.

Keywords: *Hot stone therapy; chronic low back pain; thermotherapy; Visual Analog Scale; Oswestry Disability Index; naturopathy; basalt stone massage*

1. Introduction

Chronic low back pain (CLBP) is the single leading cause of years lived with disability globally and ranks among the most burdensome musculoskeletal conditions worldwide [1]. According to the Global Burden of Disease Study 2021, approximately 619 million people were affected by low back pain in 2020, with projections estimating a rise to over 843 million cases by 2050 [1]. In India, lifetime prevalence is estimated at 60–80% of the population [3]. When pain in the lumbar region persists beyond three months, it transitions from an acute tissue injury response to a complex biopsychosocial condition involving peripheral and central sensitization, muscle dysfunction, and significant functional decline [2,16,19].

Conventional management has relied heavily on non-steroidal anti-inflammatory drugs, muscle relaxants, and opioids. While these agents provide short-term relief, long-term use is associated with gastrointestinal, hepatorenal, cardiovascular, and dependency risks [2,12]. Pharmacological approaches also fail to address underlying structural and psychosocial contributors. This has generated substantial interest in evidence-based non-pharmacological interventions, of which thermotherapy occupies a well-supported position [5,11,12].

Hot stone therapy is a specific form of thermotherapy in which smooth volcanic basalt stones, heated to 45–55°C, are placed and manipulated over targeted anatomical regions [7,8]. Basalt is preferred for its dense microcrystalline structure, high iron content, and excellent heat-retention capacity. Within naturopathic practice, the modality aligns with the principle of *vis medicatrix naturae* (the healing power of nature) [8].

The therapeutic rationale rests on multiple physiological mechanisms: thermally induced vasodilation improves local perfusion and clearance of metabolic waste; activation of cutaneous thermoreceptors inhibits nociceptive transmission via gate-control mechanisms; heat reduces muscle-spindle sensitivity and resting tone; mechanical strokes with the stones provide myofascial release; and the overall experience promotes parasympathetic activation and endogenous opioid release [5,14,15,21]. These actions collectively interrupt the pain–spasm–pain cycle that perpetuates CLBP.

Despite widespread clinical use, the evidence base specifically examining a standardized naturopathic hot stone protocol for CLBP, with both pain intensity (Visual Analog Scale, VAS) and functional disability (Oswestry Disability Index, ODI) as primary outcomes, remains limited [7,8]. The present study was therefore undertaken to evaluate the effectiveness of hot stone therapy in reducing pain and improving functional quality of life in individuals with chronic low back pain.

2. Aims and Objectives

Aim: To evaluate the effectiveness of hot stone therapy in the management of chronic low back pain.

Objectives:

1. To assess pain intensity in the lower back before and after hot stone therapy using the Visual Analog Scale (VAS).
2. To evaluate improvement in functional disability before and after hot stone therapy using the Oswestry Disability Index (ODI).
3. To analyse the overall clinical effect of hot stone therapy on muscle relaxation, flexibility, and functional ability in patients with chronic low back pain.

3. Review of Literature

Thermotherapy is among the oldest healing practices, with documented use in ancient Egyptian, Chinese, Ayurvedic, and Greek traditions [5,8]. Modern hot stone therapy was systematized by Mary Nelson in 1993 (LaStone Therapy) and has since been widely adopted in clinical and spa settings [8]. Classical basalt hot stone massage employs stones heated to 45–55°C; the material's high specific heat capacity allows sustained thermal delivery to deeper tissues [7,8].

Physiological mechanisms include activation of warm receptors and TRPV channels that trigger gate-control analgesia and endogenous opioid release [14,15]; neurogenic vasodilation mediated by CGRP, substance P, and nitric oxide, increasing local blood flow several-fold [5]; reduction of muscle-spindle sensitivity and resting tone [5,21]; thermally mediated increase in collagen extensibility [5]; and parasympathetic activation with reduction of cortisol and anxiety [9,22]. The mechanical component of stone massage adds myofascial release effects that address trigger points and fascial adhesions [21,23].

Clinical evidence supports the modality. Li et al. (2024) conducted a multicenter randomized controlled trial in 120 patients with moderate chronic back pain and demonstrated significantly greater pain reduction and increases in deep paraspinal muscle thickness with hot stone massage compared with flurbiprofen plaster [7]. A Cochrane review of superficial heat for low back pain concluded that heat wrap therapy provides moderate-quality evidence of clinically meaningful pain relief [11]. The American College of Physicians 2017 guidelines assigned superficial heat a Grade B recommendation as first-line non-pharmacological treatment for both acute and chronic low back pain [12]. Additional trials have shown benefits for sleep quality and acute low back pain [9,10].

CLBP itself is multifactorial. Approximately 85–90% of cases are non-specific; the remainder involve identifiable structural pathology such as disc herniation or facet arthropathy [2]. Pathophysiology encompasses discogenic and facet-mediated pain, paraspinal muscle atrophy and trigger-point formation, central sensitization, and low-grade systemic inflammation [19,24]. Psychosocial factors (catastrophizing, fear-avoidance, depression) are powerful predictors of chronification [26]. Validated outcome instruments include the VAS (minimum clinically important difference $\approx$ 13 mm) and the ODI (MCID $\approx$ 10 percentage points) [6,13].

4. Materials and Methods

4.1 Study Design and Setting

A single-group, pre-test/post-test interventional (quasi-experimental) study was conducted at Tapovana Medical College of Naturopathy and Yogic Sciences, Doddabathi, Davangere, Karnataka. Each participant served as his own control.

4.2 Participants

Ten male participants (N = 10) aged 20–51 years (mean 40.4 ± 8.83 years) with a clinical diagnosis of chronic low back pain of more than three months' duration and a baseline VAS score ≥ 4 were enrolled. All participants completed the protocol with no dropouts.

Inclusion criteria:

- Either sex, age 20–51 years
- Chronic low back pain >3 months
- Baseline VAS ≥ 4
- Willingness to provide written informed consent and comply with the schedule
- Ability to lie prone for the duration of each session

Exclusion criteria:

- History of spinal surgery, fracture, or instrumentation
- Specific causes of LBP (malignancy, infection, inflammatory spondyloarthropathy)
- Skin conditions, open wounds, or heat hypersensitivity over the lumbar region
- Pregnancy; uncontrolled cardiovascular disease; bleeding disorders; peripheral neuropathy affecting thermal sensation
- Concurrent active physiotherapy or manual therapy for low back pain

4.3 Ethical Considerations

The study was conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from every participant after explanation of the purpose, procedure, benefits, and potential risks. Confidentiality was maintained and participants retained the right to withdraw at any stage without affecting their ongoing care.

4.4 Intervention

All participants received hot stone therapy as the sole intervention, administered five sessions per week for 2–4 weeks. Each session lasted approximately 20–30 minutes and was delivered by trained naturopathy interns under faculty supervision. Smooth basalt stones of varying sizes were heated in a thermostatically controlled water bath and maintained at 45–55°C; temperature was verified with a contact thermometer before skin contact. Stones were placed bilaterally along the lumbar paraspinal muscles (L1–L5), targeting the erector spinae and multifidus, and manipulated with gliding and circular massage strokes combined with static placement over tender points. Participants remained in the prone position with appropriate draping throughout.

4.5 Outcome Measures

Visual Analog Scale (VAS): A 10 cm horizontal line anchored by “No Pain” (0) and “Worst Imaginable Pain” (10). The distance from the “No Pain” end to the patient’s mark was recorded in centimetres [13].

Oswestry Disability Index (ODI) Version 2.1: A 10-section questionnaire assessing functional disability across domains of daily life. Each section is scored 0–5; the total is expressed as a percentage (0–100%) [6].

4.6 Data Collection and Statistical Analysis

Baseline VAS and ODI scores were recorded on the day of enrolment prior to the first session. Post-intervention scores were recorded on completion of the protocol under identical conditions. Data were analysed with descriptive statistics (mean $\pm$ SD) and the paired Student’s t-test. Effect size was estimated with Cohen’s d. A p-value < 0.05 was considered statistically significant. Participants were also categorized into standard VAS and ODI severity bands to illustrate clinical shift.

5. Results

All 10 enrolled participants completed the intervention with no adverse events or dropouts.

5.1 Demographic Profile

All participants were male. Age ranged from 22 to 51 years (mean 40.4 ± 8.83 years).

5.2 Primary Outcomes

Table 1 summarizes the pre- and post-intervention comparisons.

Variable	Pre (Mean $\pm$ SD)	Post (Mean $\pm$ SD)	Mean Reduction $\pm$ SD	t-value	p-value
VAS (0–10)	7.30 $\pm$ 2.00	2.10 $\pm$ 0.74	5.20 $\pm$ 2.57	6.39	<0.001
ODI (0–100%)	67.70 $\pm$ 15.51	25.00 $\pm$ 2.87	42.70 $\pm$ 15.20	8.89	<0.001

Table 1. Comparison of pre- and post-intervention VAS and ODI scores (paired t-test, $n = 10$)

The mean VAS score reduced by 71.2% (from severe to mild pain range). The effect size was very large (Cohen’s $d = 2.02$). The mean ODI score improved by 63.1 percentage points, far exceeding the minimum clinically important difference of 10 points (Cohen’s $d = 2.81$).

5.3 Shift in Severity Categories

Tables 2 and 3 illustrate the clinical shift in severity distribution.

VAS Category	Pre n (%)	Post n (%)
Mild (1–3)	0 (0%)	10 (100%)
Moderate (4–6)	4 (40%)	0 (0%)
Severe (7–9)	5 (50%)	0 (0%)
Worst imaginable (10)	1 (10%)	0 (0%)

Table 2. Shift in VAS pain-severity category, pre- versus post-intervention

ODI Category	Pre n (%)	Post n (%)
Minimal disability (0–20%)	0 (0%)	1 (10%)
Moderate disability (21–40%)	1 (10%)	9 (90%)
Severe disability (41–60%)	2 (20%)	0 (0%)
Crippled (61–80%)	5 (50%)	0 (0%)
Bed-bound (81–100%)	2 (20%)	0 (0%)

Table 3. Shift in ODI disability-severity category, pre- versus post-intervention

Prior to intervention, all participants were in moderate, severe, or worst-imaginable VAS categories. After intervention, 100% moved into the mild category. For ODI, 90% of participants were in severe, crippled, or bed-bound categories at baseline; after intervention, 90% were in the moderate disability category and 10% in the minimal disability category.

6. Discussion

The present study demonstrated statistically highly significant and clinically meaningful reductions in both pain intensity and functional disability following a short course of hot stone therapy in individuals with chronic low back pain. The 71% reduction in mean VAS score and the 43-percentage-point improvement in ODI far exceeded the respective minimum clinically important differences, indicating that the changes were of real clinical relevance to the participants.

These findings are consistent with the multicenter RCT of Li et al. (2024), which reported greater pain reduction and ultrasound-documented increases in deep paraspinal muscle thickness with hot stone massage compared with topical NSAID therapy [7]. They also align with the Cochrane review of superficial heat [11] and the American College of Physicians guideline recommendation of heat as first-line non-pharmacological treatment [12]. The relatively large effect sizes observed in the present study may reflect the synergistic combination of sustained thermal energy and mechanical myofascial release that distinguishes hot stone therapy from passive heat-wrap application alone [5,21,23].

Mechanistically, the observed benefits can be attributed to interruption of the pain–spasm–pain cycle through simultaneous vasodilation, reduction of muscle-spindle sensitivity, gate-control analgesia, and

myofascial release, together with central effects mediated by descending inhibitory pathways and parasympathetic activation [5,14,15,19]. The parallel improvement in both sensory (VAS) and functional (ODI) domains supports a multidimensional therapeutic action consistent with the biopsychosocial model of CLBP [16,17].

The study has several limitations. The sample size was small ($n = 10$) and drawn from a single centre; all participants were male, limiting generalizability; there was no control or comparator group, so non-specific effects cannot be fully excluded; the intervention and follow-up period was short (2–4 weeks); and outcomes relied solely on self-report instruments without objective corroboration (e.g., ultrasound or electromyography). These limitations are acknowledged and provide clear directions for future research.

Nevertheless, the magnitude of change, the absence of adverse events, the low cost, and the alignment with naturopathic principles support the incorporation of hot stone therapy as a safe and effective adjunct within multimodal management of chronic low back pain.

7. Conclusion

Within the limitations of this single-group pre–post study, hot stone therapy administered five times weekly for 2–4 weeks produced statistically highly significant and clinically meaningful reductions in pain intensity (VAS) and functional disability (ODI) in individuals with chronic low back pain. The intervention was safe, well tolerated, and free of adverse events. These findings support the integration of hot stone therapy as a useful, low-cost, non-pharmacological component of naturopathic care for CLBP. Larger randomized controlled trials with longer follow-up, mixed-gender samples, and objective outcome measures are recommended to confirm and extend these results.

Acknowledgements

The authors express sincere gratitude to Dr. Parameshwara M.N., Associate Professor, TMCNYS, for his valuable guidance and constant encouragement & Dr. Shashikumar Meharwade, for granting necessary permission and infrastructure; to the members of the Institutional Ethics Committee for timely review and clearance; and to all study participants for their willing cooperation.

Conflict of Interest

The authors declare that they have no conflict of interest.

References

1. Ferreira ML, de Luca K, Haile LM, et al. Global, regional, and national burden of low back pain, 1990–2020, its attributable risk factors, and projections to 2050: a systematic analysis of the Global Burden of Disease Study 2021. *Lancet Rheumatol.* 2023;5(6):e316–e329.
2. Maher C, Underwood M, Buchbinder R. Non-specific low back pain. *Lancet.* 2017;389(10070):736–747.

3. Hoy D, Bain C, Williams G, et al. A systematic review of the global prevalence of low back pain. *Arthritis Rheum.* 2012;64(6):2028–2037.
4. Meucci RD, Fassa AG, Faria NM. Prevalence of chronic low back pain: systematic review. *Rev Saude Publica.* 2015;49:1.
5. Nadler SF, Weingand K, Kruse RJ. The physiologic basis and clinical applications of cryotherapy and thermotherapy for the pain practitioner. *Pain Physician.* 2004;7(3):395–399.
6. Fairbank JC, Pynsent PB. The Oswestry Disability Index. *Spine (Phila Pa 1976).* 2000;25(22):2940–2952.
7. Li L, Xi Y, Wang Y, et al. A novel temperature-controlled device with standardized manipulation improves chronic back pain mediated by modulating deep muscle thickness: a multicenter randomized controlled trial. *Clin Transl Discov.* 2024;4(3):e330.
8. Li L, Xi Y, Wang Y, et al. Heat-stone massage for patients with chronic musculoskeletal pain: a protocol for multicenter randomized controlled trial. *Front Med (Lausanne).* 2023;10:1215858.
9. Ghavami H, Shamsi SA, Abdollahpoor B, Radfar M, Khalkhali HR. Impact of hot stone massage therapy on sleep quality in patients on maintenance hemodialysis: a randomized controlled trial. *J Res Med Sci.* 2019;24:71.
10. Dehghan M, Farahbod F. The efficacy of thermotherapy and cryotherapy on pain relief in patients with acute low back pain, a clinical trial study. *J Clin Diagn Res.* 2014;8(9):LC01–LC04.
11. French SD, Cameron M, Walker BF, Reggars JW, Esterman AJ. A Cochrane review of superficial heat or cold for low back pain. *Spine (Phila Pa 1976).* 2006;31(9):998–1006.
12. Qaseem A, Wilt TJ, McLean RM, Forciea MA. Noninvasive treatments for acute, subacute, and chronic low back pain: a clinical practice guideline from the American College of Physicians. *Ann Intern Med.* 2017;166(7):514–530.
13. Huskisson EC. Measurement of pain. *Lancet.* 1974;2(7889):1127–1131.
14. Melzack R, Wall PD. Pain mechanisms: a new theory. *Science.* 1965;150(3699):971–979.
15. Caterina MJ, Schumacher MA, Tominaga M, Rosen TA, Levine JD, Julius D. The capsaicin receptor: a heat-activated ion channel in the pain pathway. *Nature.* 1997;389(6653):816–824.
16. Engel GL. The need for a new medical model: a challenge for biomedicine. *Science.* 1977;196(4286):129–136.
17. Waddell G. A new clinical model for the treatment of low-back pain. *Spine (Phila Pa 1976).* 1987;12(7):632–644.
18. Moseley GL. Unravelling the barriers to reconceptualisation of the problem in chronic pain. *J Pain.* 2003;4(4):184–189.
19. Woolf CJ. Central sensitization: implications for the diagnosis and treatment of pain. *Pain.* 2011;152(3 Suppl):S2–S15.
20. Apkarian AV, Bushnell MC, Treede RD, Zubieta JK. Human brain mechanisms of pain perception and regulation in health and disease. *Eur J Pain.* 2005;9(4):463–484.

21. Bialosky JE, Bishop MD, Price DD, Robinson ME, George SZ. The mechanisms of manual therapy in the treatment of musculoskeletal pain: a comprehensive model. *Man Ther.* 2009;14(5):531–538.
22. Field T. Massage therapy research review. *Complement Ther Clin Pract.* 2016;24:19–31.
23. Weerapong P, Hume PA, Kolt GS. The mechanisms of massage and effects on performance, muscle recovery and injury prevention. *Sports Med.* 2005;35(3):235–256.
24. Staud R. Evidence for shared pain mechanisms in osteoarthritis, low back pain, and fibromyalgia. *Curr Rheumatol Rep.* 2011;13(6):513–520.
25. Itz CJ, Geurts JW, van Kleef M, Nelemans P. Clinical course of non-specific low back pain: a systematic review of prospective cohort studies set in primary care. *Eur J Pain.* 2013;17(1):5–15.
26. Sullivan MJ, Feuerstein M, Gatchel R, Linton SJ, Pransky G. Integrating psychosocial and behavioral interventions to achieve optimal rehabilitation outcomes. *J Occup Rehabil.* 2005;15(4):475–489.
27. Henschke N, Ostelo RW, van Tulder MW, et al. Behavioural treatment for chronic low-back pain. *Cochrane Database Syst Rev.* 2010;(7):CD002014.
28. Rubinstein SM, Terwee CB, Assendelft WJ, de Boer MR, van Tulder MW. Spinal manipulative therapy for acute low-back pain. *Cochrane Database Syst Rev.* 2012;(9):CD008880.