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Dry Needling of Calf in Chronic Non- Specific Low Back Pain: A Randomized Controlled Trial

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ABSTRACT

Background: Chronic non-specific low back pain (CNSLBP), characterized by pain lasting more than three months without a clear pathoanatomical cause, is frequently associated with muscle imbalances and restricted mobility.

Purpose: This experimental study investigated the effects of Dry Needling (DN) of the calf muscle on CNSLBP.

Methods: A total of 46 participants aged 20–45 years with diagnosed CNSLBP and calf muscle tightness were randomly assigned into two groups: Group A received DN plus conventional therapy (hamstrings, iliopsoas, and back muscle stretching), and Group B received only conventional therapy. Pain intensity, lumbar spine ROM, and disability were measured using the VAS, MFTTF, and MODI before and after intervention.

Results: Both groups demonstrated statistically significant improvements in all outcome measures ($p < 0.05$). However, Group A showed greater improvement compared to Group B. Group A reported a significant reduction in VAS scores (from 6.31 ± 1.22 to 1.65 ± 0.62), increased ROM in lumbar flexion (from 9.95 ± 4.03 to 24.76 ± 3.45), and decreased disability (MODI from 10.86 ± 2.79 to 3.19 ±1.07).

Conclusions: Dry needling of the calf muscle, when combined with conventional therapy, significantly enhances pain relief, lumbar mobility, and reduces disability in individuals with CNSLBP. These findings support the value of addressing calf muscle tightness in managing chronic non-specific low back pain. Further research with larger sample sizes and longer follow-up is recommended.

KEYWORDS: Low Back Pain, Calf, Gastrocnemius Tightness, Chronic, Non-Specific

ARTICLE DETAILS

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1. INTRODUCTION

Low Back Pain (LBP) is the most common musculoskeletal conditions that interferes with functioning and lowers quality of life (Adway et al., 2024; Ibrahim et al., 2020). Over 70% of adults have at least one episode of LBP in their lifetime. It is defined as pain and discomfort in the lumbosacral region, below the twelfth rib and above the inferior gluteal folds (Shamsi et al., 2015).

There are three types of LBP (non -specific; pain with nerve root symptoms; pain resulting from serious injury), out of which non -specific LBP contains no recognized pathoanatomic cause and can develop into chronic LBP. It is also categorized according to its duration from onset, as acute (<6 weeks), sub -acute (6 weeks -12 weeks), and chronic (>12 weeks) (Shamsi et al., 2015; Waddell et al., 2004).

Chronic non- specific LBP is defined as a repetitive occurrence of back pain lasting more than three months. It usually worsens with activity and improves with rest and usually resolves in six weeks to one year ((Shamsi et al., 2015). Typical physical findings include restricted spinal range of motion (ROM), tight hamstrings, paravertebral muscle spasms, trigger points, and aggravation of symptoms on flexion and extension (Altorairi et al., 2014).

Studies have explored the association between lower extremity muscle tightness and low back pain (LBP), with a particular focus on the gastrocnemius (calf muscle). As gastrocnemius is a two joint muscle, it spans the knee and the ankle joints. The role of muscle in knee flexion and its shortening indirectly affects the hamstring muscle, and may limit forward bending, disrupting the normal lumbopelvic rhythm, can lead to low back pain (Seif et al., 2015).

Overpronation of foot could be another reason for association of gastrocnemius muscle with LBP. Flat feet causes the overpronation of foot which leads to muscle imbalances. Several studies have linked the presence of flatfeet with excessive foot pronation, which in turn leads to internal rotation of the tibia and femur, as well as an anterior pelvic tilt. This altered lower extremity alignment is thought to contribute to an increased incidence, severity, and duration of low back pain. As in terms of biomechanics, the body movement is the system of kinetic chains working together to make up a motion and disorders in one part or the entire kinetic chain impairs other kinetic chains of the body too (Moezy et al., 2017).

Additionally, the superficial back line is suggested to be the myofascial line most associated with low back pain. It contains the plantar fascia and short toe flexors (lumbricals, flexor accessories and flexor digitorum brevis), the Achilles and the triceps surae (gastrocnemius and soleus, the hamstrings, the fascia of the lumbosacral area, and erector spinae. It is due to the superficial back line present in the body that the gastrocnemius and hamstrings muscle come in tension (Seif et al., 2015).

Tight calves can disrupt normal gait patterns, influencing the distribution of forces throughout the lower body. The restricted dorsiflexion often leads to compensatory movements that place additional strain on the lumbar spine, thereby contributing to LBP (Almutairi et al., 2021). This altered gait and force distribution may subsequently affect the lumbar spine, contributing to LBP (Johanson et al., 2009). Moreover, restricted ankle dorsiflexion can cause anterior pelvic tilt as the body attempts to maintain balance during standing and walking leading to enhanced lumbar lordosis which places additional mechanical stress on the lumbar spine, contributing to persistent LBP. Additionally, calf muscle contributes in shock absorption during weightbearing. Insufficient shock absorption affects the lumbar spine and leads to lower back pain (Hafeez et al., 2024).

Myofascial trigger points are “hyperirritable points in skeletal muscle that are associated with a hypersensitive palpable nodule in a taut band”. It is estimated that MTrPs are the primary cause of pain in 30- 85% of those with musculoskeletal disorders (Kietrys et al., 2013). Dry Needling consists of using a needle, as a physical agent, to create a mechanical stimulus with the goal of deactivating the trigger point. It is an invasive procedure, where the needle is inserted through the skin and muscle into the MTrP. Once the MTrP is deactivated, the needle is removed (Kietrys et al., 2013). There seems a lack of literature to establish the effectiveness of calf dry needling in the treatment of low back pain. So, this study will help to evaluate the effect of calf dry needling on non- specific low back pain.

2.METHODOLOGY

2.1 Study Design

A total of 46 participants aged 20–45 years with calf muscle tightness and CNSLBP (>3 months) were recruited from the Physiotherapy OPD, Sri Guru Granth Sahib World University, Fatehgarh Sahib, Punjab. Ethical clearance was obtained (Ref: SGGSWU/IEC/2025/49), and the study was registered in the Clinical Trial Registry of India (CTRI/2025/04/084393).

2.2. Sample Size: It was determined using G*Power software with α=0.05, effect size=0.5, and 10% dropout, resulting in 23 subjects per group (Seif et al., 2015).

2.3 Inclusion and Exclusion Criteria: Written informed consent was obtained from each subject and the explanation about the interventions was also given. Subjects aged 20–45 years with tightness of calf muscles and CNSLBP were included. The subjects with history of spinal injuries, lumbar radiculopathy, bleeding disorders, and needle phobia were excluded.

2.4 Recruitment, Sequence Generation and Allocation: Subjects were referred by orthopaedicians and randomly assigned (1:1 ratio) into two groups using random allocation software. Allocation was sealed in envelopes. The treating therapist followed group assignments. Participants were blinded to reduce bias.

2.5 Conduction and Blinding: A non-involved individual handled randomization and group assignment. A single-blind design was used. The outcome assessor was blinded throughout the trial. Participants were informed of group allocation post-assessment.

2.6 Predictor/Dependent Variables

- Group A: **Dry Needling + Conventional Therapy**
- Group B: **Conventional Therapy only**

2.7 Outcome Measures: All outcomes were measured pre- and post-intervention:

- **VAS (Visual Analog Scale):** 100mm scale for pain intensity (Magee, 2014).
- **Modified Fingertip-to-Floor Test:** Measures lumbar Range of Motion (ROM) via distance between fingertip and floor during trunk flexion (Seif et al., 2015).
- **Modified Oswestry Disability Index (MODI):** 10-question tool assessing LBP-related disability (Hudson-Cook et al., Seif et al., 2015).

2.8 Procedure: The study was conducted in accordance with CONSORT guidelines (Fig.1). 46 subjects were assigned to Group A (DN + conventional therapy) or Group B (conventional therapy only). Each subject attended sessions on alternate days, with assessments on Day 1 and Day 10.

2.9 Interventions

Dry Needling

The MTrPs were identified during a detailed physiotherapy assessment. Manual palpation of the calf (gastrocnemius) muscle was performed with the patient in prone position, with a pillow placed under the patient's feet to maintain knee flexion of approximately 20° and to allow some slack in the gastrocnemius muscle. The MTrPs in the medial and lateral head of the gastrocnemius muscle were identified with the cross- fiber pincer palpation, and the TrPs were fixed with a pincer- grasp between the clinician's thumb, index and middle fingers and a 0.25mm gauge of 40 or 50mm long acupuncture needle was directly inserted into the heads the muscle respectively. The fast in/fast out technique was used to obtain a local twitch response lasting 5 seconds (Boloushi et al.,2019). Needle was retained for 5 minutes (Dunning et al., 2021). Care was taken to avoid needling the tibial nerve and semi- membranous tendons (Travell and Simons 2019).

Conventional Therapy

The Conventional therapy comprised of Hamstrings, Iliopsoas and Back Muscle Stretching: For Hamstrings Stretching the subject was asked to lie in supine position. With the subjects s knee fully extended, lower leg was supported with therapist's arm or shoulder. With the knee at 0° and the hip in neutral rotation, the hip was flexed to stretch the hamstrings muscle (Kisner and Colby., 2012). For Iliopsoas Stretching, the subject was positioned close to the edge of the table, with the opposite leg against patient's chest and with the other hand, the hip was moved for a stretch in extension (Kisner and Colby.,2012). For Back Muscle Stretching the subject adopted a Quadruped (on hands and knees) position and performed a posterior pelvic tilt without rounding the thorax. Bring the hips back to the feet, hold and then return to the hands and knee position (Kisner and Colby., 2012). Each stretching/position was held for 30 seconds with 3 repetitions (Seif et al., 2015).

2.10 Harms and Potential Care: Subjects were informed of potential risks, and compensation was ensured for any adverse effects. Any adverse events that occur following insertion of needle were recorded.

2.11 Strategies to encourage participation and subject retention: The participants were encouraged to be present regularly at the OPD. All treatment procedures were free of cost. The therapist was also available to talk to the subject or via telephonic conversation as and when required.

2.12 Data Management: The subject's personal information and pre and post intervention data was saved in confidential Excel file for analysis.

2.13 Statistical Analysis: SPSS was used to analyse data. Shapiro- Wilk test was used to evaluate the normal distribution of data. The data was found to be normally distributed, so parametric test was used for analysis.

2.14 Harms and Potential Care: The participants were well informed about the harms related to the intervention. The researcher was responsible for compensating any adverse effects related to intervention.

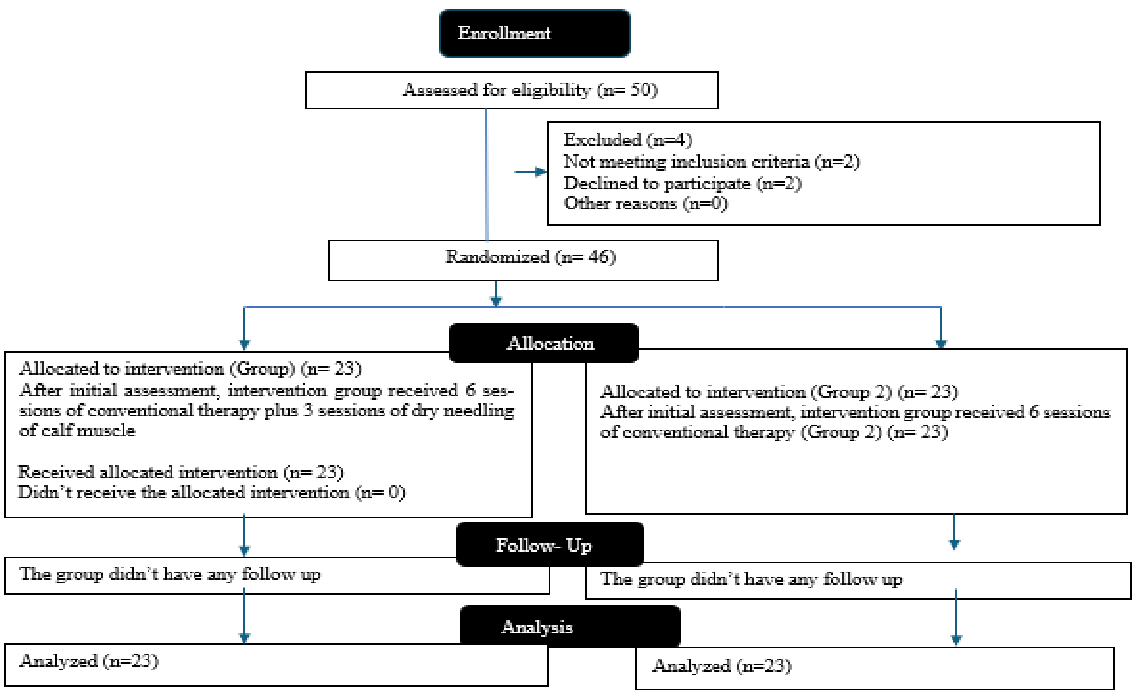

Fig.1: CONSORT Flow Diagram

3. RESULTS

In this study 46 subjects participated with ages ranging from 25 to 40 years and all the subjects completed the study period. Table 1 shows the baseline characteristics and demographic detail of subjects. In Group A, 23 subjects with a mean age of (28.57 ± 8.852), were given Dry Needling and Conventional treatment (hamstrings, iliopsoas and back muscle stretching). Similarly, Conventional treatment was given to 23 subjects in Group B, who had a mean age of (35.57 ± 9.194) and had no significant difference in height or weight.

Table 2 represents the baseline characteristics and post- intervention measures of Group A. The mean value for the MFTTF is (15.71±5.596), while after intervention it is (5.67±3.152) (p- value - 0.000); for VAS (pain) it is (6.310±1.2259), while after intervention it is (1.652±.6274) (p- value - 0.001); for MODI value is (10.86 ±2.798), while after intervention it is (3.19±1.078) (p- value - 0.003); The lumbar spine flexion range before intervention is (9.95± 4.031) while after intervention it is (24.76±3.448), with p- value 0.001; Lumbar spine extension is (2.52± 1.250), after intervention it is (5.10± .995) with p- value 0.008; Lumbar spine lateral flexion (right side) it is (18.52± 5.400) while after intervention it's (30.71± 3.243) with p- value 0.000; Lumbar spine lateral flexion (left side) it is (18.43 ± 6.423), after intervention it is (31.52± 4.600) with p- value 0.000.

Table 3 represents the baseline characteristics and post- intervention measures of Group B. The mean for VAS changed from 5.435 to 2.365 with standard deviation of 1.3200 to 0.8032 respectively (p- value - 0.000). The mean value for the modified fingertip to floor test is (15.74±3.840), while after intervention it is (9.57 ± 3.043) (p- value - 0.000); for MODI value is (12.52±4.021), while after intervention it is (6.83± 3.157) (p- value - 0.000); The lumbar spine flexion range before intervention is (9.65±3.676) while after intervention it is (19.61± 2.607), (p- value 0.08); Lumbar spine extension is (2.26± .864), after intervention it is (3.57± .945) (p- value 0.000); Lumbar spine lateral flexion (right side) it is (15.96±5.612) while after intervention it's (23.65± 4.579) (p- value 0.000); Lumbar spine lateral flexion (left side) it is (19.61±5.358), after intervention it is (22.83 ± 4.960) with p- value 0.000.

Table 4 represents the group comparison of before and after intervention measures and their p- value. The before and after intervention measures of all outcomes for both groups were significantly different from each other, as evidenced by the low p-values (less than 0.05), which indicates a significant improvement in pain intensity, range of motion of lumbar spine, and the level of disability. The group comparison showed that the changes in all outcome measures were significantly greater in Group A (Dry Needling and conventional) than Group B (conventional). These findings were supported by the Mean ±SD difference between both groups before and after intervention and the low p- values (<0.05), indicating a significant difference between the groups.

Table 1: Baseline characteristics and demographic detail of subjects

Demographic details	Group A (Dry Needling + conventional) (N= 23)	Group B (Conventional) (N= 23)
Age (years)	28.57 ± 8.852	35.57 ± 9.194
Height (centimeters)	168.14 ± 7.741	164.91± 6.480
Weight (kilograms)	64.67 ± 14.537	12.985 65.35 ±

Table 2: Baseline characteristics and post intervention measures of Group A (Dry needling + conventional)

Outcome measures	Baseline measures mean± SD	After intervention mean± SD	p- value
MFTTF	5.596 15.71±	5.67±3.152	.000
VAS	1.2259 6.310±	1.652±.6274	.001
MODI	10.86 ±2.798	3.19±1.078	.003
Lumbar spine (flexion)	9.95± 4.031	24.76±3.448	.001
Lumbar spine (extension)	2.52± 1.250	5.10± .995	.008
Lateral flexion (R)	18.52± 5.400	30.71± 3.243	.000
Lateral flexion (L)	18.43 ± 6.423	31.52± 4.600	.000

Table 3: Baseline characteristics and post intervention measures of Group B (Conventional)

Outcome measures	Baseline measures mean ± SD	After intervention mean± SD	p- value
MFTTF	3.840 15.74±	9.57 ± 3.043	.000
VAS	5.435±1.3200	.8032 2.365±	.000
MODI	12.52±4.021	6.83± 3.157	.000
Lumbar spine (flexion)	9.65±3.676	19.61± 2.607	.008
Lumbar spine (extension)	2.26± .864	3.57± .945	.003
Lateral flexion (R)	5.612 15.96±	23.65± 4.579	.000
Lateral flexion (L)	19.61±5.358	22.83 ± 4.960	.000

Table 4: Between the group comparison of before – intervention and after- intervention measures and their p- value

Outcome measures	Group A (dry needling + conventional)		p- value	Group B (conventional)		p- value
	Before intervention mean ± SD	**After intervention mean ± SD**		**Before intervention mean ± SD**	**After intervention mean ± SD**	
MFTTF	15.48± 5.401	5.39± 3.144	.000	15.74±3.840	9.57± 3.043	.000
VAS	6.204±1.2331	1.413±.6511	.000	5.435±1.3200	2.287±.7783	.000
MODI	11.17±2.902	3.13±1.058	.000	12.52±4.021	6.833±..157	.000
Lumbar spine (flexion)	10.26±3.980	24.74±3.292	.000	9.65±3.676	19.61±2.607	.000
Lumbar spine (extension)	2.48±1.201	5.00±1.000	.000	2.26±.864	3.57±.945	.000
Lateral flexion (R)	18.57±5.186	30.39±3.272	.000	15.96±5.612	23.65±4.579	.000
Lumbar flexion (L)	18.39±6.192	31.13±4.732	.000	14.83±5.557	22.83±4.960	.000

4. S

5. DISCUSSION

Low back pain (LBP) is a common musculoskeletal condition that affects function and reduces quality of life, with over 70% of adults experiencing it at least once (Adway et al., 2024; Ibrahim et al., 2020). This study aimed to evaluate the effect of dry needling (DN) of the calf muscle on chronic non-specific low back pain (CNSLBP).

A total of 46 participants were divided into two groups. Group A received calf DN along with conventional stretching exercises (hamstrings, iliopsoas, and back muscles), while Group B received only the stretching exercises. Both groups showed significant improvement in pain intensity, lumbar ROM, and disability levels, but Group A showed superior results.

The better outcomes in Group A can be linked to the role of the calf (gastrocnemius) muscle in the body's movement chain. Being a two-joint muscle, tightness in the gastrocnemius affects knee flexion and hamstring function, which in turn disturbs the lumbopelvic rhythm—leading to LBP (Seif et al., 2015). Tight calves also limit ankle dorsiflexion, causing compensatory changes in gait and posture, such as anterior pelvic tilt and lumbar lordosis, which stress the lower back (Moezy et al., 2017; Johanson et al., 2009; Almutairi et al., 2021).

DN works by targeting myofascial trigger points (MTrPs), reducing pain, muscle tension, and improving blood flow and neuromuscular control (Boloushi et al., 2019; Dunning et al., 2021). It stimulates sensory nerve fibers, which activate pain-relief pathways and the release of substances like β-endorphins and serotonin, helping reduce both peripheral and central pain sensitivity (Kietrys et al., 2013).

Although Group B also benefited from stretching, the added benefit of DN in Group A confirms its effectiveness in reducing pain and improving function. This is supported by previous studies showing the positive impact of calf muscle treatment on LBP outcomes (Hafeez et al., 2024; Altorairi et al., 2013).

Thus combining calf dry needling with conventional therapy is more effective than conventional therapy alone in managing CNSLBP. It addresses deeper muscle dysfunctions and offers a more comprehensive approach to treatment. However small sample size and short duration of study are some of the notable limitations that may affect the generalizability of the findings thus warranting further study.

6. CONCLUSION

This study evaluated the effect of dry needling of calf on chronic non- specific low back pain. The findings of this study indicated that incorporating dry needling of the calf muscles into the treatment protocol for patients with low back pain provides significantly better outcomes compared to conservative treatment alone. Participants who received Dry Needling in addition to conventional treatment demonstrated greater improvements in pain reduction, functional mobility, and disability scores. As the first study of its kind, these findings are significant, however, further research is needed due to the limited existing literature.

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Authorship Contribution

All authors have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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Declarations

The authors declare that the submitted manuscript has not been published, accepted for publication, or is currently under editorial or peer-review consideration for publication elsewhere.

Ethical statement: The Ethical Approval was obtained from the Institutional Ethical Committee (IEC) constituted by SGG-SWU, Fategarh Sahib, Punjab, India, in accordance with the ICMR Ethical Guidelines for Biomedical Research on Human Subjects (2006) with reference number SGG-SWU/IEC/2025/49.

Conflicts of Interest

Nil.

Abbreviations

CNSLBP: Chronic Non- Specific Low Back Pain, DN: Dry Needling, MTrPs: Myofascial Trigger Points, ROM: Range of Motion

Data availability: The data are available from the corresponding author upon reasonable request.

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