Original Article

Effect of Slow Deep Breathing on Muscle Pain Reduction among Adults with Myalgia: A Quasi-Experimental Study

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ABSTRACT

Background: Relaxation techniques and slow deep breathing are known to activate the parasympathetic nervous system, making them an integral non-pharmacological intervention for musculoskeletal pain management. However, evidence regarding the effectiveness of slow deep breathing interventions in reducing muscle pain in adults with myalgia, particularly in primary care settings, is limited. This study aimed to examine the effect of slow deep breathing on reducing muscle pain in adults with myalgia.

Methods: This study used a quasi-experimental pre-test-post-test control group design following TREND guidelines. Total sampling was used to recruit 36 myalgia patients at the Peneleh Community Health Center, Surabaya, who were divided into an intervention group (n = 18) and a control group (n = 18). Participants aged 17–65 years with pain intensity ≥3 on the Numeric Rating Scale (NRS) were included. The intervention group received slow deep breathing exercises for 15 minutes twice daily for five days, while the control group received standard care. Muscle pain intensity measured using the NRS was the outcome variable. Data were analyzed using the Wilcoxon Signed Rank Test due to non-normal distribution and the Mann–Whitney U test, with $p < 0.05$ considered statistically significant.

Results: Muscle pain intensity in the intervention group significantly decreased from 4.33 ± 0.84 to 2.50 ± 1.15, showing a mean reduction of 1.83 points (Wilcoxon Signed Rank Test, $p < 0.001$). The control group showed no significant change (from 4.22 ± 0.81 to 4.00 ± 0.80; mean reduction = 0.22; $p = 0.102$). Posttest comparison demonstrated significantly lower pain intensity in the intervention group than in the control group (mean rank 24.67 vs 12.33; Mann–Whitney U = 51.0, $p < 0.001$).

Conclusion: Slow deep breathing for five days significantly reduced muscle pain intensity in patients with myalgia compared to standard care, suggesting it is an effective non-pharmacological intervention for pain management in primary care settings.

Keywords: Breathing Exercises; Muscle Pain; Myalgia; Nonpharmacological Therapy; Nursing Intervention.

Implications for Practice:

- Slow deep breathing significantly reduces muscle pain intensity in patients with myalgia, providing an effective non-pharmacological pain management strategy.
- The intervention is simple, safe, and feasible to implement in primary care, particularly in low- and middle-income settings with limited access to pharmacological treatments.
- Integrating slow deep breathing into routine nursing care supports clinical protocols for pain management and promotes patient self-management, enhancing adaptability across diverse healthcare contexts

Introduction

Myalgia, or muscle pain, is a prevalent musculoskeletal disorder worldwide, with a global prevalence ranging from 50–62% of the population, particularly in industrialized countries (*World Health Organization*, 2018). In Indonesia, myalgia prevalence in 2018 was 7.3%, with 3.2% reported in East Java (Kemenkes., 2018). At Puskesmas Peneleh, myalgia ranked third among the ten most common diseases, with 1,591 cases in 2023 and 372 cases in the first quarter of 2024.

Clinically, myalgia is assessed through patient history, physical examination, and sometimes diagnostic tests. Management depends on the underlying cause and may involve rest, physical therapy, pharmacological interventions (e.g., analgesics and anti-inflammatories), and addressing contributing factors to reduce muscle pain (Arovah, 2021). Chronic work-related myalgia refers specifically to persistent muscle pain due to occupational activities (Sumardiyono et al., 2017). In low- and middle-income countries (LMICs) such as Indonesia, access to pharmacological treatments may be limited, and reliance on medications dominates care, while evidence-based non-pharmacological strategies remain underutilized.

The phenomenon that researchers found at the Peneleh Community Health Center was that most of the cases of myalgia that came were repeated, such as patients with cases of myalgia who came for treatment coming back for treatment after the medication recommended by the doctor had run out.

In clinical practice at Puskesmas Peneleh, many patients with myalgia seek repeated medical visits, often returning after prescribed medications run out, highlighting the limitations of pharmacological-only management. Non-pharmacological interventions, such as Slow Deep Breathing (SDB), have shown promise in reducing pain intensity and improving overall well-being(Abdullah et al., 2023). SDB involves slow, diaphragmatic breathing, sometimes combined with pursed-lip techniques, enhancing pulmonary ventilation, increasing blood oxygenation, and stimulating the parasympathetic nervous system. Activation of parasympathetic pathways induces relaxation, decreases heart rate and blood pressure, and modulates pain perception through central autonomic regulation (Nahdliyyah et al., 2023). Slow Deep Breathing can reduce the intensity of visceral pain, but the effect is not specific to slow breathing frequency. It is not mediated by autonomic or emotional responses, suggesting other underlying mechanisms (especially distraction) (Gholamrezaei et al., 2021). SDB may also produce analgesic effects via distraction mechanisms and stress reduction. However, evidence remains limited and patient-specific response varies (Joseph et al., 2022). Alternative options outside of medical treatment, such as water compresses, gentle massage, and avoiding excessive physical activity (Yulis *Mitra* Reformasika et al., 2023). It is hoped that the Slow Deep Breathing technique can be used as an alternative non-pharmacological therapy for adults with hypertension (Mustain et al., 2023)

The gate control theory of pain provides a conceptual framework for understanding SDB's potential effect on myalgia. Slow deep breathing may activate large-diameter afferent fibers, inhibiting nociceptive signal transmission at the spinal cord level, while modulation of autonomic and emotional responses further reduces perceived pain intensity. Despite these potential benefits, non-pharmacological interventions such as SDB are rarely implemented in primary care settings in LMICs, where healthcare protocols remain predominantly pharmacological.

Given this research gap, this study aims to evaluate the effect of slow deep breathing on muscle pain intensity in adult patients with myalgia at Puskesmas Peneleh, Surabaya, with the following objectives: to determine the effect of SDB on pain intensity (NRS) in patients with myalgia, compare pain intensity between intervention and control groups following SDB therapy, and explore the feasibility of integrating SDB as a non-pharmacological intervention in primary care settings, particularly in LMICs. This study is expected to inform evidence-based nursing practice and policy, offering a safe, cost-effective, and adaptable pain management strategy for adult patients with myalgia.

Methods

Study Design

A quasi-experimental design was chosen to compare the effects of Slow Deep Breathing (SDB) on muscle pain intensity between the intervention and control groups while maintaining internal validity through pre- and post-intervention measurements. This study was conducted in accordance with the Transparent Reporting of Evaluations with Non-Randomized Designs (TREND) statement (Haynes et al., n.d., 2021) to ensure reporting of non-randomized interventions.

Participants

The study population comprised all adult patients with myalgia attending Puskesmas Peneleh, Kelurahan Peneleh, Kecamatan Genteng, Surabaya, East Java Province during the study period. Total sampling, a non-probability sampling technique, was employed to recruit participants who met the following inclusion criteria:

Age 17–65 years, Pain intensity ≥3 on the Numerical Rating Scale (NRS), Willing to participate and provide informed consent, Not taking analgesic or anti-inflammatory medications during the study. Exclusion criteria were: Declining to participate or withdrawing from the study, Presence of severe comorbid conditions or complications that could interfere with the intervention. A total of 36 participants were included: 18 in the intervention group and 18 in the control group. No participants withdrew during the study. The sample size was justified based on the total sampling of the available population who met the criteria within the study period, ensuring sufficient power to detect a clinically meaningful difference in NRS scores between groups. The recruitment process involved screening all patients attending Puskesmas Peneleh for myalgia, confirming eligibility based on inclusion/exclusion criteria, and obtaining informed consent before allocation to either the intervention or control group.

Instruments

Assessment using observation sheets and research instruments using Numerical Pain Rating Scales. Validity and reliability tests of the NRS were not carried out because they used standard instruments. Data collection was conducted after obtaining a permit and approval from the Peneleh Community Health Center, Genteng District, Surabaya City, and submitting an ethical review request to the Research Ethics Committee (KEPK) of Hang Tuah Health College, Surabaya. The phenomenon that researchers found at the Peneleh Community Health Center was obtained mostly from visiting myalgia cases, often coming back repeatedly, such as patients with myalgia cases who came for treatment, coming back for treatment after the doctor's recommended medication ran out. Respondents were given an intervention in the form of slow breathing therapy with a frequency of 1 time a day for 15 minutes per session for 5 consecutive days, so that each respondent received a total of 5

intervention sessions. Therapy was carried out in a comfortable position (semi-supine or sitting) according to the respondent's condition, by following the stages of breathing techniques according to the research protocol. Pain intensity was measured using the Numerical Pain Rating Scale (NRS) before the intervention (pre-test) and after the intervention (post-test). NRS is a subjective pain assessment instrument with a range of 0–10, where 0 indicates no pain, and 10 indicates very severe pain (**Figure 1**).

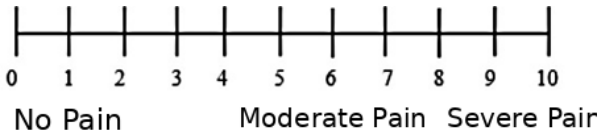

Figure 1. Pain Rating Scale

Intervention

Slow breathing relaxation is a technique that involves slow and deep diaphragmatic breathing combined with pursed-lip breathing. This method can improve lung ventilation and increase blood oxygen levels, thereby helping to reduce pain intensity and enhance overall well-being (Abdullah et al., 2023). Slow Deep Breathing (SDB) therapy is a relaxation technique aimed at reducing stress and improving both physical and psychological well-being. The technique emphasizes slow, controlled breathing that focuses on diaphragmatic movement to optimize oxygen exchange. Physiologically, Slow Deep Breathing stimulates the parasympathetic nervous system, which produces the body's relaxation response. This response helps reduce heart rate and blood pressure, improve oxygen circulation, and generate a calming effect (Nahdliyyah et al., 2023).

In this study, respondents were divided into two groups: a control group and an intervention group. The control group did not receive Slow Deep Breathing relaxation therapy and only completed the post-test assessment using a pain scale form and observation sheet. Meanwhile, respondents in the intervention group first completed a pre-test using the same pain scale form and observation sheet. Afterward, they received Slow Deep Breathing therapy through a direct tutorial and leaflet-based educational media delivered by the researchers and research assistants.

During the intervention, respondents were instructed to assume a semi-supine position, either lying on a bed or sitting comfortably on a chair. One hand was placed on the abdomen (above the stomach area) and the other hand on the chest to help participants feel the movement of the chest and abdomen during breathing. Participants were then guided to inhale slowly through the nose for approximately 3 seconds until the chest and abdomen expanded maximally. The breath was held for approximately 2 seconds while keeping the mouth closed. Afterward, respondents slowly exhaled through the mouth with slightly pursed lips while gently tightening the abdominal muscles for approximately 6 seconds. Each breathing cycle was repeated for 1 minute with a 2-second pause between repetitions and a 2-minute rest period. The breathing frequency was maintained at fewer than 10 breaths per minute in each session. The intervention was conducted once daily for 5 consecutive days, with each session lasting approximately 15 minutes. After the intervention period, a post-test was administered using the same pain scale form and observation sheet.

Throughout the intervention period, respondent safety was carefully monitored. Participants were instructed to immediately report any discomfort, such as dizziness, shortness of breath, fatigue, or other symptoms that occurred during or after the breathing exercise. Researchers also periodically observed the physical

condition of respondents throughout the intervention sessions.

The Slow Deep Breathing procedure implemented in this study consisted of the following steps. First, respondents were asked to relax and remain calm while maintaining a comfortable body position, either sitting or lying down. Second, participants were instructed to place one hand on the abdomen and the other hand on the chest, with the knees flexed and the eyes closed. Third, respondents were asked to begin inhaling slowly and deeply through the nose so that air gradually entered the lungs. During this process, participants were instructed to feel the abdomen expand while minimizing chest movement. The inhalation phase was performed while mentally counting 1..2..3..4..5..6, while silently saying a short phrase such as "I." After inhalation, respondents held their breath for approximately 3 seconds.

Fourth, respondents were instructed to slowly exhale through the mouth using pursed-lip breathing, as if gently whistling but without producing sound. The exhalation phase was also performed while mentally counting 1..2..3..4..5..6, while silently repeating a calming phrase such as "relax" or "calm." Forceful exhalation was avoided to prevent airway turbulence or bronchospasm. During exhalation, respondents were encouraged to feel the abdomen flatten as the lungs gradually emptied of air. Finally, participants were asked to repeat the breathing cycle by inhaling more deeply and slowly while focusing on achieving a relaxed body condition. The entire procedure was performed for approximately 15 minutes.

Data Collection

Data collection was conducted at the Peneleh Community Health Center in Surabaya after the researcher obtained institutional permission and ethical approval. Respondents were recruited sequentially according to the inclusion criteria. After the respondents provided informed consent, initial data collection was conducted, including respondent characteristics and initial pain measurement using the Numerical Rating Pain Scale (NRS). The data collection process was standardized, including: Providing an explanation of the study and obtaining informed consent, measuring pain before the intervention (pre-test), providing a slow deep breath intervention according to the protocol, measuring pain after the intervention (post-test), and recording and data entry. All data were recorded using a structured observation sheet prepared by the researcher. Before the study, enumerators received structured learning that included: Understanding the objectives and procedures of the study, a standardized method of using and delivering NRS instruments, Intervention implementation procedures, Research ethics and data confidentiality, and procedures for filling out observation sheets. To ensure data quality, researchers implemented several quality control measures, namely: Using the same instruments and procedures for all respondents, checking the completeness of the data every day after data collection, rechecking the observation sheets and the data that has been entered, and conducting immediate clarification if incomplete or inconsistent data is found. All observation sheets are stored in a closed folder and can only be accessed by researchers. Respondent identities are replaced with codes to maintain data confidentiality. Data completeness is monitored during the data collection process. If there is incomplete data, researchers immediately ask respondents to complete it. With this procedure, there is no missing data in the final research data, so there is no need for data imputation techniques.

Data Analysis

Data were analyzed using SPSS. Normality testing with the Kolmogorov-Smirnov test indicated a non-normal distribution; therefore, non-parametric statistics were applied. Differences in pain intensity within groups (pre-post) were analyzed using the Wilcoxon Signed Rank Test, while post-test differences between groups were examined using the Mann-Whitney U test.

Ethical Considerations

All research procedures in this study were approved by the Ethics Committee of STIKes Hang Tuah Surabaya with approval number B/052.RPL.2/VIII/2025/KEP/SHT.

Results

The demographic characteristics of the participants are presented in Table 1. Most respondents in both groups were adults aged 19–59 years, accounting for 66.7% of the intervention group and 72.2% of the control group. Participants aged ≥60 years constituted 33.3% of the intervention group and 27.8% of the control group. No participants were classified as teenagers (10–18 years) in either group.

In terms of sex distribution, females predominated in both groups, representing 77.8% of the intervention group and 72.2% of the control group. Regarding educational level, the largest proportion of respondents had completed college education (44.4% in the intervention group and 33.3% in the control group), followed by high school education in both groups. Physical activity patterns varied among participants. The most frequently reported activities were sweeping (18.8% in the intervention group and 15.7% in the control group), typing, and lifting. Overall, the distribution of demographic and activity-related characteristics appeared comparable between the intervention and control groups, indicating baseline similarity **(Table 1).**

Table 1. Characteristics of Respondents Before and After Intervention (n=18)

Variable	Category	Intervention (n = 18) n (%)	Control (n = 18) n (%)
Age group (years)	Teenagers (10–18)	0	0
	Adults (19–59)	12 (66.7%)	13 (72.2%)
	≥ 60	6 (33.3%)	5 (27.8%)
Sex	Male	4 (22.2)	5 (27.8%)
	Female	14 (77.8%)	13 (72.2%)
Education level	Elementary school	5 (27.8%)	4 (22.2%)
	Middle school	0	1 (5.5%)
	High school	5 (27.8%)	7 (38.9%)
	College	8 (44.4%)	6 (33.3%)
Physical activity	Typing	7 (13.2%)	10 (17.5%)
	Lifting	6 (11.3%)	8 (14.0%)
	Sweeping	10 (18.8%)	9 (15.7%)
	Other activities	6 (11.3%)	5 (8.7%)

Table 2 illustrates that A total of 36 participants were included in the study, with 18 participants assigned to the intervention group and 18 participants to the control group. Baseline sociodemographic and clinical characteristics were comparable between groups, with no statistically significant differences observed ($p > 0.05$), indicating homogeneity at baseline. Post-intervention analysis demonstrated a significantly greater reduction in pain intensity in the

intervention group compared with the control group. The Mann–Whitney U test showed a mean rank of 24.67 for the intervention group and 12.33 for the control group, indicating superior pain reduction in the intervention group. The between-group difference was statistically significant ($p < 0.001$).

Table 2. Clinical Characteristics of Muscle Pain among Participants by Study Group

Variable	Category	Intervention (n = 18) n (%)	Control (n = 18) n (%)
Provoking factors (pain when)	Sitting	13 (54.2%)	9 (42.9%)
	Standing	7 (29.2%)	2 (9.5%)
	Walking	2 (8.3%)	1 (4.8%)
	Quiet	0 (0.0%)	4 (19.0%)
	All the time	2 (8.3%)	2 (9.5%)
	Other activities	0	0
Pain quality	Throbbing	7 (36.8%)	8 (44.4%)
	Stabbing	3 (15.8%)	1 (5.6%)
	Cramping	4 (21.1%)	4 (22.2%)
	Burning	1 (5.3%)	1 (5.6%)
	Pressure	2 (10.5%)	1 (5.6%)
	Other (aching/stiffness)	1 (5.3%)	3 (16.7%)
Pain region	Neck	3 (11.1%)	4 (14.8%)
	Shoulder (right/left)	8 (29.6%)	8 (29.6%)
	Back	12 (44.4%)	8 (29.6%)
	Arm	1 (3.7%)	0 (0.0%)
	Lower extremity	0 (0.0%)	1 (3.7%)
Pain severity (NRS)	Scale 3	4 (22.2%)	4 (22.2%)
	Scale 4	4 (22.2%)	6 (33.3%)
	Scala 5	10 (55.6%)	8 (44.4%)
Medical history	Hypertension	3 (46.15%)	5 (30.77%)
	Diabetes mellitus	2 (30.77%)	2 (23.07%)
	Rheumatic disease	1 (7.69%)	1 (7.69%)
	Other conditions	2 (15.38%)	0 (0%)

Table 3 shows the comparison between groups, indicating a significant difference in pain scores after the intervention. The Mann–Whitney test results revealed that the intervention group had a higher mean rank (24.67) compared to the control group (12.33), indicating lower pain intensity in the intervention group. This difference was statistically significant ($U = 51.0$; $Z = -3.620$; $p < 0.001$). The effect size value of $r = 0.60$ indicates a large clinical effect of the intervention in reducing muscle pain.

Table 3: Effect of Slow Deep Breathing on Muscle Pain Scores in Intervention and Control Groups

Group	Time of Measurement	Mean ± SD	Median (Min–Max)	Statistical Test	p-value
Intervention (n = 18)	Before intervention	4.33 ± 0.84	4 (3 – 6)	Wilcoxon Signed-Rank Test	P<0.001
	After intervention	2.50 ± 1.15	2 (1 – 5)		
Control (n = 18)	Before intervention	4.22 ± 0.81	4 (3 – 6)	Wilcoxon Signed-Rank Test	P=0.102
	After intervention	4.00 ± 0.80	4 (3 – 6)		
Between-group comparison	Post-intervention	Mean Rank: 24.67 vs 12.33		Mann–Whitney U Test	P<0.001

Discussion

This quasi-experimental study demonstrated that the Slow Deep Breathing (SDB) relaxation technique significantly reduced muscle pain intensity among patients with myalgia. Within-group analysis showed a significant reduction in pain scores in the intervention group, whereas no significant change was observed in the control group. Between-group comparison further confirmed that SDB produced a statistically and clinically meaningful reduction in pain, with a large effect size. These findings support the hypothesis that SDB is an effective non-pharmacological intervention for muscle pain management. consistent with previous studies on breathing-based relaxation interventions and pain modulation (Zaccaro, Piarulli, Laurino, Garbella, Menicucci, 2018).

The analgesic effect of SDB may be explained through physiological and neurocognitive mechanisms. Slow deep breathing stimulates the parasympathetic nervous system via vagal activation, leading to reduced sympathetic activity, muscle relaxation, and improved peripheral circulation(Ravinder Jerath, Connor Beveridge, 2018). This autonomic regulation enhances oxygen delivery to ischemic muscle tissues and reduces muscle spasm, which contributes to pain reduction.

In addition, SDB may influence pain perception through central mechanisms, such as distraction, cognitive relaxation, and modulation of pain processing pathways, consistent with the gate control theory of pain (Melzack, R., & Wall, 1965). Increased baroreflex sensitivity during slow breathing has also been reported to attenuate sympathetic responses and improve cardiovascular and respiratory function, which may further reduce pain-related stress and discomfort (Lehrer, P., & Gevirtz, n.d, 2014).

The present findings are consistent with previous studies reporting the effectiveness of deep breathing relaxation techniques in reducing pain intensity. Prior research demonstrated that deep breathing significantly reduced postoperative pain among fracture patients and decreased pain intensity following general anesthesia (Wahyuningsih et al., 2020). Similar effects have been observed in musculoskeletal pain populations, where relaxation techniques improved comfort and reduced muscle tension (Cahyani et al., 2022). In line with previous research, the slow deep breathing technique is believed to reduce pain intensity through a mechanism by relaxing skeletal muscles experiencing spasms

caused by increased prostaglandins, resulting in vasodilation of blood vessels, increasing blood flow to areas experiencing spasm and ischemia (Delyka et al., 2022). Before receiving deep breathing relaxation technique intervention, most patients reported moderate pain levels. However, after administering deep breathing relaxation techniques, there was a significant decrease in pain levels. In line with research from(Rini, 2019).

Furthermore, qualitative findings from previous studies reported that participants felt relaxed, calm, and experienced reduced anxiety and muscle tension following breathing interventions, supporting the role of SDB in both physiological and psychological pain modulation.

Implications and limitations

The results of this study have important implications for nursing practice, particularly in primary healthcare and low- and middle-income country (LMIC) settings, where access to pharmacological pain management may be limited. Slow Deep Breathing is a low-cost, safe, and easily teachable intervention that can be integrated into routine nursing care protocols for patients with myalgia.

Nurses can incorporate SDB into patient education programs and pain management guidelines to complement pharmacological therapy, potentially reducing medication dependence and adverse drug effects. Policymakers and healthcare administrators should consider integrating SDB into standard clinical practice guidelines for musculoskeletal pain management.

Relevance to Practice

This study demonstrates that Slow Deep Breathing (SDB) is an effective, low-cost, and easily implemented non-pharmacological intervention for reducing muscle pain. Nurses in primary care settings should incorporate SDB as part of routine pain management. Nursing education programs should include SDB training to enhance clinical competencies in non-pharmacological pain control. Healthcare institutions are encouraged to develop standardized protocols and training programs for SDB implementation. Policymakers should consider integrating SDB into national pain management guidelines, particularly in low- and middle-income countries, to support accessible and cost-effective pain management strategies.

Conclusion

This study demonstrates that Slow Deep Breathing (SDB) relaxation therapy significantly reduces muscle pain among patients with myalgia, supporting its effectiveness as a simple and low-cost non-pharmacological pain management intervention. Given its clinical feasibility and minimal resource requirements, SDB can be incorporated into routine nursing practice in primary healthcare settings. Future research should involve larger randomized controlled trials with longer follow-up periods to confirm the effectiveness and sustainability of SDB in diverse clinical populations.

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CrediT Authorship Contributions Statement

Sri Anik Rustini and Taukhid: Conceptualization, Methodology, Supervision, Writing - Original Draft

Uswatun Hasanah: Investigation, Resources, Data Curation, Project Administration, Writing - Original Draft

Merina Widyastuti and Ninik Ambar Sari: Writing - Original Draft, Review & Editing, Visualization

Conflicts of Interest

There is no conflict of interest.

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