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The Effect of A Combination of Progressive Muscle Relaxation and Deep Breathing Techniques on Anxiety Levels in Preoperative Patients Under Spinal Anesthesia

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Abstract

Preoperative anxiety is common before surgery and may become more pronounced during spinal anesthesia because consciousness is maintained. Uncontrolled anxiety may affect physiological stability and readiness. This study aimed to analyze the effect of combining Progressive Muscle Relaxation (PMR) and Deep Breathing on anxiety levels among patients undergoing spinal anesthesia. A quasi-experimental pretest-posttest control group design included 44 patients at Permata Medika Hospital, with 22 respondents per group. The intervention group received combined PMR and Deep Breathing, whereas the control group received Deep Breathing alone. Anxiety levels were assessed before and after intervention and analyzed according to data distribution. Before intervention, both groups had identical anxiety distributions, with 68.18% experiencing severe anxiety and 31.82% experiencing panic. After intervention, the intervention group showed 45.45% mild and 54.55% moderate anxiety, while the control group showed 4.54% mild, 63.64% moderate, and 31.82% severe anxiety. Within-group analyses showed significant reductions in anxiety in both groups ($p = 0.000$). Between-group analysis demonstrated a significant posttest difference ($p = 0.000$), with a mean difference of 4.73 points. The combination of PMR and Deep Breathing was more effective than Deep Breathing alone and may be considered a simple non-pharmacological intervention for reducing preoperative anxiety among patients undergoing spinal anesthesia.

Keywords: Anxiety, Deep Breathing, Preoperative, Progressive Muscle Relaxation, Spinal Anesthesia.



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INTRODUCTION

The preoperative period begins when the decision to undergo surgery is established and continues until the patient enters the operating room for anesthesia or surgical intervention, making this phase a critical period in which physical preparation must be accompanied by adequate psychological preparation. Contemporary perioperative care increasingly recognizes psychological readiness as an integral component of safe surgical practice because patients are required not only to meet physiological criteria but also to manage uncertainty, fear, and expectations surrounding the forthcoming procedure (World Health Organization, 2020). Preoperative education has consequently developed beyond the delivery of procedural information toward approaches that support patients' psychological readiness and facilitate more adaptive responses to surgery (Fatmawati & Pawestri, 2021). Patients undergoing spinal anesthesia represent a particularly important population because consciousness is generally maintained throughout the surgical procedure, potentially exposing patients to unfamiliar sounds, sensations, and thoughts about the operation while they remain aware of their surroundings. Evidence indicates that anxiety may be more pronounced among patients receiving spinal anesthesia than among those receiving general anesthesia, with differences also observed in hemodynamic responses, suggesting that the psychological burden associated with remaining conscious during surgery warrants specific attention (Rakasiwi et al., 2023). Spinal anesthesia itself has become an established component of contemporary perioperative practice for a range of surgical procedures, particularly when regional anesthesia provides clinical advantages while avoiding the physiological consequences associated with general anesthesia. The psychological dimension of spinal anesthesia therefore represents an important intersection between anesthetic management and nursing care, particularly during the period immediately preceding surgery when anxiety may intensify.

Preoperative anxiety is not merely an emotional reaction but a multidimensional psychophysiological response involving cognitive apprehension, muscular tension, autonomic activation, and heightened anticipation of potential harm, all of which can interfere with the patient's ability to respond adaptively to the surgical situation. A substantial body of literature has demonstrated that anxiety is common among surgical patients and may influence physiological stability as well as subsequent recovery trajectories, making its management an important component of perioperative quality of care (Shebl et al., 2025). Earlier evidence has also linked preoperative anxiety with physiological changes associated with sympathetic activation, including alterations in cardiovascular and respiratory parameters, which may become particularly relevant when patients are exposed to the additional psychological demands of remaining conscious during spinal anesthesia (Orbach-Zinger et al., 2012). The clinical significance of this response extends beyond subjective discomfort because uncontrolled anxiety can contribute to hemodynamic instability, increased analgesic or anesthetic requirements, greater postoperative pain, delayed recovery, and prolonged hospitalization. These consequences indicate that anxiety management should be positioned as part of preventive perioperative care rather than treated only after psychological distress becomes pronounced. Nonpharmacological interventions have attracted increasing attention because they can be implemented by nurses, require limited resources, and may complement routine preoperative education without introducing additional pharmacological exposure. Progressive muscle relaxation has demonstrated potential for reducing anxiety among preoperative patients, while also supporting physiological relaxation through systematic contraction and release of major muscle groups (Casman et al., 2022). Evidence from surgical populations further indicates that progressive muscle relaxation can be beneficial when incorporated into perioperative care, although variations in surgical characteristics, timing, intervention protocols, and outcome assessment remain evident across studies (Hasanpour-Dehkordi et al., 2019).

Deep breathing constitutes another accessible relaxation strategy that targets respiratory regulation and autonomic balance through slow, controlled, and deeper breathing patterns. Physiological explanations suggest that diaphragmatic and slow breathing may influence autonomic regulation, reduce physiological arousal, and promote a state of relaxation that can be particularly relevant when anxiety is accompanied by rapid breathing and heightened bodily tension (Hamasaki, 2020). Clinical studies involving preoperative patients have reported significant reductions in anxiety following deep-breathing interventions, supporting its feasibility as a simple nursing intervention before surgery (Hamarno et al., 2024). Similar findings have been reported specifically among patients undergoing spinal anesthesia, indicating that respiratory relaxation may address anxiety within the distinctive psychological context of regional anesthesia in which patients remain conscious during the procedure (Rakasiwi et al., 2023). Slow deep breathing has also been associated with reduced anxiety in patients preparing for surgery, reinforcing the plausibility of respiratory regulation as a component of preoperative psychological care (Wulandari et al., 2017). Despite these findings, the existing evidence largely evaluates progressive muscle relaxation or breathing exercises as independent interventions, while differences in patient characteristics and surgical contexts make it difficult to determine whether either technique alone is sufficient for patients experiencing heightened anxiety before spinal anesthesia. The growing interest in multimodal nonpharmacological interventions consequently raises a clinically relevant question concerning whether combining interventions that target muscular tension and respiratory-autonomic regulation can provide a more comprehensive approach to preoperative anxiety management.

The conceptual rationale for combining Progressive Muscle Relaxation (PMR) and Deep Breathing lies in their potentially complementary physiological and psychological pathways, because PMR primarily addresses somatic tension through sequential muscle contraction and relaxation whereas controlled breathing directly regulates respiratory patterns and may facilitate autonomic relaxation. Research involving preoperative patients has consistently supported PMR as a promising intervention, including studies reporting significant reductions in anxiety following its application before surgery (Rihiantoro et al., 2018). More recent evidence has extended this finding to patients undergoing general anesthesia and to other surgical populations, although the magnitude and applicability of the effect may depend on intervention procedures, timing, and patient characteristics (Arvela et al., 2025). Deep-breathing interventions have similarly produced favorable outcomes, including among patients undergoing Caesarean procedures and other forms of surgery, indicating that controlled respiration can function as an independent strategy for reducing preoperative psychological distress (Utami et al.,

2026). However, the literature remains characterized by methodological heterogeneity, with studies differing in relaxation protocols, duration, frequency, anesthesia type, surgical procedure, measurement instruments, and timing of assessment, limiting direct comparison between findings. Evidence concerning combined interventions remains comparatively limited, although a recent study involving PMR and slow deep breathing reported a significant reduction in anxiety among patients undergoing surgery for breast cancer, providing preliminary support for the synergistic potential of the two techniques (Zhakia et al., 2025). Other combination-based approaches, such as deep-breathing relaxation integrated with classical music, have also demonstrated benefits among patients receiving spinal anesthesia, yet these findings do not establish whether the combination of PMR and deep breathing itself produces a clinically meaningful effect in this population (Karangan et al., 2024).

The unresolved issue is therefore not whether relaxation techniques can reduce anxiety in surgical patients, but whether a structured combination of muscular and respiratory relaxation can provide an appropriately targeted intervention for patients facing the distinctive psychological demands of spinal anesthesia. Existing studies provide useful evidence for PMR and deep breathing individually, while studies examining combined techniques remain relatively scarce and frequently involve specific surgical groups, making the transferability of their findings to broader preoperative spinal-anesthesia populations uncertain. Research on PMR has also been conducted across different clinical populations, including Caesarean-section patients and patients with chronic illnesses, but these contexts cannot automatically be equated with the psychological conditions experienced immediately before surgery under spinal anesthesia (Natosba et al., 2020). Likewise, evidence from interventions combining PMR with other relaxation modalities demonstrates the potential value of multimodal strategies but does not fully clarify the independent contribution of PMR combined specifically with deep breathing (Widiyawati et al., 2024). This empirical gap is clinically important because anxiety immediately before spinal anesthesia may involve simultaneous cognitive anticipation, muscular tension, altered respiratory patterns, and fear associated with remaining conscious during surgery, suggesting that an intervention addressing only one physiological pathway may not adequately capture the complexity of the response. The present research is positioned within this gap by examining PMR and Deep Breathing as a deliberately integrated nonpharmacological intervention rather than treating them as unrelated relaxation techniques. Such positioning is consistent with contemporary nursing care that emphasizes accessible, patient-centered, low-risk interventions capable of being incorporated into routine preoperative preparation.

Against this background, the present study aims to analyze the effect of a combination of Progressive Muscle Relaxation and Deep Breathing techniques on anxiety levels among preoperative patients undergoing spinal anesthesia. The study is designed to address the empirical limitation concerning combined relaxation strategies within a patient population for whom consciousness during surgery may constitute an important source of psychological distress. Its theoretical contribution lies in strengthening the understanding of preoperative anxiety management through an integrated relaxation framework that simultaneously considers muscular tension and respiratory regulation rather than examining these mechanisms in isolation. Its practical contribution lies in providing evidence for a feasible nursing intervention that can potentially be incorporated into routine preoperative care without relying exclusively on pharmacological approaches. The study also contributes methodologically by evaluating a clearly structured combination of two established relaxation techniques within the specific context of spinal anesthesia, thereby providing a more focused basis for interpreting intervention effects in this clinical setting. Ultimately, the findings are expected to clarify whether integrating PMR and Deep Breathing offers a meaningful approach to reducing preoperative anxiety and to provide an evidence-based foundation for strengthening psychological preparation before surgical intervention.

RESEARCH METHODS

This study employed a quantitative approach with a quasi-experimental design using a pretest-posttest control group design to examine the effect of a combination of Progressive Muscle Relaxation (PMR) and Deep Breathing techniques on anxiety levels among preoperative patients undergoing spinal anesthesia. The study population comprised 49 preoperative patients receiving spinal anesthesia at Permata Medika Hospital during May–June 2026, from which 44 respondents were selected using the Slovin formula and subsequently allocated equally into an intervention group of 22 patients and a control group of 22 patients. The sample selection was based on predetermined inclusion criteria,

namely patients scheduled for surgery under spinal anesthesia, patients who were able to communicate effectively and complete the research instruments, and patients who agreed to participate in the study, while patients with conditions that could interfere with the relaxation intervention or data collection were excluded. The selection of participants was also designed to maintain comparability between groups because differences in clinical characteristics may influence preoperative anxiety independently of the intervention. Preoperative anxiety was assessed before the intervention as a baseline measurement, after which patients in the intervention group received the combined PMR and Deep Breathing techniques according to the established intervention procedure, while the control group received standard preoperative care. The use of relaxation techniques as nonpharmacological interventions is supported by previous evidence demonstrating the potential of PMR to reduce anxiety among preoperative patients (Wahyuningsih et al., 2024), while deep-breathing relaxation has also demonstrated beneficial effects on anxiety in patients preparing for surgery (Hamarno et al., 2024), providing the clinical rationale for evaluating their combination in patients undergoing spinal anesthesia.

The primary research instrument was an anxiety-level measurement instrument administered during the pretest and posttest stages to identify changes in anxiety before and after the intervention, with the same measurement procedure applied to both study groups to support comparability of outcomes. The intervention protocol consisted of systematic muscle contraction and relaxation through PMR combined with slow and controlled deep breathing, reflecting the complementary physiological mechanisms of muscular relaxation and respiratory regulation. Previous research has indicated that PMR can reduce anxiety and provide physiological relaxation among surgical patients, supporting its application as a structured component of perioperative nursing care (Hasanpour-Dehkordi et al., 2019). Deep-breathing techniques were incorporated because controlled diaphragmatic breathing may promote autonomic regulation and reduce physiological arousal associated with anxiety (Hamasaki, 2020). Data analysis was performed by comparing anxiety scores between the pretest and posttest measurements and examining differences in changes between the intervention and control groups using appropriate inferential statistical procedures after assessment of the relevant statistical assumptions, with statistical significance determined at an appropriate conventional threshold. Ethical principles of autonomy, confidentiality, informed participation, and protection from harm were maintained throughout the research, and participation was voluntary with informed consent obtained from each respondent before data collection, consistent with established principles of nursing research methodology (Nursalam, 2020).

RESULTS AND DISCUSSION

Respondent Characteristics

The study included 44 preoperative patients undergoing spinal anesthesia at Permata Medika Hospital, with 22 respondents assigned to the control group and 22 to the intervention group. The distribution of respondents was examined according to age, gender, and educational level to describe the baseline characteristics of the sample and assess the comparability of the two groups. Age is relevant because physiological responses to surgical stress and individual coping capacity may vary across different stages of adulthood. As presented in Table 1, the respondents had an overall age range of 22–61 years, with a mean age of 40.30 years and a standard deviation of 10.514. The control group had a mean age of 40.73 years, while the intervention group had a slightly lower mean age of 39.86 years, indicating only a small difference between the groups. The relatively comparable age distribution provides an appropriate baseline for interpreting subsequent differences in anxiety levels because age-related variation was not markedly concentrated in one treatment group.

Table 1. Mean Age of Preoperative Patients Undergoing Spinal Anesthesia at Permata Medika Hospital

Age	N	Min	Max	Mean	Standard Deviation
Control	22	27	57	40.73	9.622
Intervention	22	22	61	39.86	11.548
Total	44	22	61	40.30	10.514

The gender distribution showed a relatively balanced composition between male and female respondents, although women represented a slightly larger proportion of the total sample. Table 2 shows that 24 respondents (54.5%) were female and 20 respondents (45.5%) were male, while the intervention group had an exactly equal distribution of 11 male and 11 female respondents. In the control group, women accounted for 59.1% of respondents, compared with 40.9% men, producing a modest difference from the intervention group. Gender may be relevant to preoperative anxiety because psychological responses to perceived surgical threats can differ according to individual emotional processing, previous experiences, and perceived vulnerability. Previous evidence has identified demographic and psychological characteristics as factors that may contribute to variation in preoperative anxiety, although gender alone should not be interpreted as a determinant of anxiety without considering other patient-level factors (Stuart, 2023). The relatively similar gender composition across the two groups reduces concern that the observed post-intervention differences were primarily attributable to an extreme imbalance in gender distribution.

Table 2. Distribution of Gender Among Preoperative Patients Undergoing Spinal Anesthesia at Permata Medika Hospital

Gender	Control n (%)	Intervention n (%)	Total n (%)
Male	9 (40.9%)	11 (50%)	20 (45.5%)
Female	13 (59.1%)	11 (50%)	24 (54.5%)
Total	22 (100%)	22 (100%)	44 (100%)

Educational level constituted another baseline characteristic that may influence how patients understand surgical procedures, anesthesia information, and instructions concerning relaxation techniques. As shown in Table 3, senior high school was the most common educational category, comprising 18 respondents (40.9%), whereas elementary school represented the smallest category with 5 respondents (11.4%). In the control group, 10 respondents (45.5%) had completed senior high school, followed by elementary school with 4 respondents (18.2%), junior high school and diploma education with 3 respondents each (13.6%), and bachelor-level education with 2 respondents (9.1%). The intervention group consisted of 8 respondents (36.4%) with senior high school education, 5 respondents (22.7%) with junior high school education, 4 respondents each (18.2%) with diploma and bachelor-level education, and 1 respondent (4.5%) with elementary school education. Differences in educational background may affect the way patients interpret information and manage uncertainty, yet the distribution in this sample remained sufficiently varied across both groups to permit interpretation of the intervention within the observed clinical context (Nursalam, 2020). Patient education and communication therefore remain important components of perioperative nursing because adequate understanding may support psychological preparation alongside relaxation-based interventions.

Table 3. Distribution of Educational Level Among Preoperative Patients Undergoing Spinal Anesthesia at Permata Medika Hospital

Education	Control n (%)	Intervention n (%)	Total n (%)
Elementary School	4 (18.2%)	1 (4.5%)	5 (11.4%)
Junior High School	3 (13.6%)	5 (22.7%)	8 (18.2%)
Senior High School	10 (45.5%)	8 (36.4%)	18 (40.9%)
Diploma	3 (13.6%)	4 (18.2%)	7 (15.9%)
Bachelor	2 (9.1%)	4 (18.2%)	6 (13.6%)
Total	22 (100%)	22 (100%)	44 (100%)

Taken together, the baseline characteristics indicate that the two groups had broadly comparable demographic profiles, particularly in terms of mean age and gender composition. The mean age difference between the control and intervention groups was only 0.87 years, while the gender distribution in the intervention group was evenly divided and the control group showed only a modest

predominance of women. Educational distribution also showed the same dominant category, namely senior high school, in both groups. Such comparability is important in a quasi-experimental study because marked baseline differences may introduce alternative explanations for changes in anxiety scores. The baseline equivalence observed descriptively is further supported by the pretest anxiety means, which were 23.64 in the control group and 23.50 in the intervention group. The very small difference of 0.14 points indicates that the groups entered the intervention phase with highly similar average anxiety scores, strengthening the basis for evaluating the subsequent effect of the different relaxation approaches.

From a perioperative nursing perspective, the characteristics of the respondents also illustrate the heterogeneous nature of patients approaching surgery under spinal anesthesia. Patients in adulthood may experience uncertainty related to the surgical procedure, anesthesia, anticipated pain, possible complications, and postoperative recovery, with these concerns potentially expressed through psychological and physiological manifestations of anxiety (Stuart, 2023). Spinal anesthesia may further shape the patient's perioperative experience because sensory blockade occurs while consciousness is generally maintained, meaning that some patients may remain aware of environmental stimuli associated with the operating room. Preoperative anxiety is clinically relevant because heightened psychological stress can be accompanied by physiological activation that may complicate perioperative management, including changes in cardiovascular and respiratory responses (Orbach-Zinger et al., 2012). The importance of managing this condition is also supported by evidence showing that preoperative anxiety is associated with less favorable perioperative experiences and may influence surgical outcomes (Shebl et al., 2025). Nonpharmacological relaxation strategies therefore have potential value as supportive nursing interventions that can be integrated into preoperative preparation without replacing standard clinical management (WHO, 2020). Within the present sample, the comparable demographic profile and nearly identical baseline anxiety means provide a reasonable foundation for examining whether the addition of Progressive Muscle Relaxation to Deep Breathing produces a greater reduction in anxiety than Deep Breathing alone.

The baseline profile also has implications for interpreting the intervention as a nursing-based rather than purely pharmacological approach to anxiety management. Deep Breathing can be taught relatively easily across different educational backgrounds, while PMR requires patients to recognize and intentionally release muscular tension through a structured sequence of contraction and relaxation. Evidence indicates that progressive muscle relaxation can reduce anxiety among surgical patients by targeting physical manifestations of psychological tension (Hasanpour-Dehkordi et al., 2019). Deep-breathing interventions similarly provide a physiological pathway for relaxation through controlled respiratory patterns and autonomic regulation (Hamasaki, 2020). The combination may therefore be particularly relevant for preoperative patients because it addresses both muscular tension and respiratory arousal rather than focusing on only one physiological pathway. Previous studies have reported beneficial effects of relaxation techniques among preoperative patients, including deep breathing and combined relaxation approaches (Yudanari et al., 2026). The following analysis consequently focuses on whether the initially comparable groups demonstrate different patterns of anxiety reduction after receiving their respective interventions.

Preoperative Anxiety Levels Before and After Intervention

Preoperative anxiety is a common psychological response that may arise from uncertainty about the surgical procedure, anesthesia, postoperative conditions, and perceived threats to physical safety (Stuart, 2023). In the present study, the pretest distribution showed that anxiety was relatively high in both groups before the intervention, indicating a comparable psychological condition at the initial assessment. In the control group, 15 respondents (68.18%) experienced severe anxiety, while the remaining 7 respondents (31.82%) were categorized as experiencing panic. The predominance of severe anxiety is consistent with evidence that patients approaching surgery may experience substantial psychological distress because of concerns regarding anesthesia, surgical outcomes, and loss of control (Shebl et al., 2025). Similar anxiety patterns have also been reported among patients undergoing spinal anesthesia, where preoperative apprehension can be associated with physiological responses during the perioperative period (Orbach-Zinger et al., 2012). These findings indicate that elevated anxiety was a relevant condition among the respondents before the intervention and required an appropriate non-pharmacological approach.

Table 4. Preoperative Anxiety Levels in the Control Group Before Intervention

Anxiety Level	Frequency (n)	Percentage (%)
Mild	0	0
Moderate	0	0
Severe	15	68.18
Panic	7	31.82
Total	22	100

The control group demonstrated a substantial shift in anxiety classification following the administration of deep breathing, although a proportion of respondents continued to experience severe anxiety. As presented in Table 5, the posttest results showed that 14 respondents (63.64%) were categorized as moderately anxious, 7 respondents (31.82%) remained in the severe category, and 1 respondent (4.54%) reached the mild anxiety category. The reduction from severe and panic categories toward moderate and mild anxiety suggests that controlled breathing may help patients regulate psychological tension during the preoperative period (Hamarno et al., 2024). Deep breathing can promote slower respiratory patterns and physiological relaxation, which may contribute to reduced autonomic arousal associated with anxiety (Hamasaki, 2020). Previous findings involving patients receiving spinal anesthesia have likewise demonstrated that deep-breathing relaxation can reduce preoperative anxiety levels (Rakasiwi et al., 2023). The persistence of severe anxiety in seven respondents also suggests that deep breathing alone may produce a beneficial response without necessarily eliminating anxiety among patients with initially high levels of distress.

Table 5. Preoperative Anxiety Levels in the Control Group After Deep Breathing

Anxiety Level	Frequency (n)	Percentage (%)
Mild	1	4.54
Moderate	14	63.64
Severe	7	31.82
Panic	0	0
Total	22	100

The intervention group had an identical initial anxiety distribution to the control group, with 15 respondents (68.18%) classified as severely anxious and 7 respondents (31.82%) experiencing panic. This similarity provides an important descriptive indication that the two groups entered the intervention phase with comparable levels of psychological distress. Preoperative anxiety at a high level can interfere with patients' psychological readiness and may influence perioperative physiological responses (Potter et al., 2020). Progressive muscle relaxation addresses this condition by systematically contracting and releasing muscle groups, thereby encouraging physical relaxation and reducing perceived tension (Hasanpour-Dehkordi et al., 2019). Deep breathing complements this mechanism by directing patients toward slow and controlled respiration that can support autonomic regulation (Bashir et al., 2019). The combination of these techniques was therefore relevant for patients who initially presented with severe anxiety and panic before spinal anesthesia.

Table 6. Preoperative Anxiety Levels in the Intervention Group Before Intervention

Anxiety Level	Frequency (n)	Percentage (%)
Mild	0	0
Moderate	0	0
Severe	15	68.18
Panic	7	31.82
Total	22	100

A marked improvement was observed in the intervention group after receiving the combination of progressive muscle relaxation and deep breathing. Table 7 shows that 10 respondents (45.45%) were classified as having mild anxiety and 12 respondents (54.55%) as having moderate anxiety after the intervention, while no respondents remained in the severe or panic categories. The complete disappearance of the severe and panic categories indicates a substantial shift in the distribution of anxiety toward lower levels following the combined intervention. Comparable evidence has demonstrated that a combination of progressive muscle relaxation and deep breathing can reduce anxiety among preoperative patients more effectively than conditions without the combined approach (Yudanari et al., 2026). Progressive muscle relaxation may reduce somatic manifestations of anxiety through sequential muscle tension and release, while slow breathing provides an additional mechanism for regulating physiological arousal (Zhakia et al., 2025). The present distribution therefore suggests that combining the two relaxation techniques may provide a broader relaxation response than relying on a single technique.

Table 7. Preoperative Anxiety Levels in the Intervention Group After Combined Progressive Muscle Relaxation and Deep Breathing

Anxiety Level	Frequency (n)	Percentage (%)
Mild	10	45.45
Moderate	12	54.55
Severe	0	0
Panic	0	0
Total	22	100

The contrast between the two groups becomes particularly evident when the posttest distributions are considered together, because the control group still contained respondents with severe anxiety whereas the intervention group did not. The control group showed a concentration of respondents in the moderate category after deep breathing, while the intervention group showed a higher proportion reaching the mild category. This difference is consistent with previous findings that progressive muscle relaxation can reduce anxiety among preoperative patients by promoting physical and psychological relaxation (Wahyuningsih et al., 2024). Research involving patients undergoing cesarean procedures has also indicated that progressive muscle relaxation can contribute to reductions in preoperative anxiety (Lizawati et al., 2022). Evidence from patients receiving general anesthesia similarly supports the effectiveness of progressive muscle relaxation for reducing preoperative anxiety, suggesting that the technique can be applied across different surgical contexts (Arvela et al., 2025). The descriptive pattern in the present study consequently supports further statistical examination of within-group and between-group anxiety changes to determine whether the observed differences represent statistically significant intervention effects.

Within-Group Changes in Anxiety Levels

The within-group analysis was conducted after assessing the distributional characteristics of the pretest and posttest anxiety data in each group. The normality results showed that the control group had normally distributed pretest and posttest data, with p-values of 0.498 and 0.627, respectively, whereas the intervention group had a non-normal pretest distribution with a p-value of 0.036 and a normal posttest distribution with a p-value of 0.491. The different distributional characteristics required the inferential analysis to consider the assumptions underlying each statistical test rather than applying one procedure uniformly to both groups. This approach is consistent with methodological guidance that selection of inferential tests should be based on the characteristics and distribution of the data (Nursalam, 2020). The homogeneity test further showed that the pretest data were homogeneous between groups, with Levene's test yielding $F = 0.022$ and $p = 0.884$. The posttest data were also homogeneous, with $F = 0.297$ and $p = 0.589$, supporting the comparability of variance between the groups.

Table 8. Normality and Homogeneity Tests

Group	Test	Statistic	Sig.
Control Pretest	Shapiro-Wilk	—	0.498
Control Posttest	Shapiro-Wilk	—	0.627
Intervention Pretest	Shapiro-Wilk	—	0.036
Intervention Posttest	Shapiro-Wilk	—	0.491
Pretest	Levene's Test	0.022	0.884
Posttest	Levene's Test	0.297	0.589

The control group experienced a statistically significant reduction in anxiety following deep breathing, as indicated by the paired-samples t-test. The mean anxiety score decreased from 23.64 before intervention to 17.82 after intervention, representing a mean reduction of 5.82 points. The statistical test produced a p-value of 0.000, which is below the predetermined significance level and indicates a significant change in anxiety within the control group. The finding is consistent with previous evidence showing that deep-breathing relaxation can reduce anxiety in preoperative patients by promoting controlled respiration and relaxation responses (Utami et al., 2026). Deep breathing may influence physiological arousal by slowing respiratory activity and supporting autonomic balance, which can contribute to a subjective reduction in anxiety (Hamasaki, 2020). The observed decline indicates that deep breathing alone was associated with meaningful improvement in preoperative anxiety among respondents in the control group.

Table 9. Paired-Samples t-Test of Anxiety Levels in the Control Group

Group	Mean Pretest	Mean Posttest	Mean Difference	p-value
Control	23.64	17.82	5.82	0.000

The intervention group demonstrated an even more pronounced pattern of anxiety reduction after receiving the combination of progressive muscle relaxation and deep breathing. Because the intervention-group pretest data did not meet the normality assumption, the Wilcoxon Signed Rank Test was used to evaluate the change between pretest and posttest scores. The analysis produced 22 negative ranks with a mean rank of 11.50 and a sum of ranks of 253.00, while no positive ranks or ties were identified. The p-value of 0.000 indicates a statistically significant reduction in anxiety following the combined intervention. Similar findings have shown that progressive muscle relaxation can significantly reduce anxiety among patients preparing for surgery by decreasing physical tension and promoting psychological relaxation (Rihiantoro et al., 2018). The absence of positive ranks indicates that every respondent in the intervention group experienced a decrease in anxiety score after receiving the combined relaxation techniques.

Table 10. Wilcoxon Signed Rank Test of Anxiety Levels in the Intervention Group

Rank	N	Mean Rank	Sum of Ranks
Negative Ranks	22	11.50	253.00
Positive Ranks	0	0.00	0.00
Ties	0	0.00	0.00
Total	22		
p-value			0.000

The within-group findings indicate that both groups experienced statistically significant reductions in preoperative anxiety, although the magnitude and distribution of improvement differed between the interventions. The control group showed a mean reduction of 5.82 points, whereas the intervention group demonstrated reductions across all 22 respondents based on the Wilcoxon rank pattern. Progressive muscle relaxation may contribute to anxiety reduction by interrupting the cycle between muscular tension, physiological arousal, and psychological distress (Casman et al., 2022).

Deep breathing provides a complementary mechanism by encouraging controlled respiration and reducing excessive physiological activation associated with anxiety (Wulandari et al., 2017). The combined intervention may therefore address anxiety through both muscular relaxation and respiratory regulation rather than relying on a single relaxation mechanism. Evidence from preoperative patients also indicates that progressive muscle relaxation combined with other relaxation approaches can produce meaningful improvements in anxiety levels (Widiyawati et al., 2024).

The statistical findings provide stronger evidence than the descriptive distributions alone because both groups demonstrated significant changes after their respective interventions. The control-group result confirms that deep breathing was associated with a significant reduction in anxiety, while the intervention-group result demonstrates a significant reduction after the combination of progressive muscle relaxation and deep breathing. The difference in analytical procedures reflects the distributional characteristics of the data rather than a difference in the substantive interpretation of anxiety change (Hikmawati, 2020). The intervention-group result is particularly notable because all 22 respondents moved toward lower anxiety scores, producing no positive ranks and no ties in the Wilcoxon analysis. Previous research has similarly identified progressive muscle relaxation as an effective non-pharmacological strategy for reducing anxiety among surgical patients (Alifiani et al., 2024). The subsequent between-group comparison is needed to determine whether the combined technique produced a significantly greater reduction in anxiety than deep breathing alone.

Between-Group Comparison and Effect of the Combined Intervention

The between-group analysis was performed to determine whether the anxiety level after intervention differed significantly between respondents receiving deep breathing and those receiving the combination of progressive muscle relaxation and deep breathing. The posttest mean anxiety score was 17.82 (SD = 2.839) in the control group and 13.09 (SD = 2.860) in the intervention group. The lower mean observed in the intervention group indicates that respondents receiving the combined technique reached a lower level of anxiety after the intervention. Non-pharmacological relaxation techniques are relevant in perioperative care because anxiety can influence patients' psychological readiness and physiological responses before surgery (Potter et al., 2020). Progressive muscle relaxation may strengthen the relaxation response by reducing muscular tension, while deep breathing supports respiratory regulation during periods of psychological stress (Hasanpour-Dehkordi et al., 2019). The difference in posttest scores therefore provides an initial indication that the combined intervention may offer greater anxiety reduction than deep breathing alone.

The statistical comparison showed a significant difference between the posttest anxiety scores of the two groups. As presented in Table 11, the independent-samples t-test produced a mean difference of 4.73 points, with a 95% confidence interval ranging from 2.993 to 6.461 and a p-value of 0.000. Because the confidence interval does not include zero, the difference between the two posttest means is statistically supported rather than attributable to random sampling variation. The result is consistent with previous research showing that combined progressive muscle relaxation and slow deep breathing can significantly reduce anxiety in preoperative patients (Zhakia et al., 2025). Research involving patients undergoing spinal anesthesia has also demonstrated the relevance of relaxation techniques for managing preoperative anxiety in this specific anesthetic context (Karangan et al., 2024). The statistical evidence indicates that the combined intervention produced a significantly lower post-intervention anxiety level than deep breathing alone.

Table 11. Independent-Samples t-Test of Posttest Anxiety Levels Between Groups

Group	N	Mean	SD	Mean Difference	95% CI	p-value
Control	22	17.82	2.839	4.73	2.993–6.461	0.000
Intervention	22	13.09	2.860			

The magnitude of the difference is clinically relevant because the intervention group moved from a pre-intervention condition dominated by severe anxiety and panic to a post-intervention condition consisting only of mild and moderate anxiety. The control group also improved, but seven respondents remained in the severe category after deep breathing, whereas no respondents in the combined-intervention group remained severely anxious or panicked. This pattern suggests that adding

progressive muscle relaxation may extend the effect of breathing-based relaxation by addressing the physical component of anxiety in addition to respiratory control. Previous evidence has identified progressive muscle relaxation as an effective intervention for reducing anxiety among preoperative patients, particularly through systematic tension and release of muscle groups (Arvela et al., 2025). The physiological basis of slow breathing further supports the possibility of complementary effects because controlled respiration can promote relaxation and reduce autonomic arousal (Hamasaki, 2020). The observed distribution and mean-score difference collectively support the interpretation that the combined approach provided a stronger reduction in anxiety than deep breathing alone.

The greater reduction associated with the combined intervention can be interpreted through the complementary mechanisms of progressive muscle relaxation and deep breathing. Progressive muscle relaxation involves deliberate contraction followed by relaxation of muscle groups, helping patients recognize and release bodily tension associated with anxiety (Natosba et al., 2020). Deep breathing simultaneously encourages slow and controlled respiration, which can help regulate physiological responses accompanying psychological distress (Bashir et al., 2019). When administered together, the techniques provide patients with two coordinated pathways for relaxation, namely reduction of somatic muscle tension and regulation of breathing patterns. Findings from preoperative cesarean patients have also demonstrated that progressive muscle relaxation can contribute to lower anxiety levels, supporting its application as a perioperative nursing intervention (Lizawati et al., 2022). The stronger posttest outcome in the present study is therefore theoretically plausible because the combined intervention addresses both physical and respiratory manifestations of preoperative anxiety.

The findings also reinforce the importance of non-pharmacological interventions that can be incorporated into routine preoperative nursing practice. The significant difference between groups indicates that the additional progressive muscle relaxation component contributed meaningful value beyond the reduction achieved through deep breathing alone. Similar evidence has reported beneficial effects of progressive muscle relaxation on anxiety among patients preparing for surgery, supporting its feasibility as a complementary nursing intervention (Wahyuningsih et al., 2024). The intervention is also consistent with perioperative care principles that emphasize patient safety, psychological preparation, and reduction of potentially modifiable perioperative stressors (World Health Organization, 2020). From a practical perspective, the combined technique can be considered a relatively accessible intervention because it does not depend on complex equipment or pharmacological administration. Its application may be particularly useful during the preoperative period when patients require interventions that can be delivered directly by nurses as part of holistic preparation for anesthesia and surgery.

The alternative hypothesis is accepted because the independent-samples t-test demonstrated a statistically significant difference in posttest anxiety between the two groups, with $p = 0.000$. The intervention group achieved a mean anxiety score 4.73 points lower than the control group, indicating a substantial advantage for the combination of progressive muscle relaxation and deep breathing. This finding is consistent with recent evidence demonstrating that combined relaxation techniques can reduce anxiety among preoperative patients more effectively than isolated approaches (Yudanari et al., 2026). The result also strengthens the argument that preoperative anxiety management should not focus exclusively on a single physiological pathway when multiple relaxation techniques can be integrated into patient care. The absence of severe and panic-level anxiety in the intervention group after treatment further supports the practical importance of the statistical finding. The combined progressive muscle relaxation and deep breathing technique can therefore be regarded as an effective non-pharmacological approach for reducing anxiety among preoperative patients undergoing spinal anesthesia.

CONCLUSION

The findings demonstrate that preoperative anxiety was high among patients undergoing surgery under spinal anesthesia before the interventions were administered. Both the control and intervention groups initially showed the same distribution, with 68.18% of respondents experiencing severe anxiety and 31.82% experiencing panic. After the intervention, anxiety decreased in both groups, although the reduction was more pronounced among patients who received the combination of progressive muscle relaxation and deep breathing. The control group showed a significant reduction in anxiety after deep breathing, with the mean score decreasing from 23.64 to 17.82 ($p = 0.000$). The intervention group also demonstrated a significant reduction, with all 22 respondents showing lower

anxiety scores after receiving the combined intervention ($p = 0.000$). The posttest comparison further revealed a significant difference between groups, with mean anxiety scores of 17.82 in the control group and 13.09 in the intervention group ($p = 0.000$). These findings indicate that the combination of progressive muscle relaxation and deep breathing was more effective in reducing preoperative anxiety than deep breathing alone.

The combination of progressive muscle relaxation and deep breathing can be considered an effective non-pharmacological nursing intervention for managing anxiety among preoperative patients undergoing spinal anesthesia. The intervention produced a 4.73-point lower mean posttest anxiety score compared with deep breathing alone, with a 95% confidence interval of 2.993–6.461. The absence of severe and panic anxiety categories in the intervention group after treatment further indicates a meaningful shift toward lower anxiety levels. The findings support the integration of physical muscle relaxation and controlled breathing as complementary approaches to addressing psychological and physiological manifestations of preoperative anxiety. The intervention is also relatively simple and does not require complex equipment, making it feasible for application within routine preoperative nursing care. Its implementation may assist nurses in preparing patients psychologically before surgery and supporting a more relaxed condition before spinal anesthesia. Further research with larger samples and broader clinical settings is recommended to strengthen the evidence regarding the effectiveness and applicability of this combined intervention.

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