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The Effect of Breathing Exercise and Progressive Muscle Relaxation on Improving Sleep Quality in Postmenopausal Women

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Abstract

Sleep disturbances are common among menopausal women and negatively affect quality of life, cognitive function, and emotional well-being. The decline in estrogen and progesterone during menopause often leads to insomnia, hot flashes, and anxiety. Non-pharmacological approaches such as Progressive Muscle Relaxation (PMR) and Breathing Exercise (BE) are considered effective, yet studies combining both methods remain limited, particularly in community-based settings. This study aimed to evaluate the effect of combined PMR and BE on sleep quality in menopausal women within an Integrated Health Post for the Elderly (Posyandu Lansia) community. A pre-experimental one-group pretest–posttest design was used. Twenty-six menopausal women, members of the Posyandu Lansia Dahlia II *in Surakarta, Indonesia, were recruited through total sampling. The intervention consisted of PMR and BE, conducted five times per week for eight weeks. Sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI) before and after the intervention. Data were analyzed using the Wilcoxon Signed-Rank Test with a significance threshold of $p < 0.05$. Before the intervention, all participants reported poor sleep quality with an average PSQI score of 7.54. After eight weeks, 53.8% of participants showed good sleep quality, with the average PSQI score decreasing to 6.12. Statistical analysis revealed a significant difference between pre- and post-intervention scores ($p = 0.0001$). In conclusion, the combination of PMR and BE significantly improved sleep quality in menopausal women and may serve as an effective, low-cost, community-based health promotion strategy.*

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INTRODUCTION

Postmenopause is a natural phase in a woman's life which is marked by the permanent cessation of the menstrual cycle due to a decrease in the production of the hormones estrogen and progesterone (1). One of the most common complaints among postmenopausal women is sleep disturbances, such as insomnia, difficulty falling asleep, frequent nighttime awakenings, and poor sleep quality. These disturbances are reported in 35% to 60% of menopausal women and tend to increase during the transition to postmenopause (2,3). Decreased estrogen levels are known to affect body temperature regulation, melatonin secretion, and circadian rhythms, thereby disrupting sleep homeostasis(4). In addition, Vasomotor symptoms, including hot flashes and night sweats, along with psychological disturbances such as anxiety and depression, have been shown to significantly impair sleep quality (5,6).

Chronic sleep disturbances in postmenopausal women can lead to fatigue, cognitive decline, an increased risk of affective disorders, and a reduced overall quality of life. Therefore, efforts to improve sleep quality in this group are crucial. Pharmacological therapies, such as hormone replacement therapy or sleeping pills, may provide short-term

improvement, but carry the risk of side effects and are not recommended for long-term use(7).This has prompted the need to develop safe, affordable, and self-administered non-pharmacological therapy alternatives, one of which is relaxation techniques.

From a public health perspective, the Indonesian government has initiated several programs through primary health care (*Puskesmas*) and community health posts (*Posyandu Lansia*), aiming to monitor and improve elderly women's health, including education on menopausal health and chronic disease prevention (8) . However, these programs remain limited, with greater emphasis on screening and pharmacological treatment rather than lifestyle interventions. On the community side, knowledge and awareness among menopausal women regarding safe strategies to improve sleep quality are still relatively low. Studies in Indonesia show that many women continue to rely on over-the-counter medications or perceive sleep problems as a normal part of aging, while only a small proportion adopt relaxation-based approaches ((9)). This gap between available government programs and community understanding highlights the urgency of introducing simple, evidence-based, and community-implementable interventions such as breathing exercises and progressive muscle relaxation.

Progressive Muscle Relaxation (PMR) and Breathing Exercise (BE) are relaxation techniques widely used to reduce physiological arousal and enhance sleep quality. Both interventions target the autonomic nervous system by reducing sympathetic activity and increasing parasympathetic dominance, which is essential for initiating and maintaining sleep.

PMR works by systematically tensing and then relaxing different muscle groups throughout the body. This technique helps individuals become more aware of muscular tension and promotes a state of deep physical relaxation. Compared to pharmacological therapies, PMR is non-invasive, has no side effects, and can be self-administered. Recent studies show that PMR not only improves sleep quality but also reduces anxiety and depressive symptoms in adults, with stronger efficacy when combined with other behavioral strategies (10). This is supported by a systematic review of research. This study, which summarized 46 articles from 16 countries, showed that PMR is effective in reducing depression, anxiety, and stress in adults. Efficacy increases when combined with other exercises (11). Besides PMR, another relaxation technique that provides a relaxing effect is BE. BE, focuses on slow, deep, and rhythmic breathing that optimizes oxygen exchange and stimulates the vagus nerve, thereby lowering heart rate and blood pressure. This technique is particularly beneficial compared to other relaxation methods because it directly regulates respiratory and cardiovascular function, which are often affected by menopausal symptoms such as hot flashes and palpitations. Evidence indicates that BE reduces stress, improves mental health, and enhances sleep quality, while being cost-effective and easy to implement in community settings(12). These two interventions were selected because they are safe, practical, inexpensive, and suitable for large-scale community-based implementation. Unlike meditation or yoga, which require longer training and higher adherence, PMR and BE can be easily taught in short sessions and practiced independently at home. However, studies that combine both techniques into one integrated intervention remain limited, particularly among menopausal women in community populations.

This research was conducted in collaboration with the Posyandu Lansia Dahlia II in Surakarta, Indonesia, which served as the intervention site. The location was selected purposively based on several considerations. First, this community health post has 48 permanent elderly female members, of whom more than 70% are in the menopausal phase, as recorded in the 2022 Surakarta Puskesma*s* health report (13). Second, preliminary observations and cadre interviews revealed that more than half of the members frequently complained of sleep disturbances, but had never received any structured non-pharmacological intervention such as PMR or BE. Third, the 2021 Posyandu Lansia coverage report from

the Surakarta Health Office indicated that sleep-related complaints were among the top three issues reported by elderly women during routine health screenings (14). Compared to other Posyandu Lansia in the Surakarta area, Dahlia II showed higher attendance consistency and member participation in monthly health activities (>80% average attendance), which provided a supportive environment for conducting repeated sessions over eight weeks. These factors, supported by local health data and community readiness, justified the choice of Posyandu Lansia Dahlia II as an appropriate partner for implementing and evaluating the intervention.

Thus, this study aims to evaluate the effects of PMR and BE on improving sleep quality in postmenopausal women. The novelty of this study lies in the application of the combination of two relaxation techniques in a community intervention, a practice that has not been widely scientifically studied. The results are expected to contribute significantly to the development of evidence-based health interventions that are applicable and relevant for elderly postmenopausal women at the primary care level.

This study was conducted at the *Posyandu Lansia Dahlia II*, Surakarta, Indonesia, from March to June 2025. The intervention program lasted for eight consecutive weeks, with five sessions per week, carried out during routine Posyandu activities and additional scheduled meetings. Ethical clearance was obtained from the Health Research Ethics Committee of Universitas Aisyiyah Surakarta with approval number No. 525/VII/AUEC/2025. All participants were informed about the study objectives, procedures, benefits, and potential risks, and provided written informed consent prior to participation

METHODS

1. Type of Research

This research employed a quantitative pre-experimental study design with a one-group pretest–posttest approach. This design was selected because it allows the measurement of changes in outcomes before and after the intervention within the same group of participants, without the use of a control group. The primary purpose was to evaluate the effect of the combined PMR and BE intervention on sleep quality in postmenopausal women.

2. Research Subjects

The population of this study consisted of all female members of Posyandu Lansia Dahlia II in Surakarta. In this research, menopausal women were defined as women who had experienced the permanent cessation of menstruation for at least 12 consecutive months without other pathological causes, corresponding to the postmenopausal stage. Based on the World Health Organization and Indonesian Ministry of Health guidelines, this stage is commonly observed in women aged 45 years and above (15). Therefore, the study targeted postmenopausal women within this age group.

The sample was determined using a total sampling technique. Out of 48 permanent members registered at the Posyandu Lansia Dahlia II, 32 women met the inclusion criteria. After screening, 6 women were excluded (2 had a history of psychiatric disorders, 3 reported ongoing pharmacological therapy for sleep disturbances, and 1 had a musculoskeletal condition preventing participation in relaxation exercises). Thus, a total of 26 respondents were included in the final analysis.

The inclusion criteria were:

1. Women who had entered the postmenopausal stage (≥12 months since the last menstrual period),
2. Aged 45 years or older,
3. Willing to participate in the entire intervention program,
4. Able to communicate effectively,
5. Not currently undergoing pharmacological therapy for sleep disorders.

The exclusion criteria were:

1. Women with severe psychiatric disorders,
2. Women with serious physical limitations that impeded the implementation of relaxation interventions.

3.Research Instruments

Sleep quality in this study was evaluated using the Pittsburgh Sleep Quality Index (PSQI), a validated and widely adopted instrument designed to assess subjective sleep quality over a one-month period. PSQI is a standardized instrument comprising seven components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. The total score ranges from 0 to 21, with scores below 5 indicating good sleep quality and scores above 5 reflecting poor sleep quality (16).

4. Research Procedures

The study began with participants completing an informed consent form, followed by a pretest measuring sleep quality using PSQI. Participants then underwent an intervention consisting of a combination of PMR and DB, implemented five times per week for eight weeks (17). To ensure compliance, attendance was recorded at each session using a monitoring sheet signed by participants and verified by the researcher and Posyandu cadres. In addition, cadres conducted brief follow-up checks by visiting participants who missed a session, ensuring that all participants were encouraged to complete the program. Each intervention session lasted approximately 30–40 minutes. PMR training was performed for about 20 minutes, involving sequential contraction and relaxation of specific muscle groups, including facial muscles, upper and lower arm muscles, hand muscles, back, abdomen, legs, and feet (18). DB is a is a respiratory technique performed by inhaling slowly and deeply through the nose, emphasizing diaphragmatic movement while minimizing chest motion. This technique is commonly performed in a supine position, with one hand positioned on the chest and the other on the abdomen to observe and monitor respiratory movement. The individual is instructed to concentrate on promoting abdominal expansion during inhalation. DB was conducted for approximately 10–15 minutes (12). A 5-minute rest period was provided between PMR and DB to allow participants to recover and maintain concentration. The intervention was delivered face-to-face by researchers and assisted by Posyandu cadres. Sessions were consistently conducted in the late afternoon (around 16:00–17:00) after participants completed their daily activities, as this time was most convenient for attendance and conducive to relaxation. After the eight-week intervention, a posttest using the same PSQI instrument was administered to measure changes in sleep quality.

5. Data Analysis

The data obtained were statistically analyzed using the latest version of SPSS software. The analysis was conducted in two stages: the first stage, univariate analysis, to describe the subject characteristics and distribution of PSQI scores (pre- and post-intervention). The second stage, bivariate analysis, used the Wilcoxon Signed Rank Test because the data were paired and not assumed to be normally distributed. This test was used to determine differences in sleep quality scores before and after the intervention. The significance level was set at $p < 0.05$

RESULTS AND DISCUSSION

The study involved 26 postmenopausal women from the Posyandu Lansia Dahlia II in Surakarta. The average age of participants was 63 years. Most of them were within the 55–65 year age group (53.8%), which according to the World Health Organization falls into the category of “elderly” (19). This finding reflects that the participants are predominantly in the late adulthood phase, where sleep disturbances are commonly reported. Regarding occupation, the majority of

participants were housewives (65.3%). This condition may contribute to lower physical activity levels, which has been associated with higher prevalence of sleep disturbances in elderly women (20).

Table 1 Frequency distribution of respondents based on age and current occupation

Characteristics	n	%
Age		
Middle age (45-54 years)	3	11.5
Elderly	14	53.8
Young elderly	8	30.7
Older adults	1	4.0
Total	**26**	**100**
Work		
Housewife	17	65.3
Self-employed	4	15.3
Teacher	2	7.9
Laborer	3	11.5
Total	**26**	**100**

The distribution above shows that the majority of respondents were elderly women in the postmenopausal stage with limited occupational activity. This sociodemographic profile is important, since reduced daily activity and hormonal decline in postmenopause increase vulnerability to sleep disturbances

Table 2. Effect of intervention PMR and BE in sleep quality

PSQI Score	Before			After			P Value
	n	%	Mean SD	n	%	Mean SD	
Good sleep quality (<5)	0	0	7.54 1.98	14	53.8	6.12 1.63	0.0001
Poor sleep quality (>6)	26	100		12	46.2		

Before the intervention, all participants experienced poor sleep quality, with an average PSQI score of 7.54. After eight weeks of combined PMR and BE, 53.8% of respondents achieved good sleep quality, with the mean PSQI score decreasing to 6.12. The Wilcoxon Signed-Rank Test confirmed a significant difference between pre- and post-test scores ($p = 0.0001$). This reduction indicates a statistically significant improvement in sleep quality following the combined implementation of PMR and BE. These results suggest that the integration of PMR and BE is an effective strategy for improving sleep quality in the study population

All respondents indicated low sleep quality based on the questionnaire results. Poor sleep quality is the most frequently reported complaint by post menopausal women. Research shows that more than 50% of menopausal women experience sleep disturbances, and the prevalence increases with age (21). In this context, the majority of respondents in the elderly group (55–65 years) are likely to be in the late perimenopause or early menopause phase, where hormonal fluctuations still occur and can worsen sleep quality (16). Age also plays a significant role. Older adults tend to experience decreased sleep efficiency, increased light sleep (N1 and N2), and decreased deep sleep (N3/slow-wave sleep). This is

exacerbated in menopausal women, as age-related sleep disturbances, including vasomotor symptoms (such as hot flashes and night sweats), also disrupt sleep (23).

Besides age, there are other factors, such as current occupation. The largest number of respondents were housewives, at 17 elderly (65.3%). Housewives tend to have low levels of physical activity. This is supported by a study that stated that, in addition to biological factors, psychosocial factors such as stress, anxiety, loneliness, and reduced physical activity are also common in elderly women, all of which contribute to sleep disturbances (23)(24)

The results showed that all respondents had poor sleep quality before the intervention, with an average PSQI score of 7.54. After the intervention, which included a combination of PMR and BE, there was a significant improvement, indicated by an increase in the number of respondents with good sleep quality to 53.8% and a decrease in the average PSQI to 6.12. The statistical test yielded a p-value of 0.0001, indicating a highly statistically significant difference between before and after the intervention.

Menopausal women physiologically experience a decrease in the hormones estrogen and progesterone, which play a vital role in regulating body temperature, mood, and sleep. This decrease in hormones leads to increased complaints of insomnia, frequent nighttime awakenings, hot flashes, and mood disturbances, all of which contribute to poor sleep quality (19). One meta-analysis study confirmed that more than 50% of menopausal women experience sleep disturbances, and their sleep quality tends to decline with age (26). One of the mechanisms underlying sleep disturbances in menopausal women involves heightened activation of the sympathetic nervous system, leading to elevated heart rate and blood pressure, accompanied by a reduction in parasympathetic activity, which is essential for initiating and maintaining relaxation during sleep. PMR and BE play a role in normalizing these autonomic nervous system responses. Breathing exercises stimulate the vagus nerve and enhance parasympathetic activity, which lowers cortisol and promotes a state of relaxation before sleep (27). On the other hand, PMR helps relieve muscle tension and anxiety, two factors that greatly influence sleep onset and the quality of deep sleep (slow-wave sleep) (28).

BE, particularly diaphragmatic or slow-paced breathing, can provide psychophysiological relaxation effects through various integrated physiological mechanisms. First, parasympathetic nervous system activation. Slow, deep breathing exercises stimulate the vagus nerve, part of the parasympathetic nervous system, which is responsible for the "rest and digest" response. Activation of the vagus nerve causes a decrease in heart rate and blood pressure, as well as reducing sympathetic nervous system activity, which often increases in menopausal women due to stress or nighttime anxiety (23). With this parasympathetic dominance, the body is better prepared to enter the deep non-REM sleep phase, thereby improving sleep efficiency and reducing the frequency of nighttime awakenings (30). Second, Reduced Cortisol Levels: Breathing exercises have consistently been shown to reduce cortisol levels, a stress hormone that increases during sleep disturbances or psychological stress. High cortisol levels have been shown to disrupt sleep cycles and increase sleep latency (the time it takes to fall asleep). By lowering cortisol, BE helps the body enter sleep more quickly and deeply (25). Third, Emotional Regulation and Anxiety Reduction. Postmenopausal women are also susceptible to mood disorders such as anxiety and depression, which are strong risk factors for sleep disturbances. BE increases activity in the medial prefrontal cortex, which plays a role in emotional regulation and stress responses. Furthermore, this exercise also helps reduce activity in the amygdala, the center for processing fear and anxiety, thus providing a calming effect before bed(32). Fourth, increasing heart rate variability (HRV). Breathing exercises increase HRV, which is an indicator of autonomic nervous system health. High HRV is associated with the body's ability to adapt to stress and better sleep quality. Increasing HRV through breathing exercises indicates the body's ability to maintain a balance between activity and relaxation (33). Fifth, Reorganize Inefficient Breathing Patterns. Menopause can cause mild hyperventilation due to anxiety and hormonal

imbalances. Breathing exercises help reorganize breathing patterns that are too rapid or shallow to become deeper, slower, and more efficient. This directly reduces the workload on the nervous system and creates optimal internal conditions for sleep (34).

PMR is a relaxation technique developed by Edmund Jacobson, which involves sequentially contracting and relaxing muscle groups to reduce physical tension and psychological stress. This technique is particularly relevant for menopausal women, as this phase is characterized by a decrease in the hormones estrogen and progesterone, which affect sleep quality and emotional stability. Decreased levels of these hormones are known to increase sympathetic nervous system activity and disrupt sleep patterns (35). PMR activates the parasympathetic nervous system, triggering deep relaxation, slowing the heart rate, lowering blood pressure, and suppressing the secretion of cortisol—a key stress hormone that contributes to sleep disturbances. Consistent PMR practice helps the body enter deeper, more restorative non-REM sleep, thereby increasing sleep efficiency and duration. Other studies support these findings, noting significant improvements in sleep quality in menopausal women who underwent relaxation training for at least four weeks(36). In addition to its physiological effects, PMR is also beneficial in addressing psychological symptoms such as anxiety and mild depression that often accompany menopause, which can contribute to poor sleep quality. This technique increases body awareness and the individual's ability to control stress responses, creating a calmer mental state before bed. A recent systematic review concluded that behavioral interventions such as PMR consistently demonstrate effectiveness in improving sleep quality in perimenopausal and menopausal women (31).

Although the mean PSQI score decreased, it remained above the threshold score of 5, which still indicates poor overall sleep quality. This finding may be explained by several factors. First, menopausal women commonly experience persistent vasomotor symptoms (such as hot flashes and night sweats), mood fluctuations, and chronic health conditions, which are difficult to eliminate within a short-term intervention (38). Second, lifestyle-related factors such as low levels of physical activity, stress, and caregiving responsibilities may continue to negatively affect sleep, even after relaxation techniques are introduced. Third, the intervention period of eight weeks may not have been sufficient for producing sustained long-term changes in sleep architecture, especially in participants who had experienced sleep problems for many years.

Nevertheless, the significant reduction in PSQI scores demonstrates that PMR and BE had a meaningful effect in improving sleep quality, even if the average score did not cross the “good sleep” threshold. This suggests that while relaxation techniques are effective, they may be more beneficial when combined with other lifestyle modifications, such as increased physical activity, sleep hygiene education, or dietary adjustments, to achieve optimal results in postmenopausal women

CONCLUSION

Research on the effect of a combined PMR and BE intervention on menopausal women showed significant results in improving sleep quality. Statistical testing yielded a p-value of 0.0001, indicating a highly statistically significant difference between before and after the intervention. It is recommended that PMR and BE exercises be routinely incorporated into daily routines, especially before bedtime, to naturally and non-pharmacologically improve sleep quality. Further research with a randomized experimental design and a larger control group is recommended to assess the long-term effectiveness of the combined PMR and BE intervention, as well as its impact on other health aspects such as mood, blood pressure, and overall quality of life.

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