
COMPARATIVE EFFECTS OF NUTRITIONAL AND BREATHING-BASED INTERVENTIONS ON SLEEP QUALITY AND PSYCHOLOGICAL WELL-BEING AMONG POSTMENOPAUSAL WOMEN

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Article Information:

Type of Article: Original Article

Received On: 16.08.2026

Accepted On: 23.08.2026

Published On: 29.08.2026

Abstract

Background

Postmenopausal women frequently experience sleep disturbances and psychological symptoms such as anxiety and depression. Although pharmacological approaches are available, increasing attention has been directed toward simple, inexpensive, and non-pharmacological interventions that can be incorporated into daily life. Dietary interventions and relaxation-based breathing practices may offer complementary benefits; however, limited evidence is available regarding their combined effect on sleep and psychological outcomes in postmenopausal women.

Objective

The present study aimed to compare the effects of banana consumption, deep-breathing exercise, and a combination of both interventions on sleep quality, anxiety, depression, and serum melatonin among postmenopausal women.

Methods

An experimental comparative study was conducted among postmenopausal women who met the study criteria. Participants were allocated to three intervention groups: banana consumption, deep-breathing exercise, and combined banana consumption with deep-breathing exercise. The intervention was implemented for 21 days. Outcomes were assessed using the Pittsburgh Sleep Quality Index (PSQI), Zung Self-Rating Anxiety Scale, Zung Depression Scale, and serum melatonin measurement. Descriptive statistics and non-parametric tests were used for analysis, with statistical significance considered at $p < 0.05$.

Results

The intervention groups demonstrated improvement in all major outcomes. In the reported study sample, the combined intervention produced the greatest improvement in depression, sleep quality, and anxiety. Depression scores decreased from 43.58 to 33.67 in the combined group, compared with reductions from 43.58 to 38.08 and 43.08 to 39.00 in the banana and deep-breathing groups, respectively. PSQI scores decreased from 8.25 to 6.00 in the combined group. Anxiety scores decreased from 44.33 to 31.25 in the combined group. The combined intervention also demonstrated the greatest improvement in serum melatonin.

Conclusion

Banana consumption and deep-breathing exercise were associated with improvements in psychological well-being and sleep quality, with the combined intervention showing the most favourable overall pattern. The findings support further investigation of integrated nutritional and behavioural approaches as accessible components of holistic postmenopausal care.

Keywords: postmenopausal women, banana consumption, deep breathing, sleep quality, anxiety, depression, melatonin, non-pharmacological intervention

Introduction

Menopause represents an important biological transition in a woman's life and is accompanied by substantial physiological, psychological, and social changes. Following menopause, alterations in ovarian hormone production may influence sleep regulation, mood, autonomic function, and overall quality of life. Sleep disturbance, anxiety, depressive symptoms, and reduced psychological well-being are frequently reported during the menopausal and postmenopausal periods. These concerns may occur independently or interact with one another, creating a cycle in which poor sleep contributes to emotional distress and psychological symptoms further impair sleep.

Sleep quality is particularly important because persistent sleep disturbance can affect daytime functioning, cognitive performance, emotional regulation, physical health, and social participation. The Pittsburgh Sleep Quality Index (PSQI) is widely used to assess subjective sleep quality and incorporates seven domains, including subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and

daytime dysfunction. A global score greater than 5 generally indicates poor sleep quality.

Psychological symptoms during postmenopause may range from mild anxiety and emotional instability to clinically significant depressive symptoms. The Zung Self-Rating Anxiety Scale and Zung Depression Scale provide structured approaches to assessing these symptoms. The study material indicates that the Zung Anxiety Scale evaluates cognitive, autonomic, motor, and central nervous system symptoms, while the Zung Depression Scale is used to quantify depressive symptom severity.

Conventional management of menopausal symptoms may include pharmacological treatment, hormone therapy, psychological interventions, lifestyle modification, and complementary approaches. However, the increasing emphasis on person-centred and preventive healthcare has created interest in low-cost interventions that can be practiced safely and independently. Nutrition and mind-body interventions are particularly relevant because they can potentially be incorporated into routine lifestyle practices without requiring sophisticated equipment.

Bananas are nutritionally rich fruits containing carbohydrates, vitamin B6, magnesium, and other bioactive nutritional components. The study framework considered banana consumption as a dietary intervention with potential relevance to sleep and psychological well-being. Previous research cited in the source material reported reductions in sleep-disorder scores among older adults receiving banana-based dietary interventions, although those studies did not assess biological markers such as melatonin.

Deep-breathing exercise is a simple relaxation strategy involving controlled inspiration and relaxed expiration. It may influence autonomic balance, physiological arousal, and perceived stress. Previous research among perimenopausal women suggested beneficial effects of breathing-based exercise on psychological and somatic menopausal symptoms. However, comparative evidence examining breathing exercise alongside a nutritional intervention remains limited.

The research gap identified in the source material was therefore the limited evidence concerning the combined effect of nutritional and breathing-based interventions on multiple outcomes among postmenopausal women. Most earlier studies evaluated either dietary approaches or relaxation techniques independently. The present investigation addressed this gap by comparing banana consumption alone, deep-breathing exercise alone, and their combination.

The rationale for combining the two interventions is based on their potentially complementary mechanisms. A dietary intervention may provide nutritional substrates associated with sleep and mood regulation, while controlled breathing may promote relaxation and reduce physiological arousal. The combination may therefore produce broader benefits than either intervention alone.

Accordingly, the present study was undertaken to evaluate whether combining banana

consumption with structured deep-breathing exercise could produce greater improvements in sleep quality, anxiety, depression, and serum melatonin than either intervention used independently.

Objectives

The study was designed to:

1. Assess sleep quality, anxiety, depression, and serum melatonin among postmenopausal women before and after intervention.
2. Determine the effect of banana consumption alone on sleep quality, anxiety, depression, and serum melatonin.
3. Determine the effect of deep-breathing exercise alone on the selected outcomes.
4. Evaluate the effect of combined banana consumption and deep-breathing exercise.
5. Compare the effectiveness of the three intervention approaches.
6. Establish the relative rank order of the interventions based on percentage improvement.

These objectives correspond with the original research framework documented in the study material.

Materials and Methods

Research Design

A comparative experimental design with three intervention groups was used. The intervention groups comprised:

- Group I: Banana consumption
- Group II: Deep-breathing exercise
- Group III: Banana consumption + deep-breathing exercise

The research framework specified a 21-day intervention period.

Participants

The study population consisted of postmenopausal women meeting the predetermined eligibility criteria. The available pilot results included 36 participants, with 12 participants in each intervention group. The pilot participants were aged 45–56 years.

For the manuscript, the pilot findings are presented separately from the broader research findings so that the reported results are not incorrectly represented as belonging to a larger sample.

Intervention

Participants in the banana group received a prescribed banana-consumption intervention. Participants in the breathing group practiced standardized deep-breathing exercises. The combined group received both interventions during the study period.

Deep breathing was defined as a controlled technique involving slow, deep inspiration followed by relaxed expiration.

The combined intervention was designed to examine whether the nutritional and behavioural components could provide complementary effects.

Outcome Measures

Pittsburgh Sleep Quality Index

Sleep quality was assessed using the PSQI. The instrument consists of 19 self-rated items organized into seven components, producing a global score ranging from 0 to 21. A score greater than 5 indicates poor sleep quality.

Zung Anxiety Scale

Anxiety was evaluated using the Zung Self-Rating Anxiety Scale. The scale contains 20 items scored on a four-point response format, with higher scores reflecting greater anxiety severity.

Zung Depression Scale

Depressive symptoms were assessed using the Zung Depression Scale. It provided a standardized measure for evaluating changes in depressive symptomatology before and after the intervention.

Serum Melatonin

Serum melatonin was included as a biological outcome reflecting the potential influence of the interventions on circadian and sleep-related physiology.

Statistical Analysis

Data were summarized using descriptive statistics, including means and standard deviations. Between-group comparisons were performed using the Kruskal–Wallis H test because of the distributional characteristics and ordinal nature of selected outcomes. A *p*-value below 0.05 was considered statistically significant.

Percentage improvement was calculated to compare the magnitude of change across intervention groups.

Ethical Considerations

Participation was voluntary, and informed consent was obtained. The interventions were non-invasive and designed as low-cost lifestyle approaches. The research framework identified the intervention as ethically acceptable and feasible.

Results

Table 1. Baseline and Post-Intervention Depression Scores

Intervention	Pre-test Mean	Post-test Mean	Mean Reduction	Percentage Improvement
Banana consumption	43.58	38.08	5.50	12.62%
Deep-breathing exercise	43.08	39.00	4.08	9.47%
Banana + deep breathing	43.58	33.67	9.92	22.77%

The baseline depression scores were comparable among the three groups, with no significant difference ($p = 0.728$). After intervention, depression scores decreased in all three groups. The greatest reduction was observed in the combined intervention group, whose mean score declined from 43.58 to 33.67.

The percentage improvement was 22.77% in the combined group, compared with 12.62% for banana consumption and 9.47% for deep-breathing exercise.

Table 2. Changes in Sleep Quality

Intervention	Pre-test PSQI	Post-test PSQI	Mean Reduction	Percentage Improvement
Banana consumption	7.33	6.42	0.92	12.55%
Deep-breathing exercise	7.08	6.17*	1.08	15.24%
Banana + deep breathing	8.25	6.00	2.08	25.21%

Baseline PSQI scores did not differ significantly among groups ($p = 0.210$). Following intervention, sleep quality improved in all groups, with the combined intervention demonstrating the greatest reduction in PSQI score.

Table 3. Changes in Anxiety

Intervention	Pre-test Mean	Post-test Mean	Mean Reduction	Percentage Improvement
Banana consumption	40.50	36.42	4.08	10.07%
Deep-breathing exercise	44.08	41.00	3.08	6.99%
Banana + deep breathing	44.33	31.25	13.08	29.51%

The baseline anxiety scores were comparable among the groups ($p = 0.562$). After intervention, the combined group demonstrated the largest reduction, from 44.33 to 31.25.

The source study reported that post-intervention anxiety scores declined across all three groups, although the between-group difference did not reach statistical significance in the small pilot sample ($p = 0.370$).

Overall Intervention Pattern

The available research findings consistently showed that the combined intervention produced the greatest magnitude of improvement across the principal outcomes. The source material reports a mean melatonin improvement of approximately 22.44 units in the combined group, along with improvements of 23.11% in depression, 30.18% in anxiety, and 32.73% in PSQI-related sleep quality.

The reported rank order was:

1. Banana consumption + deep-breathing exercise
2. Deep-breathing exercise
3. Banana consumption

The combined intervention ranked first across the major outcome measures.

Discussion

The present investigation provides evidence supporting the potential usefulness of simple nutritional and behavioural interventions for addressing multiple postmenopausal concerns simultaneously. The most important observation was that all three intervention approaches were associated with improvement, while the combined intervention generally produced the greatest magnitude of change.

The improvement in depression scores is particularly relevant because depressive symptoms during postmenopause may arise from a combination of biological, psychological, and social influences. The combined intervention reduced the mean depression score by approximately

22.77% in the reported comparative analysis, compared with 12.62% following banana consumption and 9.47% following deep-breathing exercise.

The findings suggest that nutritional and behavioural interventions may complement one another. Banana consumption provides nutrients that may be relevant to neurotransmitter synthesis and physiological regulation, while deep breathing may reduce autonomic arousal and promote relaxation. It is important, however, to interpret these mechanisms as plausible explanations rather than definitive causal pathways.

Sleep quality also improved across all intervention groups. The combined group demonstrated the greatest reduction in PSQI score. This finding is clinically meaningful because sleep disturbance is a multidimensional problem and may require more than one lifestyle strategy. Previous work identified in the source material found that banana-based dietary interventions could reduce sleep-disorder scores, although biological markers such as melatonin were not evaluated.

Deep-breathing exercise may contribute to sleep improvement through relaxation and reduction of physiological arousal. Previous research among perimenopausal women similarly indicated that breathing-based interventions could improve psychological and somatic symptoms.

The reduction in anxiety was especially notable in the combined group. Anxiety can interfere with sleep onset and maintenance, creating a reciprocal relationship between psychological distress and sleep disturbance. Therefore, an intervention that addresses both physiological relaxation and lifestyle factors may have broader benefits than an intervention targeting only one component.

The findings relating to melatonin provide an additional dimension to the study. The source research reported the greatest melatonin improvement in the combined intervention group. The thesis discussion describes an approximately 70.9% improvement in the combined group compared with 42.4% for deep breathing and 34.3% for banana consumption in one reported analysis.

Nevertheless, these results should be interpreted cautiously. Melatonin is influenced by numerous factors, including light exposure, sleep timing, age, medications, lifestyle, and circadian rhythm. A short intervention period and relatively small pilot sample cannot establish a definitive causal relationship between the intervention and melatonin regulation.

An important strength of the investigation is its integrated approach. Rather than examining sleep, anxiety, and depression as completely separate problems, the study evaluated them together. This reflects the reality of clinical nursing practice, where patients commonly present with interconnected physical, psychological, behavioural, and social concerns.

Another strength is the use of both subjective and biological measures. The PSQI and Zung scales provide structured assessments of patient-reported outcomes, while serum melatonin

offers a biological indicator. The combination of these measures can provide a more comprehensive picture of intervention effects.

However, the findings also demonstrate why larger studies are necessary. In the pilot data, between-group differences for depression, PSQI, and anxiety were not statistically significant despite favourable trends in the combined group. For example, the post-test depression comparison had $p = 1.000$, while PSQI and anxiety comparisons were also non-significant. This suggests that statistical power may have been limited by the small number of participants.

The study therefore provides encouraging preliminary evidence rather than definitive proof of superiority. Future research should employ larger samples, robust randomization procedures, longer follow-up, standardized dietary dosing, objective sleep measures, and appropriate adjustment for potential confounders.

Conclusion

The present study examined three accessible approaches—banana consumption, deep-breathing exercise, and their combination—for improving sleep quality and psychological well-being among postmenopausal women. All three interventions demonstrated favourable changes in depression, anxiety, and sleep quality, while the combined intervention consistently showed the greatest magnitude of improvement.

The combined approach produced particularly favourable changes in depression, anxiety, PSQI scores, and serum melatonin. The available findings therefore suggest that combining a simple nutritional intervention with a structured relaxation technique may offer a promising holistic approach to postmenopausal health management. The research material likewise concludes that the combined intervention demonstrated the strongest overall improvement and ranked first across the major outcomes.

However, the results should be regarded as preliminary, particularly where pilot sample analyses did not demonstrate statistically significant between-group differences. Further adequately powered randomized controlled studies are necessary before firm clinical recommendations can be made.

From a nursing perspective, the findings reinforce the importance of holistic care that addresses not only physical symptoms but also sleep, emotional health, lifestyle, and self-care. Nutritional counselling and breathing-based relaxation may be valuable complementary components of comprehensive postmenopausal care when appropriately individualized and used alongside evidence-based clinical management.

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