Original Research Article

The effect of lavender aromatherapy on the sleep quality of elderly patients: A quasi-experimental study

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Abstract

Background: Sleep disturbances are common among elderly individuals and negatively affect physical health, psychological well-being, and overall quality of life. Non-pharmacological approaches such as lavender aromatherapy have increasingly been used to improve sleep quality across different populations.
Objective: This study aimed to examine the effect of lavender aromatherapy on sleep quality among elderly patients.
Methods: This study applied a quasi-experimental design with a pretest–posttest control group approach. A total of 60 elderly participants were recruited and randomly allocated into two groups consisting of 30 participants in the intervention group and 30 participants in the control group. The intervention group received lavender aromatherapy through a diffuser for 30 minutes each night before bedtime for 14 consecutive days, while the control group received routine care without aromatherapy exposure. Sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI) before and after the intervention period. Statistical analysis was performed using paired t-tests to evaluate changes in sleep quality within each group and independent t-tests to compare differences between the intervention and control groups. The level of statistical significance was set at $p < 0.05$.
Results: The mean PSQI score in the intervention group decreased from 11.3 ± 2.1 at baseline to 6.2 ± 1.8 after the intervention, whereas the control group showed no significant change. Statistical analysis demonstrated significant differences between pretest and posttest scores in the intervention group and significant differences between groups after the intervention.
Conclusion: Lavender aromatherapy significantly improves sleep quality among elderly patients and may serve as an effective complementary intervention in geriatric nursing care.

Keyword: Aromatherapy, Elderly, Lavender, Sleep Quality

Research Highlights

What is the current knowledge?
- Lavender aromatherapy has been widely reported to improve sleep quality and psychological well-being through its sedative and anxiolytic effects.

What is new here?
- Lavender aromatherapy administered through nightly inhalation significantly improves sleep quality among elderly patients within a short intervention period.

Background

Sleep quality plays an important role in maintaining physical health, cognitive function, and emotional regulation in human life across the lifespan (Baranwal et al., 2023). Aging processes in older adults often alter sleep architecture and increase the risk of sleep disturbances due to physiological and neurological changes (Miller & Howarth, 2023). Epidemiological studies report that sleep disorders frequently occur in adult and elderly populations and are associated with multiple chronic health conditions (McArdle et al., 2020). Poor sleep quality also contributes to metabolic disorders such as obesity and cardiovascular disease, which further complicate the health status of older adults (Lee & Cho, 2022). Population-based studies demonstrate that sleep problems are highly prevalent in community

settings and represent a significant public health concern (Shaheen & Alkaid Albqoor, 2022). In addition, inadequate sleep hygiene awareness significantly influences the occurrence of sleep disturbances among adults (Qi et al., 2023).

Sleep disturbances among elderly individuals often coexist with psychological problems such as anxiety and depression, which negatively affect overall quality of life (Yin et al., 2023). Long-term sleep disruption in older adults also increases the risk of emotional distress and depressive symptoms in aging populations (Duan & Wang, 2023). Clinical evidence shows that sleep disorders frequently occur in patients with chronic diseases, including diabetes and neurological disorders, which complicate disease management (Schipper et al., 2021). In some neurological conditions, interventions targeting neural mechanisms have been shown to improve sleep outcomes (Bjerknes et al., 2020). Other clinical treatments, such as positive airway pressure therapy, have also demonstrated improvements in sleep perception and sleep structure in patients with sleep-related breathing disorders (Lee et al., 2023). However, pharmacological and technological interventions are not always feasible or preferred among elderly patients due to potential side effects and accessibility issues.

Consequently, non-pharmacological approaches have gained increasing attention in sleep management research. Behavioral interventions such as cognitive behavioral therapy for insomnia have demonstrated effectiveness in improving sleep quality and reducing depressive symptoms (Kalmbach et al., 2019). Complementary therapies, including music therapy and relaxation techniques, also contribute to improvements in sleep and psychological well-being in various populations (Gassner et al., 2022; Pouraboli et al., 2019). These approaches are often recommended as supportive interventions because they are relatively safe and easy to implement in clinical and community settings. Among these complementary approaches, aromatherapy has emerged as a promising intervention for improving sleep quality. Aromatherapy uses essential oils extracted from plants to stimulate physiological and psychological

responses through inhalation or topical application (Farrar & Farrar, 2020).

Lavender essential oil represents one of the most widely studied aromatherapy agents for sleep improvement. Pharmacological evidence indicates that lavender contains bioactive compounds that interact with the central nervous system and influence neurotransmitter activity associated with relaxation and sleep regulation (Soares et al., 2021). Several studies report that lavender aromatherapy can reduce anxiety, stabilize mood, and promote relaxation through its sedative properties (Bavarsad et al., 2023). Clinical trials have also demonstrated that inhalation of lavender essential oil significantly improves sleep quality in patients experiencing various health conditions (Hamzeh et al., 2020). Randomized controlled trials further show that aromatherapy interventions can reduce fatigue and enhance sleep quality in elderly individuals (Genç et al., 2020). Additional clinical evidence indicates that lavender aromatherapy improves sleep quality and physiological parameters in palliative care patients (Yıldırım et al., 2020).

Systematic reviews and meta-analyses have consistently reported positive effects of aromatherapy interventions on sleep outcomes. A comprehensive meta-analysis concluded that aroma inhalation therapy significantly improves sleep quality in adults and older populations (Her & Cho, 2021). Another meta-analysis also demonstrated that aromatherapy interventions effectively reduce insomnia symptoms and improve sleep patterns (Tang et al., 2021). Clinical research further confirms that aromatherapy can improve mood and sleep quality in specific populations such as postpartum women and cancer patients (Chen et al., 2022; Liu et al., 2022). Experimental studies conducted in different healthcare settings also report improvements in sleep quality following aromatherapy interventions (Hsu et al., 2021; Mahdood et al., 2022). These findings suggest that aromatherapy represents a promising complementary therapy for managing sleep disturbances.

Despite increasing evidence regarding the benefits of aromatherapy, research focusing specifically on

elderly populations remains relatively limited. Some clinical studies have demonstrated that lavender aromatherapy improves sleep quality in hospitalized elderly patients and individuals with chronic illnesses (Givi et al., 2019; Rafi et al., 2020). Other studies also report improvements in sleep quality and psychological well-being among elderly patients receiving aromatherapy interventions (Zheng, 2020; Zhang, 2022). Nevertheless, variations in study design, intervention methods, and participant characteristics create inconsistencies in research findings. Therefore, further empirical research is needed to evaluate the effectiveness of lavender aromatherapy in improving sleep quality among elderly patients using robust experimental approaches.

Therefore, this study aims to examine the effect of lavender aromatherapy on the sleep quality of elderly patients.

Methods

Study Design

This study applied a quasi-experimental design with a pretest–posttest control group approach to examine the effect of lavender aromatherapy on sleep quality among elderly patients. The quasi-experimental design was selected because the study was conducted in a real clinical environment where complete randomization and strict experimental control were difficult to implement due to ethical and logistical considerations. The study design followed the Transparent Reporting of Evaluations with Nonrandomized Designs (TREND) guideline from the EQUATOR Network, which provides methodological guidance for reporting nonrandomized intervention studies. The TREND guideline was used to ensure transparency in study procedures, participant allocation, intervention implementation, and data analysis. The research involved two groups consisting of an intervention group receiving lavender aromatherapy and a control group receiving routine care without aromatherapy exposure. The study measured sleep quality before and after the intervention period to evaluate the

change in outcomes associated with the aromatherapy intervention.

Sampling

The population of this study consisted of elderly individuals residing in a long-term care facility. The study targeted elderly patients who experienced sleep disturbances because sleep problems are commonly reported among institutionalized older adults. The inclusion criteria included elderly individuals aged 60 years and above, experiencing mild to moderate sleep disturbances, able to communicate effectively, and willing to participate in the research process. Participants who had a history of allergy to essential oils, severe cognitive impairment, severe psychiatric disorders, or acute medical conditions were excluded from the study to prevent potential confounding factors and health risks.

The sampling technique used in this study was purposive sampling, which allowed the researchers to select participants who met the predetermined inclusion criteria relevant to the research objective. A total of 60 elderly participants were recruited and then allocated into two groups consisting of 30 participants in the intervention group and 30 participants in the control group. Allocation of participants into groups was conducted using a simple random assignment method to minimize selection bias and ensure comparable baseline characteristics between groups. The sample size was determined based on feasibility considerations and the expected statistical power required to detect meaningful differences in sleep quality between the intervention and control groups.

Instruments

Sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI) questionnaire, which is a widely used instrument for assessing subjective sleep quality in clinical and research settings. The PSQI instrument consists of 19 self-reported items that evaluate seven sleep components, including subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. Each component score ranges from 0 to 3, and the

total global PSQI score ranges from 0 to 21, where higher scores indicate poorer sleep quality.

The PSQI instrument was selected because it has demonstrated strong validity and reliability across various populations, including elderly individuals. A global PSQI score greater than 5 indicates poor sleep quality, while a score of 5 or below indicates good sleep quality. In this study, the PSQI questionnaire was administered twice to each participant, including before the intervention (pretest) and after the intervention period (posttest). The researchers provided clear instructions to participants to ensure accurate responses, and assistance was provided to participants who experienced difficulty in completing the questionnaire.

Intervention

The intervention in this study consisted of lavender aromatherapy administered through inhalation using an essential oil diffuser. Lavender essential oil was selected due to its widely reported sedative and anxiolytic properties that may contribute to relaxation and sleep improvement. Participants in the intervention group received aromatherapy exposure every night before bedtime for a duration of 30 minutes over a 14-day intervention period.

The diffuser device was placed in the participant's sleeping environment at a safe distance to ensure adequate diffusion of lavender aroma throughout the room. Approximately 3–5 drops of lavender essential oil diluted in water were used for each aromatherapy session according to aromatherapy safety recommendations. The intervention was implemented at the same time each night to maintain consistency in treatment exposure. Participants in the control group continued to receive routine care without any aromatherapy intervention during the study period. This approach allowed the researchers to compare the changes in sleep quality between participants receiving aromatherapy and those receiving standard care.

Data Collection

Data collection was conducted over a two-week study period. At the beginning of the study, researchers provided detailed explanations about the study objectives, procedures, and participant responsibilities. After obtaining informed consent, baseline data were collected from all participants using the PSQI questionnaire to assess pre-intervention sleep quality.

The intervention group then received lavender aromatherapy each evening for the next 14 consecutive days, while the control group did not receive any aromatherapy treatment. Researchers monitored the intervention implementation daily to ensure adherence and consistency in the intervention protocol. At the end of the two-week period, participants from both groups completed the PSQI questionnaire again to measure post-intervention sleep quality. Researchers ensured that data collection procedures were conducted consistently across both groups to reduce measurement bias.

Data Analysis

Data analysis was conducted using statistical software to evaluate the effect of the lavender aromatherapy intervention on sleep quality. Descriptive statistics were first performed to summarize participant characteristics, including age, gender, and baseline sleep quality scores. The normality of the data distribution was examined using appropriate statistical tests to determine the suitability of parametric analysis.

To examine changes in sleep quality within each group, the paired t-test was applied to compare pretest and posttest PSQI scores within the intervention group and the control group. This analysis allowed the researchers to determine whether significant improvements in sleep quality occurred following the aromatherapy intervention. Furthermore, the independent t-test was used to compare the mean differences in PSQI scores between the intervention group and the control group. The significance level for statistical analysis was set at $p < 0.05$, indicating that differences with a probability value below this threshold were considered statistically significant.

Ethical Consideration

This study adhered to ethical principles for human subject research. Ethical approval for the study was obtained from the Institutional Research Ethics Committee before data collection began. All participants received clear explanations regarding the purpose of the study, research procedures, potential benefits, and possible risks associated with participation. Participants were informed that their participation was voluntary and that they had the right to withdraw from the study at any time without any negative consequences.

Written informed consent was obtained from each participant prior to enrollment in the study. Confidentiality of participant information was maintained by assigning identification codes to all collected data. Personal identifiers were removed from the dataset to protect participant privacy. The aromatherapy intervention used in this study followed established safety standards to ensure that the procedure did not pose any health risks to participants. Researchers also monitored participants during the intervention period to detect any potential adverse reactions related to essential oil exposure.

Results

This study involved 60 elderly participants who were randomly allocated into the intervention and control groups. Table 1 presents the demographic characteristics of participants in both groups. The distribution of age, gender, and duration of sleep disturbance was analyzed to ensure comparability between the intervention and control groups. Table 1 shows that the baseline characteristics between the two groups were relatively similar, indicating that both groups were comparable before the intervention was administered. Table 1 also demonstrates that no substantial demographic imbalance occurred between groups, which supports the internal validity of the study findings.

Table 1. Demographic Characteristics of Participants

Characteristics	Intervention (n=30)	Control (n=30)	p-value
Age (years), mean ± SD	69.4 ± 6.1	70.1 ± 6.4	0.63
Gender (Female), n (%)	18 (60.0%)	17 (56.7%)	0.79
Gender (Male), n (%)	12 (40.0%)	13 (43.3%)	
Duration of sleep disturbance (months), mean ± SD	8.2 ± 3.1	8.5 ± 3.4	0.71
Presence of chronic disease, n (%)	16 (53.3%)	15 (50.0%)	0.80

Table 1 shows that the mean age of participants in the intervention group was 69.4 ± 6.1 years, whereas the mean age in the control group was 70.1 ± 6.4 years, indicating comparable age distribution between groups. Table 1 also shows that the majority of participants in both groups were female, with 60.0% in the intervention group and 56.7% in the control group. Table 1 further indicates that the average duration of sleep disturbance among participants was similar in both groups, suggesting that participants experienced comparable baseline sleep problems. Table 1 demonstrates that more than half of the participants in both groups reported having chronic diseases, which is common among elderly populations. Overall, Table 1 confirms that there were no statistically significant differences in baseline characteristics between groups, indicating that both groups were comparable prior to the intervention.

Table 2 presents the comparison of Pittsburgh Sleep Quality Index (PSQI) scores before and after the intervention in both groups. Table 2 displays the mean and standard deviation values of sleep quality scores measured at baseline (pretest) and after the 14-day intervention period (posttest). Table 2 also includes the results of paired t-test analyses within each group to evaluate changes in sleep quality over time

Table 2. Changes in Sleep Quality (PSQI Score) Before and After Intervention

Group	Pretest Mean ± SD	Posttest Mean ± SD	Mean Difference	p-value
Intervention	11.3 ± 2.1	6.2 ± 1.8	-5.1	<0.001
Control	11.5 ± 2.3	11.4 ± 2.2	-0.1	0.71

Table 2 shows that the baseline PSQI score in the intervention group was 11.3 ± 2.1, indicating poor sleep quality before the aromatherapy intervention. Table 2 also shows that the PSQI score in the intervention group decreased to 6.2 ± 1.8 after the 14-day aromatherapy intervention, indicating a substantial improvement in sleep quality. Table 2 further demonstrates that the mean reduction in PSQI score in the intervention group was 5.1 points, which represents a clinically meaningful improvement in sleep quality. Table 2 indicates that the paired t-test analysis showed a statistically significant difference between pretest and posttest scores in the intervention group (p <

0.001). In contrast, Table 2 shows that the control group experienced minimal change in PSQI score from 11.5 ± 2.3 to 11.4 ± 2.2, indicating that sleep quality remained largely unchanged without intervention.

To determine whether lavender aromatherapy produced significantly different outcomes compared with the control condition, an independent t-test was conducted. Table 3 presents the comparison of post-intervention PSQI scores between the intervention and control groups

Table 3. Comparison of Post-Intervention Sleep Quality Between Groups

Variable	Intervention (n=30) Mean ± SD	Control (n=30) Mean ± SD	Mean Difference
Posttest PSQI Score	6.2 ± 1.8	11.4 ± 2.2	-5.2

Table 3 shows that the post-intervention PSQI score in the intervention group was 6.2 ± 1.8, whereas the post-intervention PSQI score in the control group was 11.4 ± 2.2. Table 3 indicates that the mean difference in sleep quality scores between groups after the intervention was 5.2 points, favoring the intervention group. Table 3 further demonstrates that the independent t-test revealed a statistically significant difference between the intervention and control groups (p < 0.001). Table 3 therefore indicates that lavender aromatherapy significantly improved sleep quality among elderly participants compared with those who did not receive the intervention. Table 3 confirms that lavender aromatherapy had a positive and measurable effect on sleep quality in elderly patients within the study population.

Discussion

The results of this study indicate that lavender aromatherapy significantly improved sleep quality among elderly patients after a 14-day intervention

period. The baseline PSQI scores in both groups showed that participants initially experienced poor sleep quality before the intervention was administered. The intervention group demonstrated a substantial reduction in PSQI scores after receiving lavender aromatherapy. In contrast, the control group did not show meaningful changes in sleep quality during the same observation period. The comparison between groups after the intervention also revealed significant differences in sleep quality outcomes. These findings suggest that lavender aromatherapy may serve as an effective non-pharmacological approach for improving sleep quality among elderly patients.

Sleep quality plays an essential role in maintaining physiological stability, emotional regulation, and cognitive performance across the human lifespan (Baranwal et al., 2023). Aging processes often alter sleep architecture and increase the risk of insomnia and fragmented sleep patterns in elderly populations (Miller & Howarth, 2023).

Epidemiological studies demonstrate that sleep disorders frequently occur in adult and elderly populations and contribute to substantial health burdens (McArdle et al., 2020). Sleep disturbances also increase the risk of metabolic disorders such as obesity and cardiovascular disease among aging individuals (Lee & Cho, 2022). Community studies show that inadequate sleep hygiene awareness is associated with increased prevalence of sleep problems among adults (Qi et al., 2023). Population-based research also reports that sleep problems are widely prevalent in different populations and require effective interventions (Shaheen & Alkaid Albqoor, 2022).

Sleep disturbances among elderly individuals frequently coexist with psychological problems such as anxiety and depression that negatively influence quality of life (Yin et al., 2023). Long-term sleep disruption also contributes to increased depressive symptoms among aging populations (Duan & Wang, 2023). Chronic health conditions such as diabetes also contribute to the development of sleep disorders among older adults (Schipper et al., 2021). Neurological disorders further complicate sleep patterns and may require targeted therapeutic interventions (Bjerknes et al., 2020). Clinical therapies targeting sleep mechanisms demonstrate improvements in sleep perception and sleep outcomes among patients with sleep disorders (Lee et al., 2023). Therefore, sleep improvement interventions remain a critical component of geriatric health management.

Non-pharmacological approaches have increasingly been recommended for managing sleep disturbances among older adults. Behavioral interventions such as cognitive behavioral therapy have been shown to improve insomnia and psychological symptoms (Kalmbach et al., 2019). Complementary therapies such as music therapy have also demonstrated benefits for sleep improvement and mental health outcomes (Gassner et al., 2022). Relaxation-based approaches have further contributed to improvements in sleep quality and psychological well-being in various patient populations (Pouraboli et al., 2019). Aromatherapy has

emerged as one of the promising complementary interventions for sleep management in clinical practice (Farrar & Farrar, 2020). These approaches offer advantages because they are generally safe, non-invasive, and easy to implement in healthcare settings.

Lavender essential oil represents one of the most frequently studied aromatherapy agents for improving sleep quality. Neuropharmacological evidence suggests that lavender essential oil interacts with the central nervous system and influences neurotransmitter activity related to relaxation and sleep regulation (Soares et al., 2021). Lavender aromatherapy also demonstrates anxiolytic and sedative properties that contribute to improved sleep outcomes (Bavarsad et al., 2023). Clinical studies report that inhalation of lavender essential oil improves sleep quality among patients with cancer and other chronic conditions (Hamzeh et al., 2020). Randomized controlled trials also show that aromatherapy interventions significantly improve sleep quality and reduce fatigue among elderly individuals (Genç et al., 2020). Similar studies demonstrate improvements in sleep quality among hospitalized elderly patients receiving lavender aromatherapy interventions (Givi et al., 2019).

Evidence from systematic reviews and meta-analyses also supports the therapeutic role of aromatherapy in sleep improvement. A systematic review and meta-analysis reports that aromatherapy interventions significantly improve sleep quality among adult and elderly populations (Her & Cho, 2021). Another meta-analysis indicates that aromatherapy provides beneficial effects in reducing insomnia symptoms and improving sleep patterns (Tang et al., 2021). Clinical studies further demonstrate that aromatherapy interventions improve sleep quality and psychological well-being in postpartum women and cancer patients (Chen et al., 2022; Liu et al., 2022). Randomized trials also show that aromatherapy interventions improve sleep quality among healthcare workers exposed to occupational stress (Hsu et al., 2021). These findings indicate that aromatherapy provides consistent benefits across various populations and healthcare settings.

The present findings also align with previous clinical studies evaluating aromatherapy interventions in different patient groups. Research conducted among palliative care patients reports that lavender essential oil significantly improves sleep quality and physiological stability (Yıldırım et al., 2020). Studies conducted among cardiac patients also demonstrate improvements in sleep quality after aromatherapy interventions (Rafi et al., 2020). Additional research indicates that aromatherapy improves psychological well-being and sleep quality among patients experiencing sleep disturbances (Zhang, 2022). Aromatherapy interventions also demonstrate beneficial effects in neurological patients with sleep disorders (Zheng, 2020). These findings collectively support the role of lavender aromatherapy as a complementary intervention in clinical sleep management.

Although aromatherapy demonstrates promising results, several considerations remain important for clinical practice and future research. Sleep quality is influenced by multiple biological, psychological, and environmental factors that interact in complex ways (Matsui et al., 2021). Aromatherapy interventions may therefore function as supportive treatments rather than standalone therapeutic approaches (Farrar & Farrar, 2020). Integrating aromatherapy with other behavioral or psychosocial interventions may provide more comprehensive sleep management strategies (Gassner et al., 2022). Future studies should also explore longer intervention periods and larger sample sizes to strengthen evidence regarding aromatherapy effectiveness. Further research may also evaluate different delivery methods and dosage protocols for essential oil interventions. Such efforts will contribute to the development of evidence-based complementary therapies for improving sleep quality among elderly populations.

Conclusion and Recommendation

Lavender aromatherapy demonstrated a significant positive effect on sleep quality among elderly patients after a 14-day intervention period. The intervention group showed substantial improvement in PSQI scores compared with the control group, indicating that inhalation of lavender essential oil can effectively enhance sleep quality in elderly individuals. Lavender aromatherapy represents a safe, simple, and non-pharmacological approach that may be integrated into geriatric nursing care to support sleep management. Healthcare providers may consider incorporating aromatherapy as a complementary intervention in elderly care settings to improve patient comfort and well-being. Future research should investigate larger populations and longer intervention durations to strengthen clinical evidence and optimize aromatherapy protocols for sleep management in elderly patients.

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