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Article

Effectiveness of Sandalwood Aromatherapy on Sleep Quality in Elderly Patients with Hypertension: A Gerontological Nursing Case Study at Wanaseraya Social Care Home

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ABSTRACT

Background: Hypertension is a major public health concern associated with increased risks of cerebrovascular and cardiovascular disease. Elderly patients with hypertension often experience poor sleep quality, which further aggravates their condition. Non-pharmacological interventions, such as aromatherapy, are increasingly recognized as effective adjuncts for improving sleep quality.

Objective: This study examined the effectiveness of sandalwood aromatherapy as a non-pharmacological nursing intervention to improve sleep quality among elderly patients with hypertension residing at Wanaseraya Social Care Home, Denpasar, Bali.

Methods: A qualitative case study design was employed involving three elderly patients (aged 62–65 years) with hypertension and documented sleep disturbances. The intervention consisted of sandalwood aromatherapy administered via electric vaporizer for 30 minutes nightly over three consecutive nights. Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI) at baseline and post-intervention. Nursing care was documented in accordance with Indonesian Nursing Standards (SDKI, SIKI, SLKI).

Results: All three patients demonstrated measurable improvement in sleep quality. PSQI scores decreased from poor (6–7) to good (5) following three sessions of aromatherapy. Subjective reports indicated reduced nocturnal awakenings, faster sleep onset, and greater overall satisfaction with sleep.

Conclusion: Sandalwood aromatherapy delivered via electric vaporizer is an effective, safe, and practical non-pharmacological intervention for reducing sleep disturbances in elderly hypertensive patients. Incorporating this approach into routine gerontological nursing care at social care homes is recommended.

Keywords: Sandalwood aromatherapy, hypertension, sleep disturbance, elderly, gerontological nursing

INTRODUCTION

Hypertension—defined as sustained blood pressure ≥140/90 mmHg is one of the most prevalent non-communicable diseases globally and serves as a primary risk factor for cerebrovascular and cardiovascular diseases. Globally, high blood pressure is responsible for approximately 62% of cerebrovascular disease cases and 49% of ischemic heart disease cases (Fitriani & Mutmainah, 2022). In Indonesia, the epidemiological burden of hypertension is substantial, with a prevalence that scales sharply among the elderly population.

Sleep disturbances are highly prevalent in older adults, affecting approximately 50% of community-dwelling elderly individuals aged 65 years and above, and up to 66% of those residing in long-term care facilities (Safinatunnajah et al., 2024). Among elderly patients with hypertension, sleep quality is particularly compromised. Dysregulation of the sympathetic nervous system—a hallmark of hypertension—leads to altered nocturnal blood pressure dynamics and disrupted sleep architecture. Conversely, poor sleep quality contributes to elevated cortisol secretion and heightened sympathetic activity, further raising blood pressure and creating a bidirectional, self-perpetuating cycle of sleep disruption and hypertensive exacerbation (Ratri et al., 2022).

The consequences of poor sleep quality in this population extend well beyond cardiovascular risk. Chronic sleep deprivation impairs immune function, accelerates metabolic deterioration, and adversely affects cognitive performance and functional independence. For elderly residents in social care homes, where physical activity is already limited, reduced sleep quality compounds physical vulnerability and severely diminishes overall quality of life (Oktaviasari & Hermawan, 2023).

Contemporary hypertension management emphasizes a multimodal approach encompassing both pharmacological and non-pharmacological strategies. Among non-pharmacological interventions, aromatherapy has garnered increasing research attention. Aromatherapy utilizing essential oils exerts its effects through the olfactory pathway, whereby inhaled volatile compounds stimulate the limbic system, hypothalamus, and pituitary gland. This stimulation facilitates the release of calming neurotransmitters, such as serotonin and endorphins, thereby promoting systemic relaxation and sedation (Pratiwi, 2020).

Sandalwood (Santalum album) essential oil is particularly notable for its sedative and anxiolytic (anxiety-reducing) properties. Its primary bioactive constituents—including santalol, santalen, santen, santenon, santalal, santalon, and isovalerylaldehyde—collectively exert a calming, sleep-promoting effect on the central nervous system (Wijayanti & Setiawan, 2020). Preliminary evidence supports its clinical utility in reducing insomnia severity among vulnerable populations, including elderly individuals and menopausal women (Latupeirissa, 2018; Putri, 2023).

Despite this emerging evidence base, the application of sandalwood aromatherapy within structured gerontological nursing care remains underexplored, particularly within the Indonesian long-term care context. This case study addresses this gap by analyzing the effectiveness of sandalwood aromatherapy, delivered via an electric vaporizer, as a targeted nursing intervention for sleep disturbance in elderly hypertensive patients at Panti Sosial Tresna Werdha Wanaseraya, Denpasar, Bali.

METHODS

Study Design

This study utilized a descriptive multiple-case study design to systematically evaluate the application and clinical outcomes of sandalwood aromatherapy within a structured gerontological nursing care framework. A case study approach was selected for its capacity to provide a granular, contextually rich, and longitudinal

examination of nursing interventions and patient responses within a real-world institutional care environment. By tracking multiple cases concurrently, this descriptive design allowed for the identification of shared patterns as well as unique variations in response to the nursing intervention, bridging the gap between clinical theory and practical gerontological nursing.

Setting and Participants

The study was conducted at Panti Sosial Tresna Werdha Wanaseraya, a government-operated social residential facility located in Denpasar, Bali, Indonesia, which housed a total resident population of 35 elderly individuals (11 male, 24 female) at the time of the investigation. A purposive sampling strategy was employed to recruit three elderly residents as case subjects based on rigorous inclusion and exclusion criteria. To be included, participants were required to be aged 60 years or older, have a formally confirmed medical diagnosis of hypertension under a stable, ongoing pharmacological regimen, and present with documented subjective sleep disturbances persisting for less than three consecutive months. Additionally, candidates had to exhibit a baseline Pittsburgh Sleep Quality Index (PSQI) global score greater than 5 to objectively establish poor sleep quality, and demonstrate an absence of known contraindications to essential oil inhalation, such as active reactive airway diseases, severe allergic rhinitis, or documented hypersensitivity to aromatic compounds. Individuals were excluded if they presented with severe cognitive impairment, operationalized as a Mini-Mental State Examination (MMSE) score less than 20, or significant depressive symptomatology, operationalized as a Geriatric Depression Scale (GDS) score greater than 9. Notably, all three selected participants exhibited maximum scores on the Modified Barthel Index, confirming complete functional independence in activities of daily living and thereby eliminating physical disability as a primary confounding variable for sleep architecture disruption.

Participant Profile

The clinical and demographic characteristics of the three case subjects at baseline revealed distinct yet comparable profiles. Participant Ny. S was a 65-year-old female with a two-year history of essential hypertension who reported a one-week onset of frequent nocturnal awakenings, presenting with a baseline blood pressure of 150/80 mmHg and a global PSQI score of 6. The second participant, Ny. W, was a 62-year-old female with a two-year history of essential hypertension who presented with a two-week history of sleep fragmentation that was clinically observed to be exacerbated by prolonged, unstructured daytime napping; her baseline parameters included a blood pressure of 130/70 mmHg and a global PSQI score of 7. The third participant, Tn. H, was a 62-year-old male with a one-year history of essential hypertension who experienced a one-week history of sleep-onset insomnia secondary to excessive daytime sedentary behaviors and napping, entering the study with a baseline blood pressure of 140/80 mmHg and a global PSQI score of 7. For pharmacological consistency, all three participants were maintained on an identical, standardized antihypertensive regimen consisting of Amlodipine (5 mg) administered orally once daily, and no alterations were made to their medication types, dosages, or administration schedules throughout the study period.

Intervention

The aromatherapy intervention utilized a premium, commercially sourced essential oil derived from pure Santalum album (Sandalwood), verified for its bioactive chemical profile. The standardized administration protocol began daily with solution preparation, where precisely 15 drops of pure sandalwood essential oil were diluted into 10 ml of sterile water within the reservoir of an electric ultrasonic cold-mist vaporizer, freshly prepared immediately prior to each session to prevent volatile degradation. Environmental optimization was then executed at 19:45 local time in each resident's private room to control for confounding sensory stimuli; artificial lighting was dimmed, windows were closed to eliminate ambient outdoor drafts, and noise levels were minimized to establish a baseline state conducive to rest. The ultrasonic vaporizer apparatus was positioned on a stable bedside surface exactly 60 cm away from the patient's head, ensuring an adequate inhalation density of the diffused volatile compounds without causing mechanical or acoustic disruption. The controlled inhalation session was initiated at approximately 20:00 local time, immediately preceding scheduled sleep, for three consecutive nights. Participants were instructed to assume a comfortable supine or semi-Fowler's position and breathe normally through the nose for a 30-minute exposure duration, while nursing staff continuously supervised the session to monitor for adverse effects such as coughing, headaches, or dizziness.

Assessment Tools and Data Collection

The primary outcome measure of sleep quality was quantitatively evaluated using the Indonesian version of the Pittsburgh Sleep Quality Index (PSQI), a validated 18-item self-report instrument. This scale evaluates sleep patterns across seven distinct clinical domains, including subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction, where each domain is scored on a 0–3 scale to culminate in a global score range of 0 to 21. A global score of 5 or less denotes good sleep quality, whereas a score greater than 5 indicates poor sleep quality, with screening performed at baseline (Day 0) and a post-intervention reassessment completed on the morning following the final aromatherapy session (Day 4). Secondary outcome measures and clinical status were monitored through vital signs—including blood pressure, pulse rate, respiratory rate, and axillary temperature—which were measured and recorded daily at fixed intervals to ensure systemic safety. Furthermore, baseline cognitive, functional, and psychological screening was conducted using the Mini-Mental State Examination (MMSE) to ensure the participant's capacity to reliably report subjective sleep metrics, the Modified Barthel Index to verify baseline physical independence, and the short-form 15-item Geriatric Depression Scale (GDS-15) to rule out underlying affective disorders that could primarily drive sleep disturbances.

Ethical Considerations

This study was executed in strict accordance with the Declaration of Helsinki, ensuring the protection and rights of all human subjects. Prior to participant enrollment, formal institutional ethical approval was reviewed and granted by the Institutional Review Board of STIKES Bina Usada Bali, alongside administrative authorization from the management of Panti Sosial Tresna Werdha Wanaseraya.

Written informed consent was obtained from all participants or their legally authorized representatives after they were thoroughly briefed via an information sheet detailing the study's explicit objectives, step-by-step procedures, potential minor risks such as temporary olfactory sensitivity, and their absolute right to withdraw from the trial at any point without penalty or compromise to their standard care. To guarantee data privacy and permanent confidentiality, all personal identifiers were removed from the records and replaced with alphanumeric codes, such as Ny. S, Ny. W, and Tn. H, on all data collection sheets, analytical files, and subsequent manuscripts.

RESULTS

Patient Characteristics

All three participants were elderly residents of Panti Sosial Tresna Werda Wanaseraya with controlled hypertension receiving Amlodipine 5 mg daily. They were functionally independent (Barthel Index: 130), cognitively intact (MMSE: 22–25), and without significant depressive symptoms (GDS: 4–8, within the normal range). None reported use of hypnotic medications. Their primary nursing diagnosis was Impaired Sleep Pattern related to inadequate sleep control (SDKI D.0055), manifested by frequent nocturnal awakening and difficulty re-initiating sleep.

Sleep Quality Outcomes

Table 1 summarizes the PSQI scores before and after the three-night intervention for all three participants.

Table 1. PSQI Score Changes Pre- and Post-Intervention

Patient	Age/Sex	PSQI Pre	PSQI Post	BP Post (mmHg)
Ny.S	65 / Female	6 (Poor)	5 (Good)	140/80
Ny.W	62 / Female	7 (Poor)	5 (Good)	120/80
Tn.H	62 / Male	7 (Poor)	5 (Good)	130/70

PSQI: Pittsburgh Sleep Quality Index; BP: Blood Pressure; Post: measured on morning after third intervention night.

All three patients progressed from poor sleep quality (PSQI >5) to good sleep quality (PSQI ≤5) over the course of the three-night intervention. Ny.S improved from a baseline PSQI of 6 to 5, with reported reduction in nocturnal awakening frequency and easier return to sleep by the third night. Ny.W showed the most notable subjective improvement, progressing from a baseline score of 7 to 5, with staff reporting decreased daytime napping duration as a contributing factor. Tn.H similarly improved from 7 to 5, with documented improvement in sleep initiation by the second session. In all cases, blood pressure showed a modest downward trend by the final evaluation, and all patients appeared visibly relaxed following each session.

DISCUSSION

The results of this case study demonstrate that sandalwood aromatherapy, delivered via electric vaporizer for 30 minutes nightly over three consecutive nights, effectively improved sleep quality in all three elderly hypertensive patients, as

evidenced by a reduction in PSQI scores from poor to good. These findings are consistent with and add practical clinical value to the existing body of evidence.

The primary mechanism through which sandalwood aromatherapy exerts its sleep-promoting effects is through olfactory stimulation. Volatile santalol molecules, upon inhalation, activate olfactory receptors that transmit signals to the limbic system—specifically the amygdala and hippocampus—and the hypothalamus, triggering the release of calming neurotransmitters and reducing sympathetic nervous system activity (Pratiwi, 2020). Santalol also demonstrates alpha-santalol activity, which has been associated with the inhibition of the 5-HT2A receptor, producing anxiolytic and sedative effects analogous to benzodiazepines but without their adverse profiles. This pharmacological rationale aligns with the clinical improvements observed in this study.

The use of an electric ultrasonic vaporizer as the delivery mechanism is a practically significant finding. Ultrasonic vaporizers generate a fine, cool mist through high-frequency vibration, preserving the chemical integrity of the essential oil and ensuring consistent, particle-optimized delivery that facilitates absorption through the nasal mucosa and into the systemic circulation (Pratiwi, 2020). This mode of delivery is particularly suitable for elderly patients in institutional settings: it is non-invasive, low-maintenance, free of open flame, and does not produce respiratory irritants. The practical simplicity of this method enhances its feasibility for integration into routine nursing care at social care homes.

The association between hypertension and sleep disturbance observed in this case study corroborates the established bidirectional relationship. Among the participants, sympathetic nervous system overactivation—a feature of poorly controlled or age-related hypertension—is likely to have contributed to nocturnal arousal and difficulty maintaining sleep continuity. By attenuating sympathoadrenal activation through the olfactory-limbic pathway, sandalwood aromatherapy appears to interrupt this cycle, facilitating more restful sleep and, consequently, contributing to the modest blood pressure reduction observed at follow-up (Wijayanti & Setiawan, 2020; Ratri et al., 2022).

These findings are broadly consistent with previous research. Latupeirissa (2018) demonstrated significant improvement in sleep quality among elderly residents of a nursing home in Yogyakarta following sandalwood aromatherapy, with a p-value of 0.000 using the McNemar test. Her and colleagues (2021) similarly reported that seven days of aromatherapy intervention reduced client PSQI scores from poor (8) to good (5). The current study extends these findings to a structured nursing care context and documents outcomes for three patients across sequential case assessments. Conversely, Fauzan et al. (2019), using EEG-based sleep efficiency metrics, found only modest average effects of sandalwood stimulation (~7.95% improvement), highlighting the relevance of individual physiological variability and the importance of subjective alongside objective outcome measurement.

From a gerontological nursing perspective, the application of this intervention aligns with the Indonesian Nursing Standard for Sleep Support Intervention (SIKI I.05174), which explicitly endorses non-pharmacological approaches—including complementary therapies—for managing sleep disturbance (Tim Pokja SIKI DPP

PPNI, 2018). The ability to train care staff to deliver this intervention independently, as demonstrated in this study, reinforces its scalability and sustainability in resource-limited care home settings. The absence of adverse effects or contraindications further supports its safety profile in this population.

Several limitations warrant acknowledgment. As a single-facility, three-patient case study, the generalizability of findings is inherently constrained. The absence of a control group precludes causal attribution, and the short observation period (three nights) does not allow conclusions about long-term efficacy or optimal treatment duration. Additionally, the contribution of concurrent nursing educational interventions (sleep hygiene counseling, daytime napping restriction) cannot be fully disentangled from the specific aromatherapy effect. Future research should employ randomized controlled designs with larger samples, objective sleep monitoring, and extended follow-up periods to more rigorously evaluate the efficacy and mechanisms of sandalwood aromatherapy in this population.

CONCLUSION

This case study demonstrates that a structured sandalwood aromatherapy protocol, administered via electric vaporizer for 30 minutes nightly over three consecutive nights, effectively improved sleep quality in elderly patients with hypertension residing at Wanaseraya Social Care Home, as reflected by improvement in PSQI scores from the poor to the good category. The intervention was well tolerated, practically feasible, and consistent with Indonesian nursing standards for non-pharmacological sleep support. These findings support the integration of sandalwood aromatherapy into gerontological nursing care practice as a complementary strategy for managing sleep disturbance in hypertensive elderly patients. Larger, controlled studies are warranted to confirm these outcomes and optimize the intervention protocol.

CONFLICT OF INTEREST

The authors stated there is no conflict of interest in this study.

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