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The Effect of Peppermint Essential Oil Administration on Sleep Quality in Asthma Patients of the Manggarai Flores-NTT Tribe

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ABSTRACT
Asthma is a heterogeneous disease, commonly characterized by chronic airway inflammation and symptoms such as wheezing, shortness of breath, chest tightness, and coughing of varying intensity. These symptoms often lead to sleep disturbances at night among asthma patients. Approximately 80% of the global population uses traditional medicine, including essential oils (EO), such as peppermint EO, to address primary health concerns. This study employed a quasi-experimental design with a pretest-posttest control group design. The total sample consisted of 49 respondents, with 25 assigned to the intervention group and 24 to the control group. The results revealed a significant improvement in sleep quality between the pre-test and post-test in the intervention group (p-value = 0.000; $\alpha < 0.05$), as well as a significant difference in sleep quality between the intervention and control groups post-intervention (p-value = 0.000; $\alpha < 0.05$). Peppermint essential oil was found to positively influence the sleep quality of asthma patients and can therefore be considered a complementary approach to improving their sleep.

Keywords: Asthma, Essential Oil, Peppermint Oil, Sleep Quality

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INTRODUCTION

Asthma is a bronchial disorder characterized by periodic, reversible bronchospasms (2). According to the Global Initiative for Asthma (14), asthma is a heterogeneous disease typically marked by chronic airway inflammation. It is identified by a history of respiratory symptoms such as wheezing, shortness of breath, chest tightness, and variable coughing in terms of time and intensity, along with fluctuating expiratory airflow limitation. The World Health Organization (39) reported that asthma affected approximately 262 million people globally in 2019 and caused 461,000 deaths. Around 300 million people have been diagnosed with asthma worldwide (15), and it is estimated that about 250,000 people die prematurely from asthma each year (4). If current trends continue, approximately 100 million more people may suffer from asthma by 2025 (15).

In Indonesia, based on the Household Health Survey, asthma ranks as the fourth leading cause of death, contributing to 5.6% of overall mortality. The national prevalence rate is approximately 13 per 1,000 population. The highest incidence is found in Central Sulawesi Province (7.8%) and East Nusa Tenggara Province (7.3%), whereas Bengkulu Province reports a rate of 2.0% (20). According to the 2018 Basic Health Research, the prevalence of asthma recurrence in East Nusa Tenggara over the past 12 years is approximately 64%. A common complaint among asthma patients is difficulty sleeping at night.

Nocturnal asthma attacks are associated with circadian rhythms—physiological processes that follow a 24-hour cycle regulated internally and influenced by external factors such as light and temperature (38).

Nighttime asthma attacks occur due to the dominant activity of the parasympathetic nervous system over the sympathetic system during sleep. This dominance leads to bronchial smooth muscle contraction, triggering asthma attacks and reducing sleep quality (8). A study by Alanzi et al, involving 200 asthma patients found that 66% experienced poor sleep quality (1). Similarly, Braido et al reported that 58.3% of asthma patients had sleep disturbances (Pittsburgh Sleep Quality Index [PSQI] score > 5), with an average PSQI score of 5.68 (SD = 3.4) (5). Tinschert et al, using mixed-effects regression analysis, demonstrated a statistically significant relationship between nocturnal cough, sleep quality, and asthma control ($p < 0.05$) (36).

Sleep quality refers to an individual's ability to achieve restful and restorative sleep, encompassing both quantitative aspects (e.g., duration, sleep latency) and subjective perceptions of sleep. High-quality sleep is characterized by the ability to maintain continuous sleep and achieve appropriate stages of REM and NREM. According to Campos et al, poor sleep quality can contribute to depression, impaired concentration, and reduced productivity (6).

Beyond pharmacological interventions such as inhaled corticosteroids for reducing nocturnal asthma attacks, non-pharmacological approaches have shown promise. For instance, essential oils have been found to help relax the airways. Masomeh et al. (2017) noted that over 80% of the global population uses traditional and herbal medicine, including aromatherapy with essential oils, for their primary healthcare needs (28). Aromatherapy is generally considered safe, with minimal side effects. Lin et al, reported that aromatherapy can improve sleep quality, reduce stress, and alleviate depression in healthy individuals. It works by relieving emotional stress and stabilizing mood through inhalation (24).

Various plants produce essential oils—such as peppermint, bergamot, lemon, citronella, lavender, jasmine, eucalyptus, ylang-ylang, and rose—each with specific therapeutic uses. Research by Kim et al demonstrated that peppermint essential oil (EO), derived from Mentha species, improved bronchial asthma symptoms induced by histamine and ovalbumin (OVA) (21). Peppermint affects the hypothalamus by stimulating the olfactory pathway, reducing corticotropin-releasing hormone, and lowering cortisol secretion, thereby reducing anxiety and enhancing sleep (16). Unlike many other oils, peppermint EO has been found to positively influence respiratory rate, heart rate, blood pressure, fatigue, and anxiety. It can relax bronchial muscles, improve oxygenation in the lungs and brain, enhance cerebral perfusion, improve lung ventilation, and reduce pain (29-31).

Peppermint oil is also commonly used to relieve symptoms of coughs, colds, bloating, and other digestive issues. Rajani et al, stated that essential oils contain volatile molecules with bactericidal and virucidal properties, making them useful in respiratory disease management (33). Menthol, a major component of peppermint, acts as a decongestant by shrinking swollen nasal membranes, facilitating easier breathing, and thinning mucus in the lungs (36).

Considering the high prevalence of sleep disturbances among asthma patients and the limited research on the effects of peppermint essential oil on sleep quality, this study aims to investigate "The Effect of Peppermint Essential Oil on the Sleep Quality of Asthma Patients."

METHODS

This study employed a quantitative approach with a quasi-experimental design using a pretest-posttest control group format. A total of 49 respondents participated, consisting of 25 in the intervention group and 24 in the control group, selected through a consecutive sampling technique. The study population included all adult asthma patients who had visited the Todo Community Health Center for at least six months between January 2020 and September 2021.

The inclusion criteria were: respondents aged 17 years or older; patients diagnosed with asthma for at least six months based on medical records; a respiratory rate between 12–20 breaths per minute; absence of wheezing sounds; and no complaints of shortness of breath during data collection. The exclusion criteria included a history of allergies to essential oil aromatherapy and a history of chronic lung diseases such as chronic obstructive pulmonary disease (COPD), emphysema, chronic bronchitis, chronic pneumonia, and lung cancer.

Data were collected using a demographic questionnaire and the Pittsburgh Sleep Quality Index (PSQI) to assess respondents' sleep quality. Upon obtaining ethical clearance and research permission, the researcher conducted a pretest by administering the PSQI questionnaire to both the intervention and control groups.

Once the required number of participants was recruited, the researcher scheduled the administration of the peppermint essential oil (EO) intervention for the intervention group. Follow-up visits were conducted at the respondents' homes once a week for four weeks. The control group did not receive any treatment and only completed the PSQI questionnaire during the pretest and again in a posttest conducted during the fourth week after the initial meeting.

The study was conducted at the Todo Community Health Center, Manggarai, Flores-NTT, over a period of one month.

RESULTS AND DISCUSSION

The univariate analysis in this study describes the characteristics of the respondents and the distribution of sleep

Table 1. Characteristics of Respondents' Age and Sleep Quality in Asthma Patients in the Intervention and Control Groups

Variable	Frequency	Group	Mean	SD
Age	25	Intervention	57.40	11.82
	24	Control	50.54	9.352
Sleep Quality	**Frequency**		**Median**	**Min-Max**
Intervention				
Before	25		16.00	15-19
After	25		5.00	3-5
Control				
Before	24		16.00	15-20
After	24		15.00	15-20

Table 2. Characteristics of Respondents' Gender, Education, Occupation, and Duration of Asthma

Variable	Intervention Group		Control Group	
	Frequency	%	Frequency	%
Gender				
Female	7	28.0	16	66.7
Male	18	72.0	8	33.3
Total	25	100	24	100
Education Level				
1 Low Education	15	60.0	13	54.2
2 Medium Education	10	40.0	9	37.5
3 High Education			2	8.3
Total	25	100	24	100
Occupation				
1 Unemployed	2	8.0	10	41.7
2 Employed	23	92.0	14	58.3
Total	25	100	24	100
Duration of Asthma				
1 6-12 months	5	20.0	13	54.2
2 >12 months	20	80.0	11	45.8
Total	25	100	24	100

Table 3. Analysis of Differences in Sleep Quality Before and After Intervention of Peppermint Essential Oil in the Intervention Group

Group	Variable	n	Median	Min-Max	p-value
Intervention	Pretest Sleep Quality	25	16.00	15-19	0.000
	Posttest Sleep Quality	25	5.00	3-5	

Table 4. Analysis of the Difference in Pre-Test and Post-Test Sleep Quality in the Control Group

Group	Variable	n	Median	Min-max	p-value
Control	Pretest Sleep Quality	24	16.00	15-20	0.106
	Posttest Sleep Quality	24	15.00	15-20	

Table 5. Analysis of the Difference in Sleep Quality Score between the Intervention Group and the Control Group

Variable	Group	n	*Mean Rank*	*Sum of Ranks*	p-value
Difference in pre-post test sleep quality	Intervention	49	37.00	925.00	0.000
	Control		12.50	300.00	

quality among asthma patients. Respondent characteristics include age, gender, education, occupation, duration of asthma, and sleep quality. Table 1 presents the characteristics of respondents by age and sleep quality. The average age of respondents in the intervention group was 57.40 years (SD = 11.82), while in the control group it was 50.54 years (SD = 9.35). The median pre-test sleep quality score in the intervention group was 16.00, with a post-test median score of 5.00. Pre-test sleep quality scores ranged from 15 to 19, while post-test scores decreased to a range of 3 to 5.

In the control group, the median pre-test sleep quality score was 16.00 and the post-test score was 15.00. Both pre-test and post-test scores ranged from 15 to 20, indicating no change. Table 2 shows that most respondents in the intervention group were male (72.0%, n = 18), while most in the control group were female (66.7%, n = 16). The majority of respondents in both groups had a low level of education (intervention: 60.0%, n = 15; control: 54.2%, n = 13). Most respondents in the intervention group were employed (92.0%, n = 23), and the same was true for the control group (58.3%, n = 14). Regarding asthma duration, 80.0% (n = 20) of respondents in the intervention group had been diagnosed for more than 12 months, compared to 45.8% (n = 11) in the control group.

Normality testing using the Shapiro-Wilk test showed that sleep quality data in the intervention group were not normally distributed ($p < 0.05$), so the Wilcoxon signed-rank test was used for analysis. As shown in Table 3, there was a significant difference between pre- and post-test sleep quality scores in the intervention group ($p = 0.000$; $\alpha < 0.05$), indicating a significant improvement in sleep quality. The median score decreased from 16.00 to 5.00, along with a decrease in the score range, suggesting enhanced sleep quality after the peppermint essential oil intervention.

In contrast, the Wilcoxon test results for the control group (Table 4) showed no significant difference in pre- and post-test scores ($p = 0.106$; $\alpha < 0.05$), with the score range remaining stable at 15–20. Furthermore, the Mann-Whitney U test (Table 5) showed a significant difference in the change in sleep quality scores between the intervention and control groups ($p = 0.000$; $\alpha < 0.05$), confirming the effectiveness of the peppermint essential oil intervention.

These findings indicate that the administration of peppermint essential oil had a statistically significant impact on sleep quality among asthma patients. The study aimed to determine the effectiveness of peppermint essential oil in improving sleep quality in this population, and the results confirmed a significant improvement in sleep quality following the intervention. Poor sleep quality is known to affect physiological and psychological functions, including fatigue, decreased immunity, and mental health issues such as anxiety and depression (32).

Peppermint essential oil, which contains menthol and menthone, has shown antibacterial, anti-inflammatory, antispasmodic, and decongestant effects (12,18). It enhances the absorption of topical medications and improves respiratory conditions, making it beneficial for asthma (35). According to Meamarbashi and Moss et al, peppermint essential oil increases brain perfusion and lung ventilation, contributing to improved sleep quality (30,31).

Several studies support the efficacy of peppermint aromatherapy in reducing

heart rate, respiratory rate, blood pressure, fatigue, and anxiety (10,30). Mahdavikian et al, also found improvements in sleep quality with peppermint use (27). Though limited studies have directly examined its effects on asthma patients, related findings suggest potential benefits. Abdelhalim (2020) reported that 48.4% of students experienced improved sleep with peppermint use, and 20.9% reported reduced stress.

A review by Lillehei & Halcon (2014) concluded that peppermint, lavender, and jasmine are the most effective essential oils for sleep improvement (23). Blackburn et al. (2017) also found peppermint effective in treating insomnia (3). Mahdavikian et al. (2021) demonstrated a significant improvement in sleep quality among cardiac patients using peppermint oil ($p < 0.001$) (27).

Menthol has long been used in traditional Asian medicine and is now understood to work through sensory nerve modulation (12). Her and Cho (2021) noted that aromatherapy is a simple, low-cost, and effective alternative therapy. Essential oil molecules affect the limbic system, modulating emotions, stress, and physiological responses, leading to improved sleep quality (17).

In conclusion, this study shows that peppermint essential oil effectively improves sleep quality among asthma patients. Despite the lack of prior research on this specific population, these findings can serve as a foundation for future clinical guidelines. However, a limitation of the study is its application to a homogeneous ethnic group (Manggarai-Flores, NTT), which limits the generalizability of the findings to a more diverse asthma population.

LIMITATIONS

This study has several limitations that should be considered by future researchers to achieve more comprehensive results. First, the scope of the study was limited to a single primary health center, which restricts the generalizability of the findings to a broader population. Second, only one type of essential oil—peppermint—was used in this study. Previous research has shown that other essential oils, such as lavender, may also be effective in improving sleep quality. However, due to budget constraints, the researcher was unable to compare the effects of lavender essential oil on the sleep quality of asthma patients.

RESEARCH ETHIC

This study received ethical approval from the Faculty of Nursing, University of Indonesia, under the ethical clearance number Ket-25x/UN2.F12.D1.2.1/PPM.00.02/20xx.

CONFLICT OF INTEREST

The author declares no conflict of interest in this study.

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CONCLUSION

The results of this study indicate that the use of peppermint essential oil significantly improves sleep quality in asthma patients. As a practical and easy-to-implement intervention, peppermint essential oil holds potential for clinical application to enhance sleep quality in this population. These findings may serve as a basis for further research on

the use of aromatherapy to address other respiratory conditions and related sleep disturbances.

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