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The Effect of Combined Cutaneous Stimulation (Massage) and Lavender Aromatherapy on Sleep Quality in Patients with Diabetes Mellitus

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Abstract. Diabetes Mellitus (DM) is a chronic disease often accompanied by sleep disturbances, which can worsen the patient's physiological and psychological conditions. Non-pharmacological interventions such as cutaneous stimulation and lavender aromatherapy are known to increase relaxation and improve sleep quality. This study aims to determine the effect of a combination of cutaneous stimulation and lavender aromatherapy on the sleep quality of DM patients. This study used a pre-experimental design with a one-group pretest–posttest approach in 38 outpatient DM patients selected using a purposive sampling technique. Sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI). The intervention was administered for seven consecutive days. Data analysis was performed using the Wilcoxon Signed Ranks Test. The results showed that before the intervention, most respondents had poor sleep quality (97.4%), whereas after the intervention, the majority of respondents experienced an improvement in sleep quality to good (81.6%). The Wilcoxon test results showed a p value = 0.001 ($p < 0.05$), indicating a significant difference between PSQI scores before and after the intervention. Thus, the combination of cutaneous stimulation and lavender aromatherapy has been proven effective in improving the sleep quality of Diabetes Mellitus patients.

Keywords: Cutan Stimulation; Diabetes Mellitus; Lavender Aromatherapy; PSQI; Sleep Quality.

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1. Background

Changes in global health epidemiology indicate a dominant shift from infectious to non-communicable diseases, one of which is Diabetes Mellitus (DM). DM is a chronic disease caused by impaired insulin production, decreased insulin sensitivity, or a combination of both, characterized by elevated blood glucose levels (Chan, 2016). The World Health Organization (WHO) reports that DM is among the top ten causes of death worldwide and has a rapidly increasing prevalence rate (World Health Organization, 2021).

In Indonesia, the prevalence of diabetes mellitus (DM) continues to increase. Basic Health Research (Riskesdas) data shows that the prevalence of diabetes mellitus increased from 6.9% in 2013 to 8.5% in 2018, while the prevalence of diabetes mellitus diagnosed by doctors increased from 1.2% to 2% (Ministry of Health of the Republic of Indonesia, 2018). At the regional level, Central Java Province also shows a high number of diabetes sufferers, indicating that diabetes remains a public health problem that cannot be optimally controlled (Central Java Provincial Health Office, 2023).

Diabetes mellitus can cause various chronic complications, both microangiopathy and macroangiopathy, such as retinopathy, nephropathy, neuropathy, cardiovascular disease, and other metabolic disorders (Chan, 2016). In addition to physical complications, DM patients also often experience sleep disturbances caused by hyperglycemia, increased frequency of

nighttime urination, and physical discomfort. These sleep disturbances can include difficulty falling asleep, frequent awakenings, and poor sleep quality, which impact cognitive function, emotional stability, and quality of life (Nashori, 2017; Spiegel et al., 2009).

Treatment for sleep disorders in diabetes patients is generally through pharmacological therapy, such as the use of hypnotics and sedatives. However, long-term use of sleeping pills carries the risk of side effects, including dependence, cognitive impairment, and respiratory depression (Davari et al., 2021). Therefore, non-pharmacological therapy is recommended as a safer and more sustainable alternative to improve sleep quality in patients (Morin et al., 2015).

One of the most widely developed non-pharmacological therapies is lavender aromatherapy. Lavender contains the active compounds linalool and linalyl acetate, which have relaxing and sedative effects through central nervous system stimulation, specifically by increasing parasympathetic activity and decreasing sympathetic nervous system activity (Koulivand et al., 2013). Several studies have shown that lavender aromatherapy can significantly improve sleep quality in patients with diabetes mellitus and other chronic patient groups (Shady et al., 2019; Nasiri Lari et al., 2020; Hamzeh et al., 2020; dos Reis Lucena et al., 2021; Davari et al., 2021; Takeda et al., 2017).

Based on these conditions, safe and effective non-pharmacological interventions are needed, one of which is through a combination of cutaneous stimulation and lavender aromatherapy, to improve sleep quality in diabetes mellitus patients.

2. Theoretical Study

Diabetes Mellitus

Diabetes Mellitus (DM) is a group of metabolic disorders characterized by hyperglycemia due to impaired insulin secretion, decreased insulin effectiveness, or both. Insulin plays a crucial role in regulating glucose metabolism and the body's energy balance. Insulin insufficiency or resistance leads to elevated blood glucose levels, which can lead to various chronic complications, such as neuropathy, retinopathy, kidney disease, and an increased risk of cardiovascular disease (Kirkman et al., 2022). DM is classified into type 1 DM, caused by autoimmune destruction of pancreatic beta cells, and the more common type 2 DM, associated with insulin resistance and unhealthy lifestyle factors, such as obesity and physical inactivity (Zhang et al., 2024).

DM Risk Factors

a. Genetic factors
   A family history of DM greatly increases a person's risk of developing this disease
b. Obesity
   Especially the accumulation of visceral fat (fat in the abdomen), is one of the main risk factors for type 2 diabetes. Excess fat can increase insulin resistance.
c. Lack of physical activity
   A sedentary lifestyle, or lack of physical activity, is closely associated with an increased risk of DM.
d. Unhealthy eating patterns
   A diet high in calories, sugar, and saturated fat can contribute to obesity and increase the risk of type 2 diabetes.
e. Age
   The risk of type 2 diabetes increases with age. After age 45, the body begins to experience a decline in its ability to regulate blood glucose levels.
f. Ethnicity
   Some ethnic groups, such as African Americans, Hispanics, Asians, and Native Americans, have a higher risk of developing type 2 diabetes compared to other ethnic groups.
g. Hypertension and dyslipidemia
   High blood pressure and high cholesterol or triglyceride levels are also closely associated with an increased risk of diabetes. These conditions often occur alongside diabetes and increase the risk of cardiovascular complications in people with diabetes.
h. Gestational diabetes
   Women who have had gestational diabetes during pregnancy have a higher risk of developing type 2 diabetes later in life.

i. Stress and sleep disorders
Chronic stress and sleep disorders (such as sleep apnea) can affect the body's hormonal balance, including hormones that regulate glucose levels, which can ultimately increase the risk of diabetes.
j. Smoke
Smoking can increase insulin resistance and contribute to elevated blood glucose levels. This habit also worsens the risk of diabetes complications.

Cutaneous Stimulation

Cutaneous stimulation involves applying physical stimulation to the skin, such as massage or touch, to activate the nervous system and trigger a relaxation response. This intervention can reduce muscle tension, improve blood circulation, and lower stress levels by increasing parasympathetic nervous system activity, thereby promoting feelings of calm and reducing anxiety (Xie et al., 2022). Furthermore, cutaneous stimulation positively contributes to sleep quality by helping calm the nervous system, reducing sleep disturbances, and improving sleep duration and patterns, particularly in individuals with sleep disorders or insomnia (Lee et al., 2023). Types of cutaneous stimulation include massage, tapotement (light tapping), acupressure, electrical stimulation, and vibration therapy.

Lavender Aromatherapy

Lavender aromatherapy is the use of lavender essential oil to provide therapeutic effects on the body and mind. Lavender is known for its calming properties and is often used in various forms, such as essential oils, diffusers, and other body care products. Lavender aromatherapy works by inhaling the vapors of its essential oil, which contains active compounds such as linalool and linalyl acetate, which function to calm the central nervous system, reduce anxiety, and promote relaxation (Zhao et al., 2023).

Sleep Quality

Sleep quality is a comprehensive description of a person's sleep experience, including duration, depth, continuity, and feeling refreshed upon awakening. Good sleep quality is characterized by restful sleep with minimal disturbances and a feeling of refreshment and energy upon awakening. Sleep quality is influenced by various factors, including the sleep environment, stress levels, and the individual's physical and psychological condition (Wang et al., 2023). Furthermore, sleep quality is also assessed based on indicators of adequate sleep duration, sleep cycle continuity, and frequency of nighttime awakenings. Sleep disorders such as insomnia and sleep apnea can reduce sleep quality and impact daytime fatigue. Therefore, sleep quality assessment is generally conducted through subjective and objective approaches, including standardized questionnaires and sleep monitoring tools (Zhao et al., 2022).

3. Research Methods

This study used a quasi-experimental design with a one-group pretest–posttest approach. The sampling technique used was non-probability sampling with a consecutive sampling method. The study population was Diabetes Mellitus (DM) patients aged ≥30 years who were hospitalized at Keluarga Sehat Hospital Pati and experienced sleep disorders. The sample size was determined using the G-Power calculation with a significance level of 5% and a power of 80%, resulting in 38 respondents. The intervention provided was a combination of cutaneous stimulation and lavender aromatherapy, carried out once a day before bed for seven consecutive days. Sleep quality was measured before and after the intervention using the Pittsburgh Sleep Quality Index (PSQI) questionnaire. Data were analyzed by comparing pretest and posttest PSQI scores using statistical tests appropriate to the data distribution, with a significance level of $p < 0.05$. This study was conducted in August 2025, adhering to the principles of research ethics.

4. Results And Discussion

Univariate Analysis

Patient Characteristics

Table 1. Frequency Distribution of Gender.

Variables	Frequency	P percentage
Gender	38	100%

Based on results research, all respondents various sex women (100%). This is show that DM patients who experience disturbance sleep in research This all of it is Woman.

Table 2. Frequency Distribution Based on Age, History of DM, Occupation and Residential Environment.

Variables	Frequency (n)	Percentage (%)
Age		
30-39	6	15.8
40-49	10	26.3
50-59	14	36.8
≥60	8	21.1
Total	38	100.0
DM History		
5 years	12	31.6
5-10 years	17	44.7
10 years	9	23.7
Total	38	100.0
Work		
Self-employed	7	18.4
Retired	5	13.2
Employees	3	7.9
Doesn't work	2	5.2
Housewife	21	55.3
Total	38	100.0
Residential Environment		
Rural areas	3	7.9
Urban	28	73.7
Suburbs	7	18.4
Total	38	100.0

Based on Table 4.2, the majority of respondents were in the 50–59 years age range (36.8%), followed by 40–49 years (26.3%), ≥60 years (21.1%), and 30–39 years (15.8%). The duration of Diabetes Mellitus (DM) was dominated by respondents with a disease duration of 5–10 years (44.7%), followed by less than 5 years (31.6%) and more than 10 years (23.7%). Based on occupation, the majority of respondents were housewives (52.6%), followed by self-employed (21.1%), farmers/laborers (15.8%), and employees/honorary workers (10.5%). In addition, the majority of respondents came from rural areas (63.2%), while the rest came from urban areas (36.8%).

Overview of Each Variable

Respondents' Sleep Quality After Being Given a Combination of Cutaneous Stimulation and Lavender Aromatherapy Therapy

Table 3. Distribution of Psqi Scores Before Lavender Aromatherapy.

Variables	Frequency	Percentage
Good	1	2.6%
Bad	37	97.4%
Total	38	100%

Based on table 4.3, the measurement of respondents' sleep quality before the intervention (pre-test) showed that 1 respondent (2.6%) had good sleep quality, and 37 respondents (97.4%) had poor sleep quality.

Table 4. Distribution of Psqi Scores After Lavender Aromatherapy.

Variables	*p- value*
Sleep quality Pre-post	0.0001

Based on the results of the Wilcoxon test in Table 4.5, a p value of 0.0001 ($p < 0.05$) was obtained, indicating a statistically significant difference between the sleep quality scores (PSQI) before and after the administration of a combination of cutaneous stimulation and lavender aromatherapy therapy in outpatients with Diabetes Mellitus. These results indicate

that the intervention provided was effective in improving the sleep quality of respondents. There was a change in sleep quality in 30 people, while 8 people experienced changes or the same sleep quality.

Discussion

All respondents in this study were female, with the majority aged 50–59 years, had a 5–10-year history of Diabetes Mellitus (DM), worked as housewives, and most lived in rural areas. These characteristics indicate that respondents were predominantly middle-aged to older adults, who are physiologically and psychologically more susceptible to sleep disorders. Hormonal factors, emotional stress, domestic workload, age-related changes in circadian rhythms, and DM complications such as peripheral neuropathy and nocturnal polyuria contribute to decreased sleep quality in this group. These findings align with various studies that suggest that middle-aged women with chronic illnesses are at higher risk of experiencing poor sleep quality due to a combination of biological, psychological, and social factors (Fardiah, 2020; Wu et al., 2021; Zhang et al., 2024).

The Wilcoxon test results showed a p value of 0.001 ($p < 0.05$), indicating a significant effect of the combination of cutaneous stimulation and lavender aromatherapy on improving sleep quality in DM patients. The decrease in PSQI scores after the intervention reflects a significant improvement in sleep quality. This effect occurs because cutaneous stimulation is able to reduce muscle tension and physical pain, while lavender aromatherapy provides a psychological relaxation effect by reducing sympathetic nerve activity and increasing the parasympathetic system. The combination of the two interventions produces an effective synergistic effect in improving sleep quality in DM patients, especially in groups with high metabolic and psychological stress. These findings support the use of non-pharmacological interventions as a safe, easy-to-implement, and effective alternative in improving sleep quality in Diabetes Mellitus patients.

5. Conclusion And Suggestions

Conclusion

This study shows that the sleep quality of outpatients with Diabetes Mellitus is generally in the poor category before the intervention, which is influenced by physiological, psychological, and environmental factors. After administering a combination of cutaneous stimulation and lavender aromatherapy for seven days, there was a significant improvement in sleep quality in most respondents. The Wilcoxon test results showed a significant difference between sleep quality before and after the intervention ($p < 0.05$). Thus, the combination of cutaneous stimulation and lavender aromatherapy has been proven effective as a non-pharmacological intervention to improve sleep quality in patients with Diabetes Mellitus and has the potential to be implemented in nursing practice to support improving patients' quality of life.

Suggestion

Combination therapy of cutaneous stimulation and lavender aromatherapy is recommended for use by patients with diabetes mellitus as a non-pharmacological supportive therapy to improve sleep quality and comfort independently at home. For nurses and healthcare workers, the results of this study can serve as a basis for developing complementary nursing interventions through education and support for patients and their families. Healthcare institutions are expected to consider implementing this relaxation therapy as part of a holistic care approach, especially for outpatients. Furthermore, studies with larger sample sizes, longer intervention durations, and various types of aromatherapies are needed to strengthen the scientific evidence and expand the application of complementary therapies in patients with chronic diseases.

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