



The Correlation between Sleep Quality and Blood Glucose Levels in Patients with Type 2 Diabetes at Dr. Chasan Boesoirie Regional Public Hospital, Ternate, North Maluku

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A B S T R A C T

Diabetes is characterized by hyperglycemia due to insulin deficiency or resistance, causing chronic complications in various organs. Poor sleep quality can worsen insulin resistance and increase the risk of complications of diabetes. This study analyzes the correlation between sleep quality and blood glucose levels in patients with type 2 diabetes at Dr. Chasan Boesoirie Regional Public Hospital, North Maluku. This study used a cross-sectional design. It was conducted from June 2024 to July 2024 at Dr. Chasan Boesoirie Regional Public Hospital. The population was 800 patients with type 2 diabetes at Dr. Chasan Boesoirie Ternate Hospital. There were 89 respondents by consecutive sampling. The instruments used the Pittsburgh Sleep Quality Index (PSQI) for sleep quality and GlucoDr for blood glucose levels. Data analysis used the Chi-Square test with a significance level of 0.05. The results showed that most respondents had moderate sleep quality, with 54 respondents (60.7%). In addition, most respondents have blood glucose levels in the poor category, with blood sugar levels >160 mg/dL, as many as 59 respondents (66.3%). The Chi-Square statistical test analysis showed a $p=0.011$ ($p<0.05$). Thus, there was a correlation between sleep quality and blood glucose levels in type 2 diabetes patients. In conclusion, sleep quality correlates with blood glucose levels in patients with type 2 diabetes at Dr. Chasan Boesoirie Regional Public Hospital, North Maluku. Further research should explore other factors affecting blood glucose control in people with type 2 diabetes.

INTRODUCTION

Diabetes is a metabolic disease characterized by increased blood glucose levels due to impaired insulin secretion or resistance. It can be classified into several types of diseases: type 1 diabetes, type 2 diabetes, gestational diabetes, and other types of diabetes. Type 2 diabetes is the most common type, around 90-95% (American Diabetes Association, 2023). Type 2 diabetes is increasingly becoming a global health problem with increasing prevalence. In 2021, the International Diabetes Federation (IDF) reported that 537 million adults suffered from diabetes, projected to reach 783 million by 2045. Indonesia is ranked fifth with the highest number of sufferers in the world after China, India, Pakistan, and the United States. In Indonesia, individuals with diabetes were diagnosed at the age of 20-79 years.

There was an increased prevalence of diabetes in Indonesia. Indonesian Basic Health Research data in 2018 showed an increase from 6.9% in 2013 to 8.5% in 2018 for residents aged ≥ 15 years diagnosed through blood tests. Jakarta Province recorded the highest prevalence at 3.4%, while East Nusa Tenggara recorded the lowest at 0.9%. In North Maluku Province, the prevalence of diabetes increased from 1.5% in 2013 to 1.8% in 2018, with the number of individuals with diabetes reaching 9,907 cases, and the prevalence based on all ages increased from 1.0% in 2013 to 1.2% in 2018. In Ternate City,

there were 2,975 cases of diabetes in 2021, with 54 deaths, 1,154 new patient cases, and 4,683 older people in 2019 (Kemenkes RI, 2019, 2020; IDF, 2021; Dinas Kesehatan Kota Ternate, 2022; Suratman, Armijn and Nur, 2023).

The number of individuals with diabetes continues to grow so rapidly that there should be much research aiming to reduce its number and minimize the impact of diabetes complications, which are closely related to blood sugar levels that are too high and can lead to death. Handling steps to reduce complications of type 2 diabetes can be done in various ways, one of which is by controlling the four main pillars in the form of education, medical nutrition therapy, physical exercise (physical activity, sports, and rest), and pharmacological interventions (PERKENI, 2021).

Lack of physical activity, unhealthy diet, and poor sleep quality are some risk factors that can affect blood glucose levels in people with type 2 diabetes (Nasution, Andilala and Siregar, 2021). Inadequate sleep can increase blood glucose through impaired regulation of insulin hormones and glucose metabolism. It can also worsen health conditions, increase the risk of cardiovascular complications, nerve disorders, and decreased quality of life in people with diabetes (Mesarwi *et al.*, 2021).

A previous study by Sumah (2019) on the relationship between sleep quality and blood sugar levels in patients with type 2 diabetes at Dr. M. Haulussy Ambon Regional Hospital obtained a $p=0.000$ ($\alpha<0.05$), indicating a significant relationship between sleep quality and blood sugar levels in type 2 diabetes patients. It provides insight into the importance of sleep quality in managing diabetes. Good sleep quality in type 2 diabetes patients enhances nursing care, enabling nurses to provide education focused on rest and sleep needs.

METHOD

This study used a cross-sectional design. It was conducted from June 2024 to July 2024 at Dr. Chasan Boesoirie Regional Public Hospital. The population was 800 patients with type 2 diabetes at Dr. Chasan Boesoirie Ternate Hospital. There were 89 respondents by consecutive sampling. The instruments used the Pittsburgh Sleep Quality Index (PSQI) for sleep quality and GlucoDr for blood glucose levels. Data analysis used the Chi-Square test with a significance level of 0.05. This study obtained ethical approval from the Poltekkes Kemenkes Ternate with the certificate number UM.02.03/6/477/2024 on May 28, 2024.

RESULT

Dr. Chasan Boesoirie Regional Public Hospital, located on Jl. Cempaka, Tanah Tinggi Subdistrict, Ternate City, is a type B hospital owned by the North Maluku Provincial Government. In addition to being a

referral hospital for the North Maluku region, this hospital also functions as a teaching hospital for medical students at Khairun University, Ternate Ministry of Health Polytechnic of Health, and North Maluku Muhammadiyah University. Outpatient services include 22 polyclinics, such as internal medicine, general surgery, pediatrics, and heart. In addition, inpatient services comprise 16 wards, including VIP rooms and Pavilions.

Table 1. Characteristics of Respondents Based on Age, Diabetes Duration, Sex, Education, and Occupation in Diabetes Patients at Dr. Chasan Boesoirie Regional Public Hospital, Ternate, North Maluku

Characteristics of Respondents	Frequency (n)	Percentage (%)
Age (Years)		
30-60	71	79.8
>60	18	20.2
Diabetes Duration		
3 Month - 1 Year	19	21.3
>1 Year	70	78.7
Sex		
Male	38	42.7
Female	51	57.3
Education		
Elementary school	9	10.1
Junior high school	15	16.9
Senior High School	40	44.9
University	25	28.1
Occupation		
Not Working	21	23.6
Farmers	8	9
Laborers	3	3.4
Self-Employed	17	19.1
Private Employees	7	7.9
Civil servants	23	25.8
Indonesian National Armed Forces	1	1.1
Retirees	9	10.1

Of the 89 respondents, almost all were 30-60 years old, namely 71 respondents (79.8%), where the age range used was based on the age of the inclusion criteria that had been set. In addition, almost all respondents had diabetes for more than 1 year, namely 70 respondents (78.7%). Most respondents were women, namely 51 respondents (57.3%). Almost half of the respondents had a high school education level, namely 40 respondents (44.9%). Furthermore, a few respondents had jobs as civil servants, namely 23 respondents (25.8%) (Table 1).

Table 2. Frequency Distribution and Percentage of Sleep Quality in Patients with Type 2 Diabetes at Dr. Chasan Boesoirie Regional Public Hospital, Ternate, North Maluku

Sleep Quality	Frequency (n)	Percentage (%)
Good	8	9
Moderate	54	60.7
Poor	27	30.3
Total	89	100

Table 2 shows that most respondents have moderate sleep quality, with 54 respondents (60.7%).

Table 3. Frequency Distribution and Percentage of Blood Glucose Levels in Patients with Type 2 Diabetes at Dr. Chasan Boesoirie Regional Public Hospital, Ternate, North Maluku

Blood Glucose Levels	Frequency (n)	Percentage (%)
Good	0	0
Moderate	30	33.7
Poor	59	66.3
Total	89	100

In addition, Table 3 demonstrates that most respondents have blood glucose levels in the poor category, as many as 59 respondents (66.3%).

Table 4. Results of Analysis of the Correlation between Sleep Quality and Blood Glucose Levels in Patients with Type 2 Diabetes at Dr. Chasan Boesoirie Regional Public Hospital, Ternate, North Maluku

Variable	<i>p</i>
Sleep Quality Blood Glucose Level	0.011

The Chi-Square statistical test analysis showed a $p=0.011$ ($p<0.05$). Thus, there was a correlation between sleep quality and blood glucose levels in type 2 diabetes patients at Dr. Chasan Boesoirie Regional Public Hospital, Ternate, North Maluku (Table 4).

DISCUSSION

Sleep Quality

Most patients with type 2 diabetes at Dr. Chasan Boesoirie Ternate Regional Public Hospital, North Maluku, had moderate sleep quality (60.7), with some experiencing poor sleep quality (30.3%) and a few having good sleep quality (9.0%) (Table 2). The PSQI questionnaire score showed that respondents generally had difficulty sleeping, felt hot at night, often woke up, and did not use sleeping pills. Poor sleep quality negatively impacts diabetes management because sleep disorders inhibit glucose metabolism, worsening the disease.

This study's results align with research conducted by Tantero et. al (2016), which showed that individuals with type 2 diabetes had moderate sleep quality. They often woke up at night and were sleepy during the day. However, this study differs from the study by Najatulla, Hendra and Maulana (2015), which found that 72.2% people with type 2 diabetes in a wound care specialist clinic with poor sleep quality, who did not feel refreshed after waking up, tended to have abnormal blood sugar levels.

Poor sleep quality in patients with type 2 diabetes can seriously affect their disease management. Quality sleep is crucial for maintaining metabolic balance, including regulating blood glucose levels. Lack of sleep or poor sleep quality can disrupt this mechanism, potentially worsening the disease.

Blood Glucose Levels

Most patients with type 2 diabetes at Dr. Chasan Boesoirie Ternate Regional Public Hospital had a poor category of blood glucose levels (66.3%), with blood sugar levels >160 mg/dL, indicating uncontrolled

hyperglycemia (Table 3). This condition increases the risk of diabetes complications such as blood vessel damage, neuropathy, and nephropathy. High blood glucose levels trigger symptoms such as polyuria, polydipsia, and polyphagia, which interfere with daily activities. Thus, it is crucial to find more effective interventions in monitoring and controlling blood glucose levels in people with diabetes. This study aligns with the research conducted by Romadoni and Septiawan (2016), which showed that most respondents (71.7%) had high blood glucose levels, while only 4.3% had low blood glucose levels. In people with diabetes, the body's ability to respond to insulin can decrease, or the pancreas stops producing insulin, which causes hyperglycemia. If blood glucose levels are too high, the kidneys cannot reabsorb all the filtered glucose, so that glucose appears in the urine.

The high prevalence of patients with type 2 diabetes who have high blood glucose levels indicates a serious problem in managing the disease. High blood glucose levels are an indicator of uncontrolled hyperglycemia, which can worsen diabetes complications such as blood vessel damage, neuropathy, and nephropathy. This study emphasizes the importance of more effective interventions in diabetes management, especially in monitoring and controlling blood glucose levels. High blood glucose levels can trigger symptoms such as polyuria, polydipsia, and polyphagia, which interfere with daily activities. In contrast, stable blood glucose levels are essential as an energy source for body cells.

The correlation between Sleep Quality and Blood Glucose Levels in Patients with Type 2 Diabetes

This paper showed a significant correlation between sleep quality and blood glucose levels at Dr. Chasan Boesoirie Ternate Regional Public Hospital, North Maluku, with a $p = 0.011$. This study revealed that most respondents had high blood sugar levels and moderate sleep quality. Many respondents slept less than 7 hours daily, mostly civil servants and women who played dual roles as working mothers. Inadequate sleep patterns, frequent waking up at night, and lack of sleep can disrupt sleep quality and potentially worsen blood glucose conditions.

This study is in line with the research of Sukamto *et al.* (2018) involving 4,241 respondents, showing a relationship between sleep duration and glycemic control. Lack of sleep potentially reduces insulin sensitivity and interferes with blood glucose tolerance. During NREM sleep, the body experiences a decrease in body temperature, a reduction in urine secretion, and a decrease in heart and respiratory rates. However, in people with diabetes mellitus, blood glucose levels increase while glucose in cells decreases. The kidneys excrete glucose, causing polyuria and polydipsia, often interfering with nighttime sleep. Irregular sleep patterns can affect insulin hormone levels and increase stress hormones, ultimately interfering with insulin function. Therefore, maintaining stable blood sugar levels is very important for people with diabetes to maintain good sleep quality.

Good sleep quality is crucial because it affects the production of catecholamines in the sympathetic nervous system. During sleep, sympathetic nervous system activity increases, producing epinephrine, norepinephrine, and melatonin. Sleep disorders, such as sleep apnea, can obstruct airflow in the respiratory tract, trigger hypoxia, and reduce normal sleep duration. In this study, poor sleep quality in patients with type 2 diabetes was associated with frequent urination at night, hot flashes, and overeating before bedtime. These factors could disrupt sleep patterns and increase blood sugar levels due to uncontrolled eating habits and high urination frequency at night.

This study, although well-conducted, had several limitations. It could not control other factors affecting sleep quality and blood glucose levels. In addition, there was a potential for information bias due to respondents' simple responses and the subjective nature of their responses when answering the questionnaire.

CONCLUSION

Sleep quality correlates with blood glucose levels in patients with type 2 diabetes at Dr. Chasan Boesoirie Regional Public Hospital, North Maluku. To improve the quality of care, nurses should enhance their knowledge and skills through special training on sleep quality management for patients with diabetes. Patients with diabetes must maintain good sleep patterns and have regular health check-ups. Hospitals could pay more attention to evaluating the sleep quality of patients with type 2 diabetes through sleep disorder examinations and education related to blood glucose level fluctuations. Further research should explore other factors affecting blood glucose control in people with type 2 diabetes to obtain more comprehensive research results.

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