

Sleep Quality and Blood Glucose Levels in Patients with Type 2 Diabetes Mellitus

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Abstract

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Background: Diabetes mellitus is a metabolic disorder characterized by the body's inability to use glucose, fat, and protein due to insulin deficiency or insulin resistance, which results in increased blood glucose. Diabetes mellitus attacks all groups of people in the world and should be addressed in order to reduce the prevalence of type 2 diabetes mellitus. Sleep quality is a person's satisfaction with sleep so that a person does not show feelings of fatigue, easily aroused and restless, lethargy and apathy, blackness around the eyes, swollen eyelids, red conjunctiva, sore eyes, fragmented attention, headaches, and frequent yawning or drowsiness.

Objective: This study aimed to determine the relationship between sleep quality and blood glucose levels in patients with type 2 diabetes mellitus at Kendari City Hospital.

Methods: This study was a quantitative study with a cross-sectional design. The sample was 68 respondents. This study employed purposive sampling.

Results: The Fisher's Exact Test showed a p-value of 0.000. This means that there was a relationship between sleep quality and blood glucose levels in type 2 DM patients. To determine the magnitude of the relationship between variables that have chi-square, a phi coefficient (ϕ) test was carried out with a result of ϕ 0.627, which means that the relationship between sleep quality and blood glucose levels in type 2 diabetes mellitus patients was statistically significant.

Conclusion: Sleep quality significantly affects blood glucose levels in patients with type 2 diabetes mellitus.

Keywords: blood glucose levels; sleep quality; type 2 diabetes mellitus

Introduction

Diabetes is a leading cause of premature death, blindness, kidney failure, heart attack, stroke, and lower extremity amputation. More than 400 million people are living with Diabetes worldwide, and this prevalence is predicted to continue to rise. Diabetes currently affects 425 million adults, a total set to reach 629 million by 2045 worldwide. In America, more than 30 million people suffer from Diabetes, and another 84 million adults in the United States have pre-diabetes. World Health Statistics in 2018 show that 1.6 million people die annually due to Diabetes Mellitus (World Health Organization, 2018).

Diabetes mellitus is a serious problem that should be addressed. Various nursing interventions can be implemented to improve self-management of patients with type 2 diabetes mellitus in order to address the problem caused by increased level of blood glucose (Fitriani & Agus, 2024). This increase occurs because people tend to have unhealthy lifestyles, especially consuming excessively sweet foods and less physical activity.

In 2019, about 415 million people in the world suffer from diabetes mellitus. This number increased from the previous year, which was 207 million people. This shows that the prevalence of diabetes mellitus increases every year. Southeast Sulawesi Province had 2,436 cases in 2021, according to the Southeast Sulawesi Health Office profile. Data on type 2 diabetes mellitus treated at Kendari City Hospital fluctuated. Type 2 diabetes mellitus in 2020 was 295

patients, 113 male patients and 182 female patients. In 2021, there were 306 patients, consisting of 128 male and 178 female patients (Medical data at Kendari City Hospital).

Riskesdas 2018 data shows that the prevalence of diabetes mellitus in Indonesia based on a doctor's diagnosis in the population aged > 15 years increased by two percent compared to 2013 (1.5%). Based on age, many sufferers are aged 56-64 years, with a prevalence of 4.8% (Demur, 2018). People with type 2 diabetes mellitus experience clinical and psychological symptoms that result in sleep disturbances. The clinical symptoms can be itching skin, polyuria, polyphagia, and polydipsia. The psychological symptoms included stress and emotional disorders. The occurrence of sleep disorders will have an impact on increasing the frequency of waking up and difficulty falling back asleep. This sleep dissatisfaction eventually results in a decrease in sleep quality. Decreased sleep quality can cause endocrine and metabolic disorders, such as impaired glucose tolerance, insulin resistance, and reduced response to insulin. The presence of sleep disturbances, especially Non-Rapid Eye Movements (NREM) for three days, can result in a decrease in insulin sensitivity of about 25%. It is reported that there is a relationship between sleep quality and blood glucose control of sufferers. The quality of sleep in patients with type 2 diabetes mellitus in Prolanis participants is known to be mostly worse and uncontrolled. Other studies also reported a relationship between diabetes mellitus and sleep quality (Lispin, 2021).

A study by Lispin (2021) found that 46 out of 78 respondents with type 2 diabetes mellitus had sleep disorders. This study showed that there was a relationship between sleep quality and blood glucose levels in type 2 diabetes mellitus patients. Sleep deprivation leads to a decrease in glucose tolerance, which results in an increase in glucose levels between 20-30%. The activity of the *Hypothalamus-Pituitary-Adrenal* (HPA) as well as the sympathetic nervous system will stimulate the production of hormones such as *cortisol* and *catecholamines*, thus causing impaired glucose tolerance and insulin resistance (Lispin, 2021).

A preliminary study in January 2022 by interviewing five type 2 diabetes mellitus patients obtained information that three patients said they could not sleep because they experienced poor sleep due to pain in the wounds in their legs; although they had been given analgesics but were less effective. Two other type 2 diabetes mellitus patients said that they only take a good nap but have poor sleep quality at night. According to the phenomena above, the authors were interested in identifying the relationship between sleep quality with blood glucose levels in type 2 diabetes mellitus patients at Kendari City Hospital.

Methods

Study Design

This study was a quantitative study with a cross-sectional approach. This approach was intended to see the relationship between sleep quality and blood glucose levels of type 2 diabetes mellitus patients.

Samples/Participants

The population was the entire object of research (Soekidjo, 2012). The population in this study was the number of patients treated in the Jasmine Room, Sakura Room, and Lavender Room of Kendari City Hospital in 2022. The samples in this study were patients in the Jasmine room and Lavender room, totaling 68 respondents. The inclusion criteria included: 1) patients diagnosed with type 2 diabetes mellitus; 2) patients who agreed to participate in the study; 3) patients who have had their blood sugar checked. The exclusion criteria were patients who did not complete the questionnaire.

Instruments

In this study, the questionnaire was adopted from a previous study that had been tested for validity and reliability.

Data Collection

Data collection in this study was carried out using questionnaires. Data were obtained directly by researchers. This study was conducted in 2022 at Kendari City Hospital.

Data Analysis

All data were analyzed using the SPSS statistical program. Descriptive statistics were used to analyze the participants' characteristics. The Chi-square tests were used to determine the relationship between sleep quality and blood glucose levels of type 2 diabetes mellitus patients.

Ethical Considerations

This research has been approved by the ethical institute of Mandala Waluya Kendari University.

Results

Characteristics of respondents

Most respondents in this study were female, accounted for 41 (60.3%) respondents, aged 50 years accounted for 40 (58.8%) respondents, education level of senior high school accounted for 26 (38.2%) respondents, and working as farmer/laborer accounted for 31 (45.6%) respondents.

This study showed that the majority of respondents reported worse sleep quality (see Table 1) and had abnormal random blood glucose levels (see Table 2).

Table 1. Sleep quality of patients with type 2 diabetes mellitus

Sleep quality	n	%
Good	8	11.8
Worse	60	88.2
Total	68	100.0

Table 2. Blood sugar levels of patients with type 2 diabetes mellitus

Blood sugar levels of type 2 DM patients	n	%
Normal	7	10.3
Abnormal	61	89.7
Total	68	100.0

The relationship between sleep quality and blood glucose levels in patients with type 2 diabetes mellitus

Table 3 shows that out of eight respondents with good sleep quality, there were five respondents (7.4%) with normal glucose levels and three respondents (4.4%) with abnormal glucose levels. While of the 60 respondents with poor sleep quality, there were two respondents (2.9%) with normal glucose levels and 58 respondents (89.7%) with abnormal glucose levels.

The statistical test obtained the X^2 count $> X^2$ table $20.736 > 3.841$ and the value of Fisher's Exact Test = $0.000 < \alpha = 0.05$. This means that there was a relationship between sleep quality and blood glucose levels in type 2 DM patients. To determine the magnitude of the relationship between variables that had chi-square, a phi coefficient (ϕ) test was carried out with the results of $\phi = 0.627$, which means there was a relationship between sleep quality and blood glucose levels in type 2 DM patients.

Table 3. The relationship between sleep quality and blood glucose levels in patients with type 2 diabetes mellitus

Sleep quality	Blood glucose levels of type 2 DM patients				Total		Results of statistical analysis
	Normal		Abnormal		n	%	
	n	%	n	%			n
Good	5	7,4	3	4,4	8	11,8	X^2 count = 20,736 X^2 table = 3,841 Fisher's Exact Test $\hat{\rho} = 0,000$ $\hat{\rho}$ value = 26,759
Worse	2	2,9	58	85,3	60	88,2	
Total	7	10,3	61	89,7	68	100	

Source: Primary Data, 2022

Discussion

Diabetes mellitus is one of the chronic diseases that causes high morbidity and mortality rates. Diabetes mellitus is also called "the silent killer" because this disease can attack all organs of the body and cause various kinds of complaints. Diabetes is the leading cause of premature death, blindness, kidney failure, heart attack, stroke and lower extremity amputation (Kurnia, 2017). Sleep quality is a quantitative and qualitative aspect such as the length of sleep, the time needed to be able to sleep, the frequency of awakenings, and subjective aspects of sleep depth and satisfaction (Basri, 2020).

This study showed a significant relationship between sleep quality and blood glucose levels. The results of this study are in accordance with the evidence found that blood glucose levels are high when sleep quality is disturbed. Sleep is necessary for routine biological repair processes (Kaslum, 2015). The theory states that if sleep quality is good then the body releases human growth hormone to repair and renew epithelial and special cells such as brain cells, as well as the role in growth hormone. Sleep is necessary for routine biological repair processes. During deep low-wave sleep (NREM stage 4), the body releases human growth hormone to repair and renew epithelial and specialized cells such as brain cells, and its role in common growth hormone as a promoter of protein synthesis is limited because its release is unrelated to blood glucose and amino acid levels. REM sleep is the phase at the end of each sleep cycle 90 minutes before a person wakes up.

Good sleep quality will provide comfort in resting. The quality of sleep is bad for DM patients is likely because of frequent urination at night, overeating before bedtime, excessive stress and anxiety and increased body temperature, which can disrupt sleep patterns at night, causing lack of sleep quality. Lack of sleep will also affect changes in the hormones leptin and ghrelin. The hormone leptin is responsible for satiety. Lack of sleep time will reduce leptin hormone levels, and make a person eat more (Demur, 2018).

Therapy to improve sleep quality can be done in several ways, such as pharmacological therapy, nonpharmacologic, and complementary therapy. Pharmacological therapy includes sleeping pills, while non-pharmacological therapy includes sleep restriction therapy, stimulus control therapy, sleep diary therapy, and complementary therapies including herbal medicine, relaxation technique therapy, reflexology, magnetic field therapy, and cupping and acupuncture therapy. Pharmacological treatment using medicine not only has a beneficial but also a detrimental effect. Side effects of medicines can cause unwanted reactions for sufferers, such as coughing, fatigue, dizziness, frequent urination, fluid retention, sexual dysfunction, cardiac arrhythmias, and allergic reactions (Kaslum, 2015).

Other studies have shown that protein synthesis and cell division for tissue renewal, such as skin, bone marrow, gastric mucosa, or brain, occur during rest and sleep. Promoting good health and recovery of ill individuals can affect endocrine system function mainly associated with impaired glucose tolerance, insulin resistance, and reduced insulin response. Sleep involves a physiological sequence that is maintained by a high integration of central nervous system activities associated with changes in peripheral, endocrine, cardiovascular, respiratory, and muscular nervous systems (Setianingsih, 2022).

Conclusion

There is a significant relationship between sleep quality and blood glucose levels in type 2 diabetes mellitus patients at Kendari City Hospital.

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