



Relationship between Sleep Quality and Blood Sugar Levels in Patients with Type II Diabetes Mellitus

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Abstract

Background: Type 2 Diabetes Mellitus (T2DM) is a major global health concern with increasing prevalence, significantly impacting quality of life and health systems. Sleep disturbances are commonly found in T2DM patients and may impair glycemic control through metabolic and hormonal dysregulation. **Purpose:** This study aimed to analyze the association between sleep quality and blood sugar levels in patients with type II Diabetes Mellitus at Adventist Hospital Bandar Lampung, Indonesia. **Methods:** A quantitative cross-sectional design was employed involving 86 T2DM patients selected from a population of 949 using purposive sampling. Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), while blood sugar levels were retrieved from patient medical records. Data collection was conducted between January 10 and February 10, 2025. The chi-square test was used for statistical analysis, with a significance level set at $p \leq 0.05$. Ethical approval was obtained from the Health Research Ethics Committee of Mitra Indonesia University. **Results:** Most respondents (75.6%) had poor sleep quality and uncontrolled blood sugar levels. Statistical analysis revealed a significant association between sleep quality and blood sugar control ($p = 0.000$). Specifically, 76.2% of patients with good sleep quality had controlled blood sugar, while 92.3% of those with poor sleep quality had uncontrolled levels. **Conclusion:** Sleep quality is significantly associated with glycemic control in patients with type II Diabetes Mellitus. These findings highlight the need to integrate sleep assessments into routine diabetes care. Enhancing patient and healthcare provider awareness regarding the role of sleep may contribute to more effective T2DM management.

Keywords: Type 2 Diabetes Mellitus; sleep quality; blood sugar level; glycemic control.

Introduction

Diabetes Mellitus (DM) is a chronic metabolic disease whose prevalence continues to increase globally and has become a major health problem in many countries. According to [11], DM has the potential to cause serious complications that can reduce quality of life and increase the risk of mortality. The World Health Organization [25] defines DM as a chronic condition resulting from impaired use or inadequate production of insulin, leading to impaired glucose metabolism. Typical signs of DM include insulin resistance, impaired insulin secretion, tissue insensitivity to insulin, and excessive hepatic glucose production [18].

The International Diabetes Federation (IDF) estimates the global prevalence of DM to reach 10.5% (536.6 million individuals) by 2021, and is predicted to increase to 12.2% (783.2 million individuals) by 2045 [20]. Indonesia ranks seventh in the world with 10.7 million DM cases, making it the country with the highest number of DM patients in Southeast Asia [9]. The Indonesian Health Survey (2023) showed 877,531 DM patients in Indonesia, with Lampung Province recording a prevalence of 1.2% or around 29,331 patients. In Bandar Lampung, the prevalence of DM reached 2.25% in the population aged ≥ 15 years, with a diagnosed number of 46,736 people [28]. Adventist Hospital Bandar Lampung (RSABL)

is one of the health facilities with the most DM cases. Medical record data shows DM as the most common disease out of the ten major diseases, with 8,872 DM patients visiting from January to September 2024. This high number indicates DM as a serious health problem that needs special attention, including aspects of sleep quality that are often overlooked but are thought to contribute to the control of blood sugar levels.

Sleep quality is one of the important factors in the management of type II DM [4]. Previous studies have shown that sleep disturbances, both too short duration and poor sleep quality, can worsen glucose control [18]. Research [5] in Iran proved that DM patients with sleep disorders had worse glucose control compared to patients with quality sleep. The National Sleep Foundation also stated that sleep quality affects physical, mental, and psychological health [15]. Patients with DM experience sleep disturbances more often than healthy populations, such as nocturia, anxiety, depression, and neuropathic pain [6, 10, 24]. Sleep disturbances can reduce patients' ability to self-manage DM, including blood sugar control. Factors such as sleep mechanisms, metabolic disturbances, hormonal changes, and decreased insulin sensitivity contribute to plasma sugar levels in DM patients [2]. According to research [1] shows that poor glycemic control, insulin resistance, hyperlipidemia, and microvascular complications of DM are associated with poor sleep rhythms and mechanisms. Interventions to improve sleep quality, such as the use of lavender aromatherapy, can improve glucose control [13]. However, in RSABL, research related to the relationship between sleep quality and blood sugar levels in DM patients has never been conducted.

A pre-survey on October 31, 2024, at RSABL showed that 7 out of 10 DM patients often woke up at night to urinate, while the other 3 woke up due to thirst and had difficulty falling back asleep. Health workers also stated that public awareness of the importance of sleep quality in DM management is still low. This condition contributes to the high prevalence of DM in the community. Impaired sleep quality in patients with DM can cause metabolic and endocrine problems, such as impaired glucose

tolerance and decreased responsiveness [10]. Lack of sleep quality has a significant impact on the control of plasma sugar levels, thus becoming an important factor in the increasing prevalence of DM. The iceberg phenomenon of DM in Indonesia, where many sufferers are unaware of their condition [26], reinforces the urgency of this study.

Therefore, the purpose of this study was to analyze the relationship between sleep quality and blood sugar levels in type II Diabetes Mellitus patients at Advent Hospital Bandar Lampung. By conducting this study, it is hoped that empirical evidence can be obtained which can be the basis for designing more effective clinical guidelines for the management of type II DM, as well as making a real contribution to the development of nursing science, especially in the aspect of sleep quality management in diabetic patients.

Methods

This study is a quantitative study with a cross-sectional design conducted on 86 patients with type II diabetes mellitus at Advent Hospital Bandar Lampung, selected from a population of 949 patients using purposive sampling technique based on inclusion and exclusion criteria, with the main instrument being the Pittsburgh Sleep Quality Index (PSQI) questionnaire which has been tested for validity and reliability. As well as blood sugar level data taken from medical records; data collection was carried out from January 10 to February 10, 2025 by the researcher and two trained enumerators, then analyzed using the Chi-Square test with the help of SPSS version 25, and this study has received ethical approval from the Health Research Ethics Commission of the Faculty of Health, Mitra University of Indonesia number 012/KEPK-FK/UMI/I/2025.

Result

Based on Table 1. The characteristics of respondents based on gender are mostly female with 45 respondents (52.3%). Based on age, the majority are aged 60-70 years with 30 respondents (34.9%). Based on the majority of jobs working as housewives with 33 respondents (38.4%). Based on the length of time suffering from DM, the majority have suffered for 1 - 9 years with 54 respondents

(62.8%). Based on sleep quality, the majority had poor sleep quality with 65 respondents (75.6%). Based on blood sugar levels, the majority had uncontrolled blood sugar levels with 65 respondents (75.6%).

Table 1. Characteristics of Respondents Based on Gender, Age, Occupation, Duration of DM, Sleep Quality, Blood Sugar Levels at Advent Hospital Bandar Lampung (n=86)

Characteristics	Frequency (n)	Presentase (%)
Gender		
Male	41	47,7 %
Female	45	52,3 %
Age		
30 - 39 years	9	10,5%
40 - 49 years	18	20,9%
50 - 59 years	29	33,7%
60 - 70 years	30	34,9%
Work		
Laborer	14	16,3%
Self-employed	16	18,6%
Civil Servant	9	10,5%
Housewife	33	38,4%
Retired	14	16,3%
Duration Of DM		
1 - 9 years	54	62,8%
10 - 19 years	24	27,9%
20 years	8	9,3%
Sleep Quality		
Good	21	24,4%
Bad	65	75,6%
Sugar Content		
Controlled	21	24,4%
Not Controlled	65	75,6%

Table 2. Relationship between Sleep Quality and Blood Sugar Levels

Sleep Quality	Sugar Content				p value
	Controlled		Not Controlled		
	n	%	n	%	
Good	16	76,2	5	23,8	0,000
Bad	5	7,7	60	92,3	
Total	21	24,4	65	75,6	

Based on Table 2. The relationship between sleep quality and blood sugar levels, it is found that 21 people have good sleep quality, tend to have controlled blood sugar levels as many as 16 people (76.2%) while uncontrolled blood sugar levels are 5 people (23.8%). In addition, it was found that 65 respondents with poor sleep quality tended to have uncontrolled blood sugar levels, as many as 60 people (92.3%), and controlled blood sugar levels, as many as 5 people (7.7%). The results of bivariate analysis using the chi-square test obtained a p-value of 0.000, which means the p-value ≤ 0.05 ; it can be concluded that there is a significant relationship between sleep quality and blood sugar levels in patients with Type II Diabetes Mellitus at Advent Hospital Bandar Lampung.

Discussions

The results showed that the frequency distribution of respondents based on gender, the majority were female, as many as 45 people (52.3%), while 41 people (47.7%) were male. In line with the study [16], which shows that Diabetes is diagnosed in most elderly women. During menopause or stopping menstruation, there will be a decrease in estrogen and progesterone, which triggers fat formation and increases insulin sensitivity problems and plasma sugar levels. If progesterone decreases, the risk of weight gain increases, and if insulin resistance increases, plasma sugar will also increase [16]. In terms of prevalence, the risk of developing DM in women is greater due to the tendency to gain weight, which makes them have a higher BMI. During post-menopause, there are women who feel premenstrual syndrome or PMS, which will cause a hormone transition, so that the fat mass in the body will be affected, which potentially increases the risk of DM. Women who are more prone to type II diabetes usually have an excessive BMI or body mass index [14].

This study found that the frequency distribution of respondents aged 60-70 years was 30 people (34.9%). These results are also in line with research conducted by [27], on the relationship between blood sugar levels with sleep quality in elderly people at risk of Diabetes Mellitus in the village posyandu Kincang Wetan Madiun City, where the

majority of respondents with the age group 60 - 74 years (elderly) who have a risk of developing Diabetes Mellitus [27]. According to the theory presented in the study [12] that many body systems have decreased due to factors of increasing age. Generative aging will result in decreased organ performance. Insulin resistance causes uncontrolled blood sugar levels. Based on the age when DM was first diagnosed, it appears that the incidence of type II DM increases with age [12].

The results of this study indicate that the majority of respondents, as many as 33 people (38.4%) work as housewives. This result is in line with [19] who defines work as a routine activity that is carried out every day. Work can provide an overview of a person's level of life because work has an influence on various aspects of life, such as maintaining health. In addition, the type of work can also have an impact on the level of individual knowledge [19]. Supported by research [8] which states that the many responsibilities and daily tasks that housewives have to do every day cause poor sleep quality. Being a housewife involves many tasks and responsibilities from morning to night. Stress caused by this daily workload has an impact on their sleep quality and health status, one of which has an impact on blood sugar levels [8].

The results of this study showed that the majority of respondents had suffered from DM for 1 - 9 years as many as 54 people (62.8%). These results are in line with [22] conducted on 52 Diabetes Mellitus patients at DR. M Haulussy Ambon Hospital regarding the relationship between the duration of suffering and its complications on sleep quality, most of them were diagnosed with this disease for more than 5 years. Based on Chi Square test, there was a significant correlation between the duration of the disease and sleep quality. Frequent urination (polyuria), excessive thirst (polydipsi), and persistent hunger (polyphagia) are symptoms that are the main causes of sleep disturbances in these patients [22].

The results of this study showed that the majority of participants experienced poor sleep quality, as many as 65 people (75.6%) were included in the poor sleep category and only 21 people (24.4%) in the good sleep quality category. These results are in line with research

[23] which suggests that short sleep duration, subjective perception of low sleep quality, and the presence of problems, such as pain, are causes of poor sleep quality [23]. In line with the theory presented by [3] regarding that sleep is proven to have the ability to control glucose tolerance and maintain its dynamic balance. Insulin production, insulin sensitivity, and glucose consumption are highly dependent on circadian regulation of sleep. The cerebral cortex, cerebral limbic system, and hypothalamus will be affected by sleep disturbance and short sleep in patients with DM because to secrete cortisol from the adrenal pituitary hypothalamus and catecholamines from the sympathetic ganglion and adrenal medulla. As a result, they release additional glucocorticoids and decrease sensitivity to insulin, leading to increased plasma sugar levels and worsening glucose control [3]. Adequate sleep is a basic need that is very important to fulfill, especially for individuals with diabetes mellitus. Sleep disturbance or lack of sleep can physiologically affect plasma sugar levels, patients' ability to perform daily activities, and decrease their motivation to stay active [21].

The results of this study showed that the majority of participants had uncontrolled plasma blood sugar levels totaling 65 people (75.6%) and a total of 21 people (24.4%) fell into the category of controlled plasma blood sugar levels. These results are relevant to the study [10] which assumes that diabetes can cause the body's ability to respond to insulin to decrease or insulin production is stopped by the pancreas, this is what results in hyperglycemia. If the concentration of sugar levels is high enough, the absorption of all the glucose that has been filtered out cannot be absorbed by the kidneys, as a result glucose eventually enters the urine. Directly, sleep disturbances alter glucose regulation and insulin resistance, and indirectly, alter appetite leading to weight gain. Obesity itself is a major factor in insulin resistance and Diabetes Mellitus [10]. Supported by the theory presented by [7] that decreased peripheral insulin response indicates insulin resistance, which leads to glucose intolerance and decreased glucose uptake. It has been shown that sleep apnea is independently associated with higher insulin resistance. Sleep

apnea, which is characterized by intermittent hypoxia and fragmented sleep disturbances, can trigger various bodily responses such as activation of the sympathetic nervous system, oxidative stress, systemic inflammation, impaired regulation of hormones that regulate appetite, and stimulation of the hypothalamic-pituitary-adrenal axis. Insulin resistance arises as a result of these mechanisms [7].

The results of the study, with bivariate analysis with the chi-square test, obtained a p-value of 0.000. Because the p-value is below the significance limit (≤ 0.05), these results indicate a significant relationship. Conversely, if the p-value exceeds 0.05, then there is no significant relationship. Thus, it can be concluded that there is a significant relationship between sleep quality and blood sugar levels in patients with Type II Diabetes Mellitus at Advent Hospital Bandar Lampung. In line with the study [3], good sleep quality will produce new body cells, repair damaged cells, give the body's organs time to rest, and keep the body's metabolism and biochemistry in balance [3]. Supported by research [6] which found that there was a significant correlation between sleep quality and participants' blood sugar levels. Deangan category of sugar levels in uncontrolled plasma of 82 DM patients at Pijorkoling Health Center in 2023 was (0.001), with a known correlation coefficient of 0.377. Thus, it can be concluded that an increase in blood sugar levels is associated with the sleep quality of individuals with Diabetes Mellitus [6].

Research [17] showed that most participants who had high blood sugar levels also had poor sleep quality. Therefore, it is defined that plasma sugar levels will increase due to factors caused by their poor sleep quality. There is a significant correlation between sleep quality and plasma sugar levels of individuals with Diabetes Mellitus. Health workers are advised to inform patients with diabetes mellitus about the importance of sleep quality in relation to blood glucose levels and advise them to use methods such as daily exercise routine, managing stress well, limiting food and beverage consumption at night, creating a comfortable and supportive room atmosphere for sleep [17]. In line with study [5] conducted at Shahid Beheshti Hospital in Hamadan, Iran on 163 patients. Based on the

results of the study, sleep quality was associated with glycemic control in patients with T2DM. Sleep disorders are common in diabetic patients. Thus, healthcare providers need to consider improving sleep quality in their holistic approach to diabetes management [5].

Limitation

This study was conducted at a single hospital with a relatively small sample size ($n = 86$), which may limit the generalizability of the findings to broader populations. Additionally, the use of a cross-sectional design does not allow for the establishment of causality between sleep quality and blood sugar levels. Sleep quality was assessed using a subjective questionnaire (PSQI), which could be influenced by recall bias or individual perception. Future studies with a longitudinal or experimental design and objective sleep assessments (e.g., polysomnography or actigraphy) are recommended to validate and expand upon these findings

Conclusion

Based on the results of research conducted at Advent Hospital Bandar Lampung, it was found that there was a significant relationship between sleep quality and blood sugar levels in patients with type II Diabetes Mellitus. Most patients with poor sleep quality tend to have uncontrolled blood sugar levels. This finding confirms that sleep quality is one of the important factors that need to be considered in efforts to manage type II Diabetes Mellitus, in addition to dietary management, physical activity, and drug use. It is hoped that the results of this study can be an input for Adventist Hospital Bandar Lampung to develop education and nursing interventions related to the importance of sleep quality as part of the management of patients with type II diabetes mellitus, as well as encourage the preparation of sleep quality assessment protocols and training for health workers. For patients with type II Diabetes Mellitus, the author hopes that this study can increase awareness of the importance of maintaining sleep quality to help control blood sugar levels and prevent complications, so that the patient's quality of life can be optimized.

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Conflict of Interest Statement

The authors declare no conflict of interest related to the conduct, authorship, or publication of this research.

Data Availability

The datasets generated and analyzed during the current study are not publicly available due to institutional privacy policies, but are available from the corresponding author on reasonable request.

Author Contributions

All authors contributed equally to the conception, design, data collection, analysis, and writing of this manuscript.

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