



THE RELATIONSHIP BETWEEN SLEEP QUALITY AND FASTING BLOOD SUGAR LEVELS IN DIABETES MELLITUS PATIENTS

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ABSTRACT

Diabetes mellitus is a major health problem with increasing prevalence and complication rates. Blood sugar control is influenced by various factors, one of which is sleep quality, which plays a role in regulating glucose metabolism. This study aims to determine the relationship between sleep quality and fasting blood sugar levels in diabetes mellitus patients. This study is a quantitative study with a correlational design and a cross-sectional approach conducted on 114 type 2 diabetes mellitus patients at the Internal Medicine Polyclinic of Dr. Moewardi Regional General Hospital, Surakarta. Sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI) questionnaire, while fasting blood sugar levels were obtained from patient medical records. Data analysis was carried out descriptively and inferentially using the Chi-Square test. The PSQI questionnaire has been tested for validity and reliability by Fatmawati (2013) using the Pearson product moment correlation coefficient, with a correlation coefficient value (r count) ranging from 0.487–0.778 (r table > 0.444) and a Cronbach's alpha value of 0.63. Most respondents had poor sleep quality (79.8%) and high fasting blood sugar levels (> 126 mg/dL) (82.5%). The chi-square test results showed a significant association between sleep quality and fasting blood sugar levels ($p = 0.001$). Poor sleep quality was significantly associated with increased fasting blood sugar levels in patients with diabetes mellitus. These findings suggest that sleep quality plays a crucial role in glycemic control, and efforts to improve sleep quality should be considered as part of a comprehensive approach to diabetes mellitus management.

Keywords: diabetes mellitus; fasting blood sugar; sleep quality

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INTRODUCTION

Diabetes is a metabolic disorder characterized by hyperglycemia due to impaired insulin secretion and function. Type 2 diabetes mellitus accounts for approximately 90% of cases and is largely preventable. This disease is more common in certain ethnic groups and is associated with oxidative stress due to hyperglycemia and hyperlipidemia (Dembinska-Kiec et al., 2008; WHO, 2024). The prevalence of diabetes mellitus in Indonesia continues to increase across various age groups. Key risk factors include overweight, especially central obesity, and low physical activity. Symptoms are often mild, leading to delayed diagnosis and increasing the risk of complications (Health Policy Agency, 2023; WHO, 2024).

The increasing number of people with diabetes mellitus contributes to high rates of complications such as heart disease, blindness, and diabetic foot disease. Therefore, good self-management is crucial to prevent complications. One factor affecting blood sugar control is suboptimal sleep quality (Lengga et al., 2023; Yazia, V., 2023). Sleep quality plays a crucial role in regulating blood glucose levels and reducing insulin resistance. Sleep disturbances in diabetes patients are often caused by complications such as nocturia and pain. These conditions contribute to poor blood sugar control and increase the risk of further complications (Ratnasari, 2022; Zahra & Farida, 2020). Efforts to improve sleep quality can be achieved through sleep hygiene, regular physical activity, and relaxation therapy before bed. Implementing good sleep habits can help prevent sleep

disturbances. Therefore, sleep quality plays a crucial role in managing diabetes mellitus (Khoiriyah et al., 2021; Lase, 2023) .

Furthermore, poor sleep quality in patients with diabetes mellitus is often associated with coexisting clinical and psychological conditions. Frequent nighttime urination (nocturia), pain from diabetic neuropathy, and anxiety about health conditions can disrupt sleep continuity. Chronic sleep disturbances can lead to daytime fatigue, decreased medication adherence, and worsened glycemic control. This suggests that sleep quality not only impacts physiological conditions but also influences self-care behaviors in patients with diabetes mellitus (Ratnasari, 2022; Zahra & Farida, 2020) .

With the increasing number of people with diabetes mellitus and the high risk of complications due to uncontrolled blood sugar levels, special attention is needed to modifiable factors, including sleep quality. Several studies have shown that poor sleep quality plays a role in increasing blood sugar levels through insulin resistance and increased stress hormones (SHELEMO, 2023; Yazia, V., 2023) . However, research on the relationship between sleep quality and fasting blood sugar levels in patients with diabetes mellitus, particularly at the referral hospital level, is still relatively limited. This study aims to determine the relationship between sleep quality and fasting blood sugar levels in diabetes mellitus patients at Dr. Moewardi Regional Hospital, Surakarta.

METHOD

This study used a correlational quantitative design with a cross-sectional approach . This study was conducted at the internal medicine (endocrine) polyclinic of Dr. Moewardi Surakarta General Hospital from September to November 2025. The study population was all type 2 diabetes mellitus patients who visited the polyclinic, with a sample of 114 respondents selected using a purposive sampling technique based on predetermined inclusion and exclusion criteria, with inclusion criteria including patients aged 18–65 years, patients who visited the Internal Medicine Polyclinic of Dr. Moewardi Surakarta General Hospital with a diagnosis of type 2 diabetes mellitus, and able to communicate in Indonesian. Exclusion criteria included patients in an unconscious state and patients with severe cognitive impairment, such as dementia.

Sleep quality measurement was conducted using the Pittsburgh Sleep Quality Index (PSQI) questionnaire, while fasting blood sugar level data was obtained through a study of respondents' medical record documentation accessed from October 13, 2025 to October 31, 2025. Data analysis was performed univariately to describe the characteristics of respondents and bivariately using the Chi-Square test to determine the relationship between sleep quality and fasting blood sugar levels with a significance level of $p < 0.05$. This study has obtained ethical approval from the Ethics Committee of Dr. Moewardi Regional General Hospital Surakarta with ethical approval letter number 1.800 / viii / HREC / 2025, and all respondents have provided written informed consent.

RESULT

The results showed that the majority of respondents were women, namely 80 people (70.2%), while 34 respondents were men (29.8%). The predominance of female respondents in this study reflects the epidemiological trend of higher type 2 diabetes mellitus in women, especially in the middle to elderly age group. Several studies have shown that hormonal changes in women, especially decreased estrogen levels during the perimenopause and menopause phases, play a role in increasing insulin resistance and impaired glucose metabolism, thereby increasing the risk of type 2 diabetes mellitus.

Based on age distribution, the largest number of respondents were in the early elderly age group (46–55 years), namely 62 people (54.4%), followed by the late elderly age group (56–65 years) with 46 people (40.4%). Meanwhile, respondents in the late adult age group (36–45 years) only

numbered 6 people (5.3%), and there were no respondents in the early adult age group (26–35 years). These findings indicate that type 2 diabetes mellitus in this study was more frequently found in the elderly group, which is in line with the characteristics of diabetes as a chronic degenerative disease. Increasing age is closely related to decreased pancreatic beta cell function, decreased insulin sensitivity, and the accumulation of metabolic risk factors that occur progressively.

Table 1.
Respondent Characteristics (n=114)

Characteristics	f	%
Gender		
Man	34	29.8
Woman	80	70.2
Age		
Late adulthood 36-45 years	6	5.3
Early elderly aged 46-55 years	62	54.4
Late elderly aged 56-65 years	46	40.4
Long-Term DM Suffering		
< 1 year	24	21.1
1-5 years	51	44.7
> 5 years	39	34.2
Complication History		
Never	21	18.4
Tingling/numbness	44	38.6
Kidney disorders	5	4.4
Eye disorders	27	23.7
Wound on the leg	15	13.2
Other	2	1.8
Types of Treatment		
Just diet	18	15.8
Antidiabetic drugs	40	35.1
Insulin injections	25	21.9
Oral and insulin combination	31	27.2
Diet Management		
Often	79	69.3
Sometimes	35	30.7

Based on the duration of diabetes mellitus, the majority of respondents were in the 1–5 year group, namely 51 people (44.7%), followed by the group with a duration of more than 5 years (39 people) (34.2%), and the group with a duration of less than 1 year (24 people) (21.1%). This distribution indicates that the majority of respondents have lived with diabetes mellitus for a considerable period of time. Long disease duration has important clinical implications, because the longer a person suffers from diabetes mellitus, the greater the risk of complications due to exposure to chronic hyperglycemia. This condition also has the potential to affect patients' quality of life, including sleep quality and ability to self-manage the disease.

Regarding complication history, the most common complication experienced by respondents was peripheral neuropathy, characterized by tingling or numbness, with 44 (38.6%) respondents experiencing this. Diabetic neuropathy is one of the most common microvascular complications in patients with type 2 diabetes mellitus and is closely associated with suboptimal long-term glycemic control. Chronic hyperglycemia can cause nerve damage through oxidative stress and microcirculatory disorders.

In addition to neuropathy, other complications found included eye problems in 27 people (23.7%), slow-healing foot wounds in 15 people (13.2%), and kidney problems in 5 people (4.4%). Twenty-one respondents (18.4%) also reported never experiencing complications. The high proportion of respondents with uncontrolled fasting blood sugar levels may contribute to the development of diabetes mellitus complications. Previous research has shown that poor blood sugar control is a risk factor for diabetes mellitus complications (Purwanti et al., 2016) . Variations in the types of complications reflect differences in disease severity, diabetes duration, and success of diabetes

management in each respondent. The low proportion of kidney complications in this study may be due to the nature of diabetic nephropathy, which often develops slowly and does not show clear clinical symptoms in the early stages. The results showed that some respondents experienced complications of diabetes mellitus, particularly neuropathy, which is characterized by tingling or numbness. This is in line with previous research that found peripheral neuropathy to be a common complication in people with diabetes mellitus. (Purwanti et al., 2023) .

Based on the type of therapy, the majority of respondents used oral antidiabetic drugs, namely 40 people (35.1%). Furthermore, 31 respondents (27.2%) used a combination of oral drugs and insulin, 25 respondents (21.9%) used insulin, and 18 respondents (15.8%) only followed dietary management. These findings indicate that the majority of patients are still in the diabetes management phase that allows the use of oral pharmacological therapy, either as monotherapy or in combination with insulin. Insulin use is generally given to patients with inadequate glycemic control or to patients with longer disease duration and decreased pancreatic beta cell function.

Regarding diet management, the majority of respondents (79 respondents (69.3%) stated that they often do diet management, while 35 respondents (30.7%) only do it occasionally. No respondents reported not doing diet management at all. This shows that the majority of respondents are aware of the importance of diet management as part of diabetes mellitus management. However, the fact that some respondents are inconsistent in their eating habits indicates that adherence to dietary recommendations remains a challenge. Inconsistency in eating patterns can cause fluctuations in blood glucose levels and increase the risk of diabetes complications.

The relationship between sleep quality and fasting blood sugar levels in type 2 diabetes mellitus patients was analyzed to determine the relationship between the two variables based on the categories of sleep quality and fasting blood sugar levels.

Table 2.
Relationship between Sleep Quality and Fasting Blood Sugar Levels in Diabetes Mellitus Patients (n = 114)

Sleep Quality	(n = 114)				p -value
	blood sugar levels				
	Pre-diabetes (100-125 mg/dL)	Tall (>126 mg/dL)	amount		
	F	f	f	%	0.001
Good	10	13	23	20.2	
Bad	10	81	91	79.8	

Bivariate analysis of this study showed a highly significant association between sleep quality and fasting blood sugar levels in patients with type 2 diabetes mellitus ($p = 0.001$). This finding suggests that sleep quality plays a crucial role in controlling fasting blood sugar levels. Respondents with poor sleep quality were proportionally more likely to have high fasting blood sugar levels compared to those with good sleep quality.

In the group of respondents with good sleep quality, patients still had high fasting blood sugar levels, although the proportion was lower than in the group with poor sleep quality. This suggests that sleep quality is not the sole factor influencing fasting blood sugar levels, but rather interacts with other factors such as diabetes duration, medication adherence, diet, physical activity, and the individual's metabolic state. However, the proportion of respondents with high fasting blood sugar levels was significantly higher in the group with poor sleep quality, confirming the role of sleep quality as a contributing factor to poor glycemic control. Physiologically, poor sleep quality can affect the regulation of glucose metabolism through several mechanisms. Sleep disturbances are known to increase sympathetic nervous system activity and the secretion of stress hormones, particularly cortisol. Elevated cortisol levels at night and in the morning can stimulate gluconeogenesis in the liver and reduce insulin sensitivity in peripheral tissues. As a result, glucose

utilization by cells becomes suboptimal, and fasting blood sugar levels tend to increase. This mechanism explains why respondents with poor sleep quality in this study experienced higher levels of fasting hyperglycemia. Furthermore, sleep disturbances are also associated with changes in hormones that regulate appetite, such as leptin and ghrelin. Poor sleep quality can decrease leptin levels and increase ghrelin levels, which can lead to increased appetite and a preference for high-calorie foods. This condition can indirectly affect stable blood sugar levels, especially when accompanied by irregular eating patterns. Therefore, poor sleep quality not only directly impacts glucose regulation but also influences eating behavior and self-management in diabetes mellitus patients. The findings of this study align with several previous studies reporting a relationship between sleep quality and glycemic control in patients with type 2 diabetes mellitus. These studies showed that patients with poor sleep quality tended to have higher fasting blood sugar and HbA1c levels than patients with good sleep quality. This suggests that sleep disturbance is a consistent risk factor for poor glycemic control in diabetes mellitus patients.

The results of this study have important implications. Sleep quality often receives insufficient attention in diabetes mellitus management, which generally focuses on pharmacological treatment and dietary adjustments. However, untreated sleep disorders can hinder the success of therapy and worsen glycemic control. Diabetes mellitus patients with poor sleep quality also tend to experience daytime fatigue, decreased motivation, and decreased adherence to medication and a healthy lifestyle, ultimately worsening their metabolic condition. Furthermore, the presence of respondents with good sleep quality who still have high fasting blood sugar levels suggests that diabetes mellitus control is multifactorial. Good sleep quality can act as a protective factor, but it does not automatically guarantee optimal glycemic control if not accompanied by comprehensive diabetes management. Therefore, sleep quality needs to be viewed as part of a holistic approach to diabetes mellitus management, rather than as a stand-alone factor. Thus, the results of this study strengthen the evidence that sleep quality is significantly associated with fasting blood sugar levels in patients with type 2 diabetes mellitus. Efforts to improve sleep quality, through sleep hygiene education, pain management due to diabetes complications, and control of factors that disrupt sleep, should be considered an integral part of diabetes mellitus management strategies. This approach is expected to help improve glycemic control and reduce the risk of long-term complications.

DISCUSSION

The results of the univariate analysis in this study provide a general overview of the characteristics of respondents with type 2 diabetes mellitus who were the subjects of the study. Based on gender, the majority of respondents were women, amounting to 70.2%. This finding indicates that women are the dominant group in the population of type 2 diabetes mellitus patients at the study site. The dominance of female respondents is in line with several previous studies that reported that the prevalence of type 2 diabetes mellitus in women tends to increase from middle age to old age. Biologically, women experience significant hormonal changes, especially during the perimenopause and menopause phases, which are characterized by decreased estrogen levels. Estrogen has a protective role in insulin sensitivity and glucose metabolism. This decrease in hormones contributes to increased insulin resistance, visceral fat accumulation, and impaired glucose metabolism, thereby increasing the risk of developing type 2 diabetes mellitus. In addition to biological factors, psychosocial factors and women's dual roles in the family can also influence lifestyle, stress levels, and adherence to disease management, which indirectly impact glycemic control.

Regarding age, the results showed that the majority of respondents were in the early elderly (46–55 years) and late elderly (56–65 years). These findings reinforce the view that type 2 diabetes mellitus is a chronic and degenerative disease whose prevalence increases with age. The aging process causes a decline in pancreatic beta cell function, decreased insulin sensitivity in peripheral tissues, and increased low-grade systemic inflammation that play a role in the pathogenesis of diabetes mellitus. Furthermore, in the elderly group, physical activity tends to decrease and comorbidities

increase, which also worsens glycemic control.

In terms of diabetes mellitus duration, most respondents had diabetes for 1–5 years, followed by respondents with a disease duration of more than 5 years. Disease duration is an important factor in determining the clinical condition of diabetes mellitus patients. The longer a person has diabetes, the greater the risk of developing chronic complications due to continued exposure to hyperglycemia.

Chronic hyperglycemia causes structural and functional changes in small blood vessels and peripheral nerves, ultimately leading to the development of microvascular complications. Furthermore, long-term diabetes is associated with a reduced quality of life, including sleep disturbances, chronic fatigue, and a reduced ability to perform daily activities. This can create a reciprocal cycle, where complications and sleep disturbances worsen glycemic control, while poor glycemic control accelerates disease progression.

The study results showed that the most common complication experienced by respondents was peripheral neuropathy, characterized by tingling or numbness. Diabetic neuropathy is one of the most common microvascular complications found in patients with type 2 diabetes mellitus. This condition occurs due to nerve damage caused by chronic hyperglycemia, oxidative stress, and microcirculation disorders. Peripheral neuropathy not only causes sensory complaints but can also significantly impact patients' quality of life, including impaired mobility, an increased risk of diabetic foot ulcers, and sleep disturbances due to pain or discomfort at night. This indicates that complications of diabetes mellitus have broad implications, not only for physical aspects but also for psychological aspects and sleep quality. In addition to neuropathy, some respondents also experienced eye problems and slow-healing foot wounds. These complications reflect the presence of progressive microvascular disorders. Meanwhile, the proportion of respondents experiencing kidney disorders was relatively small, likely due to the slow and often asymptomatic progression of diabetic nephropathy in its early stages.

Based on the type of therapy they underwent, the majority of respondents used oral antidiabetic medications, either as monotherapy or in combination with insulin. The use of oral antidiabetic medications indicates that most patients still have relatively adequate pancreatic beta cell function. However, the presence of respondents using insulin or combination therapy indicates that some patients experienced decreased pancreatic beta cell function or had suboptimal glycemic control with oral therapy alone.

Regarding dietary management, the majority of respondents reported frequently adjusting their diet. This indicates that patients recognize the importance of diet in managing diabetes mellitus. However, some respondents remained inconsistent in their dietary management. This inconsistency can be caused by various factors, such as limited knowledge, long-established eating habits, sociocultural factors, and economic constraints. Irregular eating patterns can cause fluctuations in blood glucose levels and contribute to poor glycemic control.

The study results showed that most respondents had poor sleep quality. The high prevalence of sleep disorders in diabetes mellitus patients indicates that sleep quality is a frequently overlooked issue in the management of this disease. Sleep disorders in diabetes mellitus patients can be caused by various factors, including hormonal changes, increased sympathetic nervous system activity, nocturia, and pain due to diabetic neuropathy. Poor sleep quality impacts patients' physical and mental functioning. Patients with sleep disorders tend to experience daytime fatigue, decreased concentration, and decreased motivation to manage their disease, including adherence to medication and diet. These conditions can worsen glycemic control and increase the risk of complications.

Most respondents in this study had high fasting blood sugar levels, indicating suboptimal glycemic control. High fasting blood sugar levels reflect persistent glucose metabolism disorders. Factors influencing this condition include dietary adherence, physical activity, disease duration, type of therapy, and sleep quality. Furthermore, respondents were also found to have fasting blood sugar levels in the range of 100–125 mg/dL, or prediabetes. This condition can be explained through the concept of glucose variability, where blood glucose levels in diabetes mellitus patients do not always remain at a consistently hyperglycemic level. Glucose variability reflects the body's metabolic response to therapy and lifestyle, not an indication of improvement or cure for diabetes mellitus.

Bivariate analysis results showed a highly significant association between sleep quality and fasting blood sugar levels in diabetes mellitus patients. Respondents with poor sleep quality were more likely to be in the group with high fasting blood sugar levels. This finding confirms that sleep quality is a crucial factor in glycemic control. Physiologically, sleep disturbances can increase the secretion of stress hormones such as cortisol and decrease insulin sensitivity, thereby increasing glucose production by the liver and inhibiting glucose utilization by peripheral tissues. These conditions lead to increased fasting blood sugar levels. Therefore, improving sleep quality should be considered an integral part of diabetes mellitus management to achieve optimal glycemic control and prevent long-term complications.

CONCLUSION

This study provides a comprehensive overview of the characteristics of respondents with type 2 diabetes mellitus and their relationship to sleep quality and fasting blood sugar levels. The results showed that respondents were predominantly female, with the majority in the early to late elderly age group. The majority of respondents had had diabetes mellitus for 1–5 years, indicating that most patients had experienced this disease for a considerable period of time. From a clinical perspective, peripheral neuropathy was the most common complication among respondents, followed by eye disorders and foot ulcers, while a small proportion reported no complications. Regarding treatment type, most respondents were on oral antidiabetic medication, either as monotherapy or in combination with insulin, and most reported regularly adjusting their diet as part of their diabetes mellitus management.

The results of the sleep quality assessment showed that the majority of respondents reported poor sleep quality. This finding indicates that sleep disturbances are a common condition experienced by patients with type 2 diabetes mellitus. Poor sleep quality has the potential to impact patients' physical and metabolic health and can hinder optimal disease management efforts. Based on fasting blood sugar levels, most respondents had high fasting blood sugar levels, while others were in the prediabetic category. These findings indicate that fasting blood sugar control in the diabetes mellitus patients in this study was still suboptimal and reflects ongoing impaired glucose metabolism regulation. Bivariate analysis results showed a significant association between sleep quality and fasting blood sugar levels in patients with type 2 diabetes mellitus. Respondents with poor sleep quality tended to have higher fasting blood sugar levels compared to those with good sleep quality. These findings confirm that sleep quality is an important factor in controlling fasting blood sugar levels and should be considered as part of a comprehensive diabetes mellitus management approach.

REFERENCES

Indonesian Ministry of Health Policy Agency. (2023). Diabetes prevalence: Main results of the 2023 Indonesian Health Surveillance (SKI) .

- <https://www.badankebijakan.kemkes.go.id/daftar-frequently-asked-question-seputar-hasil-utama-ski-2023/hasil-utama-ski-2023/>
- Dembinska-Kiec, A., Mykkänen, O., Kiec-Wilk, B., & Mykkänen, H. (2008). Antioxidant phytochemicals against type 2 diabetes. *British Journal of Nutrition*, 99 (Appendix 1), S109–S117. <https://doi.org/10.1017/S000711450896579X>
- Khoiriyah, A., Masithoh, RF, & Kamal, S. (2021). Sleep hygiene innovation on sleep quality in patients with type 2 diabetes mellitus. *Journal of Nursing Science*, 1 (2), 27–33.
- Lase, WN (2023). The relationship between sleep hygiene and sleep quality in diabetes mellitus patients. *Prepotif: Journal of Public Health*, 7 (1), 158–166.
- Lengga, VM, Mulyati, T., & Mariam, SR (2023). The effect of diabetes self-management education (DSME) on the level of knowledge of diabetes mellitus in diabetes mellitus patients. *Journal of Professional Nursing Research*, 5 (1), 103–112.
- Purwanti, OS, Istiningrum, AI, & Wibowo, SF (2023). Improving Knowledge of Diabetes Mellitus in the Management of Neuropathy. *Jurnal Masyarakat Mandiri*, 7 (4), 3831–3839. <https://doi.org/10.31764/jmm.v7i4.16403>
- Purwanti, OS, Yetti, K., Herawati, T., Sudaryanto, A., & Daryani. (2016). Study on the relationship between blood glucose control and diabetic foot ulcers at Dr. Moewardi Hospital, Surakarta. *Proceedings of the International Seminar on Education and Health Technology (ISET-H)* , 296–301.
- Ratnasari, D. (2022). Literature Review: The Effect of Sleep Quality on Blood Pressure Levels in Type 2 Diabetes Mellitus Patients
- World Health Organization. (2024). Diabetes . <https://www.who.int/europe/news-room/fact-sheets/item/diabetes>
- Yazia, V., & Sari, V. (2023). Factors related to sleep quality in diabetes mellitus patients. *Journal of Mental Health Nursing (JKJ)*, 11 (4), 983–994.
- Zahra, AN, & Farida, SAYA (2020). The relationship between HbA1c levels and sleep quality in patients with type 2 diabetes mellitus. *Journal of the Indonesian National Nurses Association*, 3 (3), 189–196. <https://doi.org/10.32419/jppni.v3i3.170>