The relationship between sleep patterns and blood sugar levels in type 2 diabetes mellitus patients at Puskesmas Gamping 1

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Abstract

Type 2 diabetes mellitus is the predominant kind and is frequently linked to numerous risk factors, including sleep problems. People with diabetes frequently experience sleep problems resulting from polyuria, thirst, and physical discomfort, which can affect blood sugar levels. This study aims to determine the relationship between sleep patterns and blood sugar levels in people with type 2 diabetes mellitus at the Puskesmas (Primary Health Center) Gamping 1. This study employed an observational analytical design with a cross-sectional methodology. The sample consisted of 78 people with type 2 diabetes mellitus participating in the Prolanis program, chosen through incidental sampling. The instruments employed were the Pittsburgh Sleep Quality Index (PSQI) and a glycemic monitoring sheet. The Kendall's tau test was utilized for data analysis. The findings indicated a relationship between sleep patterns and blood sugar levels in people with type 2 diabetes mellitus at the Puskesmas Gamping 1, with a p-value of 0.002 < 0.5 and a correlation coefficient of 0.354. 23 respondents (65%) exhibiting adequate sleep patterns demonstrated normal blood sugar levels, whereas 12 respondents (34.3%) exhibited elevated blood sugar levels. Among the respondents exhibiting poor sleep patterns, 13 (30.2%) maintained normal blood sugar levels, while 30 (69.8%) presented high blood sugar levels. There is a relationship between sleep patterns and blood sugar levels in people with type 2 diabetes mellitus at the Puskesmas Gamping 1. This study's findings can help healthcare practitioners in educating and evaluating sleep patterns in diabetic individuals participating in Prolanis to manage blood sugar levels.

Keywords: blood sugar level; diabetes mellitus; sleep patterns

1. Introduction

Diabetes mellitus is a chronic disease characterized by high blood glucose levels exceeding normal limits due to impaired insulin production or effectiveness (Nuridayanti et al., 2021). According to the WHO (2023), globally, there are more than 422 million people with diabetes mellitus, with 1.5 million deaths annually directly caused by this disease. Diabetes and its complications not only impact individual health but also impose a significant economic burden on patients, their families, and the health and socioeconomic systems.

The prevalence of diabetes mellitus continues to increase. Based on data from the International Diabetes Federation, (2021), in 2021 the number of people with diabetes mellitus reached 537 million people or around 9.8% of the world's population, increasing from 8.5% in 2011, and is estimated to reach 11.2% in 2045. In Indonesia, the number of diabetes sufferers is predicted to increase from 19 million in 2021 to 23 million in 2030. In the Special Region of Yogyakarta (DIY), 78,004 cases of diabetes were recorded in 2022, with Sleman Regency having 27,192 sufferers (D.I Yogyakarta Health Office, 2023). According to the Indonesian Endocrinology Association (2019), diabetes mellitus is classified into four types: type 1 diabetes mellitus, type 2 diabetes mellitus, other specific types of diabetes mellitus, and gestational diabetes mellitus. Type 2 diabetes mellitus is the most common type, accounting for approximately 90% of all cases. This disease occurs due to insulin resistance, which causes blood glucose to remain high because it cannot be absorbed optimally by the body's cells (Firdaus et al., 2022).

One factor that can affect blood sugar levels in people with diabetes mellitus is sleep patterns. Sleep disturbances are often experienced by people with diabetes mellitus due to physical factors such as polyuria, frequent thirst and hunger, and other physical discomforts (Miller & Cappuccio, 2007). Studies show that disturbed sleep patterns can reduce glucose tolerance by 20–30%, increase insulin resistance, and cause metabolic disorders that worsen diabetes (Rudnicka et al., 2017). According to Arzaq et al., (2022), as many as 32 of 62 respondents (51.6%) experienced sleep disturbances, and 35 respondents (56.4%) had high blood sugar levels. Research conducted by (Basir & Misnarliah, 2020)

also stated that of 48 respondents, 35 people had high blood sugar levels and 26 people experienced sleep disturbances.

Based on the results of a preliminary study conducted by researchers on 11 type 2 diabetes mellitus sufferers who participated in the Prolanis program conducted by Gamping 1 Community Health Center on July 24, 2024. It can be concluded that 7 samples experienced abnormal blood sugar levels. Among them, 6 sufferers experienced high blood sugar levels (hyperglycemia), 1 sufferer experienced low blood sugar levels (hypoglycemia). In addition, there were 7 of the 11 type 2 diabetes mellitus sufferers who said they often experienced sleep pattern disturbances during the past month, 4 other sufferers said they rarely experienced pattern disturbances during the past month, with a frequency of 1-2 times in the past month. Based on previous research, it is necessary to conduct research to link sleep patterns with blood sugar levels, in this study, the blood sugar levels used were venous blood sugar measured in fasting conditions. The purpose of this study was to determine the relationship between sleep patterns and blood sugar levels in type 2 diabetes mellitus sufferers at Gamping 1 Community Health Center.

2. Methods

This study employed an observational analytical quantitative approach (Sucipto, 2020). Using a cross-sectional design, this study observed subjects at a specific point in time (Setiawan & Prasetyo, 2015), using the Kendall-tau test. This study was conducted in February 2025 at the Gamping 1 Community Health Center.

The population in this study were patients with type 2 diabetes mellitus participating in the Prolanis program. The sample was obtained using incidental sampling, with a total of 78 respondents (Notoatmodjo, 2018). The instruments used were the PSQI (Pittsbrug Sleep Quality Index) and photometry for measuring blood sugar levels. The PSQI questionnaire was declared valid by Handayani, (2023) with a calculated r value of 0.365-0.733 (> r table 0.361) and reliable with a Cronbach's Alpha value > 0.60. Initial reliability testing by the University of Pittsburgh (1988) also showed an Alpha value of 0.83, which indicates very good reliability.

3. Results and Discussion

3.1. Results

This study was conducted in February 2025 at Gamping 1 Community Health Center . The population consisted of patients with type 2 diabetes mellitus participating in the Prolanis program. The sample was obtained using incidental sampling, with a total of 78 respondents.

Table 1. Frequency distribution of respondent characteristics

Characteristics	Frequency (F)	Percentage (%)
Age		
40-60 Year	33	42.3%
61-75 year	41	52.6%
>76 year	4	5.1%
Amount (N)	78	100%
Gender		
Man	26	33,3%
Woman	52	66,7%
Amount (N)	78	100%
Long Suffering		
2-5 year	48	61,5%
6-10 year	27	34,6%
>10 year	3	3,8%
Amount (N)	78	100%

Based on the data in Table 1, the majority of respondents were aged 61-75, totaling 41 respondents (52.6%). There were 33 respondents aged 40-60 (42.3%). The fewest respondents were over 76, totaling 4 (5.1%).

Based on the data in the table, the majority of respondents were female (52 respondents) and 26 (33.3%) were male.

Based on the data in the table, 48 respondents (61.5%) had suffered from the condition for 2-5 years, 27 respondents (34.6%) for 6-10 years, and 3 respondents (3.8%) had suffered from it for more than 10 years.

Table 2. Frequency distribution of sleep patterns

Sleep Patterns	Frequency (F)	Percentage (%)
Pretty good	35	44,9%
Pretty bad	43	55,1%
Amount	78	100%

Based on the data in the table, it can be seen that the majority of respondents had fairly poor sleep patterns. 43 respondents (55.1%) had fairly poor sleep patterns, while 35 respondents (44.9%) had fairly good sleep patterns.

Table 3. Frequency distribution of blood sugar levels

Blood Sugar Levels	Frequency (F)	Percentage (%)
Normal	36	46,2%
hyperglycemia	42	53,8%
Amount	78	100%

Based on the data in the table, it can be seen that the majority of respondents had high blood sugar levels (hyperglycemia), as many as 42 respondents (53.8%). Meanwhile, respondents with normal blood sugar levels were 36 respondents (46.2%).

Table 4. The results of the relationship between sleep patterns and blood sugar levels in type 2 diabetes mellitus patients at Gamping 1 Community Health Center

Sleep Patterns	Blood sugar levels			P value	correlation coefficient
	Normal f	hyperglycemia f	Amount f		
pretty good	23	12	35		
pretty bad	13	30	43	0,002	0,354
Amount	36	42	78		

Based on the results of cross tabulation in the table of 78 respondents, it was found that there were no respondents with very good sleep patterns with low blood sugar levels (Hypoglycemia). There were no respondents with very good sleep patterns with normal blood sugar levels. There were no respondents with very good sleep patterns with high blood sugar levels. There were no respondents with quite good sleep patterns with low blood sugar levels. A fairly good sleep pattern with normal blood sugar levels was 23 respondents (65%), a fairly good sleep pattern with high blood sugar levels was 12 respondents (34.3).

There were no respondents with quite bad sleep patterns with low blood sugar levels, 13 respondents (30.2%) had quite bad sleep patterns with high blood sugar levels, 30 respondents (69.8%) had quite bad sleep patterns with high blood sugar levels. There were no respondents with very poor sleep patterns with low blood sugar levels, there were no respondents with very poor sleep patterns with normal blood sugar levels, there were no respondents with very poor sleep patterns with high blood sugar levels.

From the results of the Kendall Tau test, the value (P value = 0.002 <0.5) is obtained. This means that H0 is rejected and Ha is accepted, so the hypothesis states that there is a relationship between sleep patterns and blood sugar levels in type 2 diabetes mellitus sufferers at Gamping 1 Health Center. The correlation coefficient value of 0.354 indicates that the relationship between the two variables is in the sufficient category and is positive in one direction, meaning that the worse the sleep pattern, the higher the blood sugar levels of type 2 diabetes mellitus sufferers at Gamping 1 Health Center. Conversely, the better the sleep pattern, the better the blood sugar levels in type 2 diabetes mellitus sufferers at Gamping 1 Health Center.

3.2. Discussion

Based on the data in Table 2, it is known that most of the type 2 diabetes mellitus patients at the Gamping 1 Community Health Center had quite poor sleep patterns, as many as 43 (55.1%), while 35 respondents (44.9%) had quite good sleep patterns. The results of this study are in line with Arzaq et al., (2022) which showed that of the 62 respondents, 32 of them (51.6%) experienced disturbed sleep patterns.

According to Arzaq et al., (2022), good sleep occurs when a person has gone through all stages of sleep, from stage 1 to stage 4. Meanwhile, people with diabetes mellitus often experience shallow sleep, only reaching stages 1 and 2. This makes them easily awakened, causing respondents to wake up and need to urinate, have difficulty sleeping, and feel like their sleep is not restful. This sleep disturbance can increase blood sugar levels. Therefore, people with diabetes mellitus should limit drinking at night to prevent polyuria.

This study also aligns with (Euis & Giyaningtyas, (2023), who found that out of 144 respondents, 80 (54.8%) experienced poor sleep patterns. In addition to increasing blood sugar levels, sleep disturbances experienced by people with diabetes mellitus can also trigger stress. This is supported by research conducted by Basir & Misnarliah, (2020), which showed that explaining lack of sleep can increase the risk of stress. This condition is associated with an increased risk of diabetes because it worsens the already decreased effectiveness of insulin in people with diabetes.

Maintaining good sleep quality plays a crucial role in maintaining blood sugar levels in people with diabetes mellitus. Adequate, quality sleep supports cell regeneration, repairs cell damage, allows the body time to rest, and maintains metabolic balance and biochemical processes. Sleep quality in people with diabetes can be measured by sleep duration and latency. Sleeping less than 5 hours per day is a sign of poor sleep quality. This condition can reduce glucose tolerance and insulin sensitivity, leading to increased blood sugar levels that are difficult to control (Saleha et al., 2022).

Furthermore, people who sleep 7-8 hours have the lowest risk of diabetes. However, a one-hour reduction in sleep can increase the risk of diabetes by 9%. Sleep deprivation can also reduce insulin sensitivity by up to 29% and inhibit the body's process of eliminating blood sugar (Zuliana et al., 2025).

Based on the data in Table 3, the majority of respondents experienced high blood sugar levels (hyperglycemia), as many as 42 respondents (53.8%). This study's results align with Lispin & Narmawan, (2021), who found that the majority of respondents had high blood sugar levels, as many as 21 respondents (51.2%).

According to research byLispin & Narmawan, (2021), in people with diabetes, the body may experience a decreased response to insulin, or the pancreas may stop producing insulin altogether, leading to hyperglycemia. If blood sugar levels rise, the kidneys cannot reabsorb all the filtered sugar, so the blood sugar is ultimately excreted in the urine.

Blood glucose control is influenced by the response of pancreatic beta cells and insulin sensitivity. Low insulin production and decreased cell sensitivity to insulin can lead to elevated blood glucose levels. Consequently, people with type 2 diabetes mellitus tend to have poor glucose control (Najatullah, 2015).

This study is also in line with Umam et al.,(2020), the results of the researchers obtained from 104 respondents, the majority of 68 respondents (65.4%) had high blood glucose levels. The researchers explained that high blood glucose levels in respondents were related to short sleep duration. Lack of sleep causes decreased cell sensitivity to insulin, so blood glucose levels tend to be high.

Based on the data in table 4, there were 23 respondents (65.7%) who had a good sleep pattern and normal blood sugar levels, while 12 respondents (34.3%) had a good sleep pattern but with high blood sugar levels. %), meanwhile, 13 respondents (30.2%) had a bad sleep pattern and normal blood sugar levels, while 30 respondents (69.8%) had a bad sleep pattern with high blood sugar levels.

Most respondents with poor sleep patterns said they frequently woke up at night due to the urge to urinate, had difficulty falling asleep, and did not sleep soundly. The results of this study are in line with research by Arzaq et al., (2022) which concluded that there is a relationship between sleep patterns and blood sugar levels in diabetes mellitus sufferers in the work area of the UPT BLUD Airtiris Health Center. Of the 62 respondents, 32 respondents (51.6%) experienced disturbed sleep patterns, and 35 respondents (56.4%) experienced high blood sugar levels. This study also revealed that sufferers of type 2 diabetes mellitus often experience disturbed sleep patterns, especially due to frequent waking up at

night due to the urge to urinate. This disturbed sleep pattern can cause increased blood sugar levels. Therefore, sufferers of diabetes mellitus should not drink a lot at night to prevent polyuria.

The results of this study are supported by research by Basir & Misnarliah, (2020), The results of the study showed that the p value = 0.004 <α value = 0.05 so that Ho was rejected with the interpretation of the influence of random blood sugar levels on sleep patterns of diabetes mellitus sufferers, which showed that most respondents had high blood sugar levels as many as 35 people (72.9%), and respondents experienced disturbed sleep patterns as many as 26 people (54.2%). Sleep disorders in diabetes mellitus sufferers can be influenced by various factors, including physical, psychosocial, and environmental factors. Physical factors that cause sleep disorders include polyuria, frequent thirst and hunger, pain, and physical discomfort, polyuria is urinating at night which disrupts the sleep cycle and causes poor quality sleep (Miller & Cappuccio, 2007).

Research by Basir & Misnarliah, (2020) shows that lack of sleep can increase the risk of stress, and stress is associated with an increased risk of diabetes. This condition is caused by decreased insulin function in people who lack sleep. Research conducted by Anastasia A. Basir and Misnarliah found that respondents with disturbed sleep patterns tended to have higher blood sugar levels than those with regular sleep patterns (Basir & Misnarliah, 2020). Quality sleep occurs when respondents have passed through all stages of sleep, from stage 1 to stage 4. Meanwhile, respondents with diabetes mellitus often experience shallow sleep, only reaching stages 1 and 2. So they are easily awakened, this causes respondents to wake up and want to urinate, have difficulty sleeping, and feel like their sleep is not restful. This sleep disorder can increase blood sugar levels (Arzaq et al., 2022).

Adequate sleep is a basic need for everyone, especially for people with diabetes mellitus. Physiologically, sleep disturbances can lead to increased blood glucose levels. This condition not only affects the sufferer's ability to carry out daily activities but can also decrease motivation to live (Tentero et al., 2016).

From the description above, researchers conclude that poor sleep patterns are closely associated with increased blood sugar levels in people with type 2 diabetes mellitus. Sleep disturbances, such as frequent nighttime awakenings, can trigger physiological stress that interferes with insulin function, leading to elevated blood sugar levels. Therefore, maintaining a healthy sleep pattern is a crucial aspect of comprehensive diabetes management.

4. Conclusion

Based on the results of the study entitled the relationship between sleep patterns and blood sugar levels in type 2 diabetes mellitus sufferers at Gamping 1 Health Center, it was concluded that there was a relationship between sleep patterns and blood sugar levels in type 2 diabetes mellitus sufferers at Gamping 1 Health Center with a p-value (0.002) < 0.05, a correlation coefficient value of 0.354, indicating that the relationship between the 2 variables was in the sufficient category.

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References

Arzaq, M., Hamidi, N. S. M., & Isnaeni, M. A. L. (2022). *Hubungan Tingkat Stres Dan Pola Tidur Dengan Kadar Gula Darah Penderita Diabetes Melitus Tipe II Di Wilayah Kerja UPTD BLUD Puskesmas Airtiris* (Vol. 1, Issue 1).

Basir, A. A., & Misnarliah. (2020). Hubungan Antara Pola Tidur Terhadap Kadar Glukosa Darah Pada Penderita Diabetes Melitus Di Wilayah Kerja Puskesmas Leworeng Kecamatan Donri Donri Kabupaten Soppeng. In *JHNMSA* (Vol. 1, Issue 2).

Dinas Kesehatan D.I Yogyakarta. (2023). 2022 Profil DIY Publish. In *Dinas Kesehata D.I Yogyakarta*.

Euis, N., & Giyaningtyas, I. J. (2023). *Hubungan Pola Tidur Terhadap Kadar Gula Darah Penderita Diabetes Melitus Tipe 2 di Puskesmas Karang Bahagia*.

Firdaus, A. O. R., Indrawati, U., Wahdi, A., Puspitosari, R. D., & Arham, H. A. (2022). Hubungan kadar gula darah dengan kebutuhan tidur pada pasien Diabetes Mellitus. In *Jurnal Keperawatan* (Vol. 20).

Handayani, S. H. (2023). *Hubungan Kecemasan Dengan Kualitas Tidur Penderita Hipertensi di Puskesmas Mantrijeron*.

IDF. (2021). *Diabetes Facts Figures*. Https://Idf.Org/about-Diabetes/Diabetes-Facts-Figures/.

Lispin, & Narmawan, N. (2021). Hubungan Kualitas Tidur Terhadap Kadar Glukosa Darah Pasien Diabetes Mellitus Tipe 2. *Jurnal Keperawatan*, *04*. https://stikesks-kendari.e-journal.id/JK

Miller, M. A., & Cappuccio, F. P. (2007). Inflammation, sleep, obesity and cardiovascular disease. *Current Vascular Pharmacology*.

Najatullah, I. W. (2015). Hubungan Kualitas Tidur dengan Kontrol Glukosa Darah Pasien DM tipe 2 di Klinik Spesialis Perawatan Luka, Stoma, dan Inkontinensia "KITAMURA" Pontianak tahun 2015. *Program Studi Ilmu Keperawatan Fakultas Kedokteran Universitas Tanjungpura Pontianak*.

Notoatmodjo, S. (2018). *Metode Penelitian Kesehatan*. Rineka Cipta.

Nuridayanti, A., Puspitosari, R. D., Wahdi, A., & Jayanti, A. P. E. (2021). Pengaruh Lidah Buaya Dan Madu Terhadap Penyembuhan Luka Diabetik Pada Pasien Diabetes Mellitus. In *Journal Well Being* (Vol. 6, Issue 1).

Perkumpulan Endokrinologi Indonesia (PERKENI). (2019). *Pedoman Pengelolaan dan Pencegahan Diabetes Melitus Tipe 2 Dewasa di Indonesia 2019*.

Rudnicka, A. R., Nightingale, C. M., Donin, A. S., Sattar, N., Cook, D. G., Whincup, P. H., & Owen, C. G. (2017). Sleep Duration and Risk of Type 2 Diabetes. *Pediatrics*, *140*(3). https://doi.org/10.1542/peds.2017-0338

Saleha, T. Y., Cahyati, Y., Putri, P. A., & Raina, S. D. (2022). Kualitas Tidur dan Kadar Gula Darah Pasien Diabetes Mellitus Tipe II. *Jurnal Penelitian Kesehatan "SUARA FORIKES."* https://doi.org/10.33846/sf13207

Setiawan, D., & Prasetyo, H. (2015). *Metodologi Penelitian Kesehatan Untuk Mahasiswa Kesehatan* (1st ed.). Graha Ilmu.

Sucipto, D. C. (2020). *Metodologi Penelitian Kesehatan* (1st ed.). Gosyen.

Tentero, I. N., Pangemanan, H. C., & Polii, H. (2016). Hubungan diabetes melitus dengan kualitas tidur. In *Jurnal e-Biomedik (eBm)* (Vol. 4, Issue 2).

Umam, R. H., Fauzi, A. K., Rahman, H. F., Khotimah, H., & Wahid, A. H. (2020). Hubungan Kualitas Tidur Dengan Kadar Glukosa Darah Pada Penderita Diabetes Melitus Tipe 2 Di Puskesmas Besuk Probolinggo. *Jurnal Ilmiah Keperawatan*.

WHO. (2023, June 20). *Diabetes*. Https://Www.Who.Int/Southeastasia/News/Detail/14-11-2023-World-Diabetes-Day--Access-to-Diabetes-Care.

Zuliana, E., Rusnoto, & Sukesih. (2025). Hubungan Kualitas Tidur, Kepatuhan Minum Obat dan Aktivitas Fisik dengan Kadar Gula Darah Pasien Diabetes Melitus di Pukesmas Kaliwungu Kudus. *Jurnal Pendidikan Tambusai*.