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THE RELATIONSHIP BETWEEN *SLEEP HYGIENE* AND SLEEP QUALITY IN PATIENTS WITH DIABETES MELLITUS: A CROSS-SECTIONAL STUDY IN BABAKAN SARI, INDONESIA

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ABSTRACT

Gangguan tidur merupakan salah satu permasalahan umum yang dialami oleh penderita diabetes melitus dan berpotensi memperburuk regulasi glukosa serta kualitas hidup. Penelitian ini bertujuan untuk mengetahui hubungan antara sleep hygiene dan kualitas tidur pada penderita diabetes melitus di Kelurahan Babakan Sari. Desain penelitian yang digunakan adalah kuantitatif korelasional dengan pendekatan cross-sectional. Sebanyak 75 responden dipilih menggunakan teknik purposive sampling. Pengumpulan data dilakukan menggunakan instrumen Pittsburgh Sleep Quality Index (PSQI) dan Sleep Hygiene Index (SHI). Hasil penelitian menunjukkan bahwa mayoritas responden memiliki sleep hygiene dalam kategori sedang (50,7%) dan kualitas tidur yang buruk (92,0%). Analisis menunjukkan adanya hubungan positif yang signifikan antara sleep hygiene dan kualitas tidur (r = 0.620, p < 0.001). Temuan ini mengindikasikan bahwa sleep hygiene berperan penting dalam menentukan kualitas tidur pada penderita diabetes melitus. Oleh karena itu, intervensi berbasis edukasi mengenai kebiasaan tidur sehat perlu diintegrasikan dalam program pengelolaan diabetes di tingkat komunitas.

Sleep disturbances are a common comorbidity among individuals with diabetes mellitus and can negatively impact blood glucose regulation and overall quality of life. This study aims to examine the relationship between sleep hygiene and sleep quality among patients with diabetes mellitus in Kelurahan Babakan Sari. A correlational quantitative design with a cross-sectional approach was applied. A total of 75 respondents were selected using purposive sampling. Data were collected using the Pittsburgh Sleep Quality Index (PSQI) and Sleep Hygiene Index (SHI) instruments. The findings revealed that most respondents had a moderate level of sleep hygiene (50.7%) and poor sleep quality (92%). Pearson correlation analysis indicated a significant positive relationship between sleep hygiene and sleep quality ($r = 0.620$, $p < 0.001$). These results suggest that sleep hygiene plays a vital role in determining sleep quality among individuals with diabetes. Therefore, educational interventions promoting healthy sleep habits should be integrated into community-based diabetes management programs.

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INTRODUCTION

Diabetes mellitus (DM) is a chronic disease whose global prevalence continues to rise. According to the *International Diabetes Federation* (IDF, 2023), approximately 537 million adults worldwide live with diabetes, and this figure is expected to increase substantially in the coming decades due to changes in lifestyle, obesity, and population aging. In Indonesia, the 2021 Riskesdas report showed that 10.8% of adults were diagnosed with diabetes, indicating a significant public health burden (Kementerian Kesehatan Republik Indonesia, 2021). The increase is influenced by various factors, including the consumption of high-calorie foods, the lack of physical

activity, the rapid rate of urbanization, and low public awareness of the importance of early detection and sustainable disease management.

One of the main challenges often faced by people with diabetes mellitus is sleep disorders that can worsen blood sugar management and overall quality of life. Sleep disorders that are often found in people with diabetes mellitus include insomnia, intermittent sleep, or poor sleep, which ultimately has an impact on blood sugar control and worsening overall health condition (Borzouei et al., 2024). If chronic, sleep disturbances in people with DM can reduce productivity levels, increase the risk of cardiovascular complications, and negatively impact the patient's mental health and well-being.

This phenomenon shows the urgency to conduct a more in-depth study of the relationship between *sleep hygiene* (sleep hygiene) and sleep quality in individuals with DM. *Sleep hygiene* covers various behaviors and habits that support the achievement of optimal sleep, such as maintaining consistency when going to bed and waking up, creating a conducive bedroom atmosphere, regulating lighting and room temperature, and avoiding triggers for sleep disorders such as overeating, consuming caffeinated beverages, and using electronic devices before bed. Application of *sleep hygiene* has been shown to be effective in improving sleep quality and acts as a beneficial non-pharmacological intervention in various groups of people, including people with chronic diseases (Rahmawati et al., 2019). However, the majority of previous studies conducted in Western countries have paid less attention to socio-cultural differences in Indonesia, which most likely influence sleep behavior. Factors such as social values, late-night activities, religious activities at night, and certain bedtime diets can affect people's sleep quality (García-Serrano et al., 2022; Ma et al., 2024). Therefore, an effective intervention strategy in Western countries cannot necessarily be directly applied in Indonesia. For example, religious activities or night worship during the month of Ramadan, activities such as trading in the night market make people's sleep schedules more flexible and irregular. This condition confirms the need for locally-based research so that the interventions formulated are more relevant and can be applied sustainably.

Unfortunately, studies on *sleep hygiene in people with* DM in Indonesia are still limited, especially those that highlight the influence of socio-cultural factors in the formation of sleep patterns. Some habits such as sleeping with bright lighting or using electronic devices for a long time before going to bed are clear examples of obstacles to the formation of healthy sleep patterns in society. If this gap is not addressed, the quality of life of people with DM has the potential to decrease due to persistent sleep disorders.

Initial findings in Babakan Sari Village show that many DM sufferers experience insomnia, often wake up at night (*sleep maintenance insomnia*), and wake up feeling tired. This condition not only decreases quality of life, but can also worsen glycemic control as well as increase the risk of long-term complications.

Based on this description, this study has an important position because the majority of previous studies have focused on Western populations or urban areas with different characteristics. There have not been many studies in Indonesia that specifically explore the relationship between sleep hygiene and sleep quality in people with DM by considering socio-cultural dimensions. Therefore, this study offers *novelty* in the form of an analysis of the relationship between the two variables in the Babakan Sari community which has distinctive social and cultural characteristics. The results of the research are expected to enrich scientific understanding and produce recommendations for cultural-based interventions that are more targeted and easy to implement at the community level.

METHODS

Study Design

This study uses a quantitative approach with a correlational design that aims to analyze the relationship between *sleep hygiene* as an independent variable and sleep quality as a dependent variable in patients with Diabetes Mellitus.

Population and Sample

The population that is the subject of this study is all patients with Diabetes Mellitus who are registered at the Babakan Sari Health Center in 2024. The selection of this population was considered based on the clinical relevance for people with diabetes in the area as well as the ease of obtaining valid and verified data. The sampling technique uses the Slovin formula which produces a sample number of 75 people in accordance with the criteria that have been set. The inclusion criteria include: (1) Diagnosed with Type 2 DM for at least one year prior, (2) Aged 18 years and above, (3) Able to communicate verbally well, and (4) Willing to participate in the study by signing *informed consent*. Meanwhile, exclusion criteria include: (1) Presence of cognitive or mental impairments that may hinder the completion of the questionnaire, (2) Being taking medication or undergoing medical therapy that may affect sleep quality (e.g. certain sedatives) at the time of data collection, and (3) Having severe vision and hearing impairments that make it difficult to communicate during the data collection process. Researchers use techniques *purposive sampling* to select respondents based on certain pre-determined criteria. The *purposive sampling* technique was chosen because it can produce the right sample according to the purpose of the research, namely respondents who have relevant knowledge about *sleep hygiene* and sleep quality in people with diabetes (Irwan, 2021).

Research Location and Time

This research was conducted in Babakan Sari Village in November-December 2024.

Instruments

The data collection tool in this study was carried out using two instruments that have been tested for validity and reliability. The instrument is *Sleep Hygiene Index* (SHI) which is used to measure sleep habits or *sleep hygiene*and *Pittsburgh Sleep Quality Index* (PSQI) which is used to assess an individual's sleep quality. SHI includes 12 statements that assess behavioral aspects related to sleep hygiene, while PSQI measures seven key components that describe overall sleep quality, resulting in a global score that indicates respondents' levels of sleep disturbances. Instruments *Pittsburgh Sleep Quality Index* (PSQI) in the original version has been proven to have good validity and reliability, with an internal reliability coefficient (Cronbach's alpha) of 0.83 (Smyth, 2012). In the adaptation into Indonesian, PSQI also showed adequate measurement quality, where the content validity test reached 0.89, while the reliability test resulted in a Cronbach's alpha value of 0.79 (Alim, 2015).

Data Collection Procedure

The type of data used in this study is primary data, namely data obtained directly from respondents through face-to-face interaction at the research site. The data collection procedure was carried out when the respondents were on site, by providing a structured questionnaire that had been prepared in advance. In the process of filling out the questionnaire, the researcher also assists the respondents to ensure that each question is well understood, as well as to minimize errors in filling in the data.

Data Analysis

The data obtained from the SHI and PSQI questionnaires will be analyzed using descriptive statistical analysis to describe the characteristics of the respondents and the distribution of data regarding *sleep hygiene* and sleep quality. Next, to test the relationships between the variables *sleep hygiene* and sleep quality, using Pearson's correlation analysis. The Pearson correlation test was chosen because both variables have numerical data measured on an interval scale that makes it possible to measure the extent of the relationship between the two (Irwan, 2021).

Ethical Considerations

This research has obtained ethical approval from the Ethics Committee of Padjadjaran University with decree number 1064/UN6. KEP/EC/2024, which ensures that all research procedures are carried out in accordance with the principles of research ethics. This includes information-based consent from respondents, data confidentiality, and protection of the rights of research subjects. The researcher is committed that participation in this study will not have a negative impact or loss on the respondents.

RESULTS

This section of the analysis of results presents research findings based on data obtained from 75 respondents with Diabetes Mellitus who live in Babakan Sari Village, with the main objective of identifying the relationship between *sleep hygiene* and sleep quality in this group. The data from the study results were summarized in the form of a frequency distribution table, which describes the number and percentage of each category in the variables studied, including demographic characteristics, *sleep hygiene* levels, and sleep quality of the respondents. The demographic characteristics analyzed in this study included age range, gender, last level of education, type of occupation, presence of comorbidities, lighting conditions during sleep, bedroom temperature, and caffeine consumption habits in the past month. All of this information is presented in detail in the following frequency distribution table that reflects the real conditions of each respondent in their respective categories.

Table 1. Frequency Distribution of Respondent Characteristics (N=75)

Characteristics	Category	(f)	Percentage (%)
Age	<40 years	1	1.3%
	40-60 years	37	49.3%
	>60 years	37	49.3%
Gender	Female	55	73.3%
	Male	20	26.7%
Education Level	Higher Education	3	4.0%
	Senior High School	23	30.7%
	Junior High School	16	21.3%
	Elementary School	33	44.0%
Employment Status	Employed	17	22.7%
	Unemployed	58	77.3%
Comorbid Conditions	Hypertension	44	58.7%
	Hypertension & Respiratory Disorders	2	2.7%
	Prostate Lung	1	1.3%
	None	28	37.3%
Lighting During Sleep	Bright	25	33.3%
	Dim	25	33.3%
	Dark	25	33.3%
Room Temperature	Warm	21	28.0%
	Moderate	20	26.7%
	Cool	34	45.3%
Caffeine Consumption	Yes	34	45.3%
	No	41	54.7%

Based on the analysis, it was known that of the 75 respondents, half of the respondents were 40-60 years old and > 60 years old. It can be seen that the majority of respondents were female as many as 55 respondents (73.3%), the majority of respondents' education level was elementary school as many as 33 respondents (44.0%), 58 respondents were unemployed (77.3%), had hypertension diseases other than DM as many as 44 respondents (58.7%), light when sleeping was bright, dim, and dark as many as 25 respondents each (33.3%), cold room temperature due to weather as many as 34 respondents (45.3%), and not drinking caffeine as many as 41 respondents (54.7%).

Table 2. Distribution of *Sleep Hygiene* Frequency and Sleep Quality in Patients with Diabetes Mellitus in Babakan Sari Village (N=75)

Variable	Category	(f)	(%)
Sleep Hygiene	Good	10	13.3%
	Moderate	38	50.7%
	Poor	27	36.0%
Sleep Quality	Good	6	8.0%
	Poor	69	92.0%

Based on the results of the study in table 2, it shows that most of the respondents with Diabetes Mellitus in Babakan Sari Village are in the moderate *sleep hygiene* category as many as 38 respondents (50.7%), followed by the bad category as many as 27 respondents (36.0%), while only 10 respondents (13.3%) have good *sleep hygiene*. This pattern shows that *sleep hygiene* practices among respondents are still not optimal. This condition is in line with the fact that the majority of respondents experienced poor sleep quality as many as 69 respondents (92.0%), and only 6 respondents (8.0%) had good sleep quality. The high proportion of poor sleep quality is influenced by various factors, including irregular sleep patterns, unsupportive rest environments, and nighttime habits that are not conducive to deep sleep.

Table 3. Results of the Correlation Test on the Relationship between *Sleep Hygiene* and Sleep Quality in Patients with Diabetes Mellitus in Babakan Sari Village

Variable	r	P-value
Sleep hygiene	0.620	<0.001
Sleep Quality	0.620	<0.001

The relationship between the two variables in table 3 shows that statistical analysis through correlation tests yielded a coefficient value of r = 0.620 which indicates a strong positive relationship between *sleep hygiene* and sleep quality, with a significance level of p < 0.001. This shows that the better a person's *sleep hygiene*, the higher the likelihood that he or she will have good sleep quality. Thus, it can be concluded that *sleep hygiene* plays an important role in supporting the improvement of sleep quality in people with diabetes mellitus, and is an aspect that needs to be considered in non-pharmacological management strategies for sleep disorders.

DISCUSSION

The results of this study show that the majority of respondents are in the middle age group (40–60 years) to the elderly (>60 years). This condition is in line with research reports indicating that about half of the elderly are more prone to sleep disorders, either in the form of difficulty starting sleep or waking up often at night (Patel et al., 2018). The composition of respondents is also dominated by women, which is consistent with epidemiological data that the prevalence of diabetes mellitus tends to be higher in women than men.

The education level of the respondents in this study was mostly elementary school graduates (44.0%). This limited education can limit the understanding of medical information, including education about sleep

hygiene, thus affecting respondents' ability to carry out healthy sleep practices. This can be seen from the distribution of sleep hygiene, where more than half of the respondents were in the moderate category (50.7%) and the other third were in the poor category (36.0%), while only a small percentage (13.3%) practiced *sleep hygiene* well.
In addition to the educational factor, the high rate of hypertension comorbidities in respondents (58.7%) is also noteworthy. Hypertension is often associated with sleep disorders, such as obstructive sleep apnea, as well as increased activity of the sympathetic nervous system at night which can interfere with sleep quality (*International Diabetes Federation,* 2023). Socio-cultural factors in the Babakan Sari area also worsen the situation, such as the habit of gathering late at night, religious activities at night, and the consumption of sweet or fatty foods before bed, which can physiologically increase metabolic load and disrupt the sleep process.

Another finding that stood out was the high prevalence of poor sleep quality, which was 92% of respondents. This figure far exceeds the results of a study in Ethiopia which reported that 55% of people with DM experienced poor sleep quality (Jemere et al., 2019), as well as a systematic review in Sub-Saharan Africa which found a prevalence of 61% (Fentaun et al. 2024). Even previous research in Indonesia only recorded a figure below 70% (Harahap et al., 2022). This difference confirms that the problem of sleep quality in the DM community in Babakan Sari is much more serious than many other populations.

Statistical analysis showed a strong positive correlation between sleep hygiene and sleep quality ($r = 0.620$, $p < 0.001$). Based on the classification of Cohen (1988), this value is included in the high category. This means that healthy sleep practices are not only statistically related to sleep quality, but also have important clinical impacts. Simple interventions such as maintaining sleep consistency, avoiding caffeine before bedtime, limiting the use of electronic devices, and creating a comfortable sleep environment are very likely to provide a real improvement in the sleep quality of people with DM. Further impacts of good sleep quality are improved glycemic control, insulin sensitivity, reduced physiological stress, and prevention of long-term complications (Fentahun et al., 2024; Harahap et al., 2022).

The high proportion of patients who had poor sleep quality in this study, which reached 92.0%, is an important finding that deserves attention from the clinical and public health sides. This very large percentage is likely due to a combination of socio-cultural factors and medical conditions typical of the region. From a cultural perspective, the people of Babakan Sari Village often carry out activities that have the potential to disrupt sleep patterns, such as gathering until late at night *(late-night community gatherings*), carrying out social or religious activities at night, as well as consuming foods or drinks high in sugar and fat before bedtime, a pattern that can increase metabolic load and disrupt the physiological sleep process. From a medical aspect, the high prevalence of hypertension (58.7%) is also a contributing factor, considering that hypertension is often associated with sleep disorders such as *obstructive sleep apnea* as well as increased activity of the sympathetic nervous system at night, both of which can inhibit the attainment of restorative sleep (Simarmata et al., 2020). This synergy between cultural habits that influence sleep behavior and medical factors that affect physiological function is likely to be the main cause of the high rates of poor sleep quality. Thus, the designed interventions need to include education *sleep hygiene* At the same time, consider cultural factors and comorbidity management as a whole.

The symptoms of sleep disorders that are often experienced are often waking up at night because they want to urinate. This is a feature of nocturia, a condition that is common in people with diabetes and can cause sleep fragmentation. As a result, many patients find it difficult to return to sleep and experience fatigue during the day. This condition is caused by metabolic disorders such as osmotic diuresis and dehydration (Simarmata et al., 2020).

In the study conducted (Lispin et al., 2021) It was found that out of 41 respondents, as many as 25 people (61.0%) experienced poor sleep quality. The respondents complained of difficulty maintaining sleep, often waking up at night, and feeling tired during activities. This habit is also closely related to unstable blood sugar levels and decreased productivity, which ultimately affects the overall quality of life of sufferers. The study also showed a link between low sleep quality and increased symptoms of diabetes mellitus. People with

diabetes who have low sleep quality often experience complaints such as pain when urinating, discomfort, and difficulty falling back asleep after waking up, all of which lead to a decrease in the quality of daily activities.

From the results of the statistical analysis carried out, it was found that there was a significant relationship between *sleep hygiene* and sleep quality of people with diabetes mellitus in this study area ($p < 0.001$). This data strengthens the theory that improving healthy sleep habits can have a positive impact on optimizing the sleep quality of people with diabetes. This is in line with research showing that *sleep hygiene*, such as maintaining a consistent sleep schedule, avoiding caffeine before bed, avoiding the use of electronics before bed, and creating a comfortable environment, has been shown to improve sleep quality in DM patients (Harahap et al., 2022). Good sleep quality is essential for managing diabetes, as it significantly affects glycemic control and insulin sensitivity. In addition, sleep disorders, including obstructive sleep apnea, worsen insulin resistance and complicate diabetes management, highlighting the need for effective sleep interventions.

Research conducted by Fentaun et al. (2024) found that in order for the body and brain to understand that the bed is only used for sleeping and resting, not for other purposes, it is necessary to limit the time spent in bed and the activities that can be done there. For example, sufferers should only sleep when they feel tired and ready to fall asleep. Therefore, interventions to improve *sleep hygiene* In people with diabetes mellitus, it can provide broader benefits, not only on sleep quality, but also on other aspects of health. These interventions can help reduce clinical symptoms related to diabetes mellitus, such as sleep disorders, as well as improve the patient's overall quality of life (Harahap et al., 2022).

The findings in this study have broad implications for healthcare services and the intervention strategies that can be implemented. Within the scope of community nursing, nurses can integrate education about *sleep hygiene* into activities such as home visits or counseling sessions with health cadres. At a more macro level, it is important to develop a campaign to promote healthy sleep through educational media that is simple, visual, and easy to understand, especially for people with low levels of education. Adaptation to local cultural values is also an important aspect, for example by providing an understanding of the impact of sleeping in bright light or nighttime activities that interfere with sleep quality. In clinical nursing practice, nurses have the responsibility to guide patients in creating a comfortable sleep environment, covering aspects of lighting, room temperature, and noise. These interventions can be extended through digital technologies, such as the development of educational apps or videos based on local culture. To evaluate its effectiveness, regular measurements of *sleep hygiene* and sleep quality are needed as indicators of the success of a DM management program. In addition, *longitudinal* research needs to be conducted to monitor the long-term impact of such community-based interventions.

Based on the results of the research, there are a number of strategic recommendations that can be implemented, such as designing *sleep hygiene* education modules in health centers or first-level health facilities that are tailored to people's literacy skills, establishing cross-sector cooperation by involving community leaders, health cadres, and religious institutions to expand the reach of health messages, developing educational content based on local culture, such as short videos or podcasts, and conduct long-term studies to assess changes in sleep behavior and improvement in sleep quality in the DM population on an ongoing basis.

In addition, it should be noted that this study has not comprehensively covered all confounding variables. Although the instruments used have good validity, aspects such as psychological condition, type of diabetes treatment undertaken, and daily physical activity levels have not been statistically analyzed as control variables. This is one of the limitations in this study and needs to be considered in the interpretation of the results, and can be used as a reference for future research development.

LIMITATIONS OF THE RESEARCH

This research has limited time available for the data collection process. The relatively short time limits the scope of observation and more in-depth interaction with respondents, so the data obtained only represents the

conditions at any given moment. This limitation also affects the ability of researchers to conduct *longitudinal evaluations* of changes in *sleep hygiene* and sleep quality in patients with diabetes mellitus in the long term. Therefore, the results of this study must be interpreted by considering the existing temporal limitations. In addition, this study fully uses standardized and validated *self-report* instruments , namely *the Sleep Hygiene Index* (SHI) and *the Pittsburgh Sleep Quality Index* (PSQI), to assess the sleep hygiene and sleep quality of the respondents. Both instruments have been widely used in international and national research, and have been proven to have high validity and reliability in a wide range of populations, including patients with chronic diseases. However, the measurement approach that relies on self-report cannot be separated from its fundamental limitations. One of these limitations is the potential *for recall bias*, where respondents have difficulty remembering their sleep patterns and habits correctly over a certain period, which can affect the accuracy of the data obtained. In addition, there is a possibility of *social desirability bias*, which is the tendency of respondents to give answers that are considered more positive or in accordance with social norms which has implications for a decrease in the accuracy of measurement results. Both forms of bias can affect the internal validity of studies, especially in determining the magnitude of the relationship between *sleep hygiene* and sleep quality. Therefore, the results obtained need to be interpreted carefully, and it is recommended in subsequent studies to combine subjective methods with objective approaches, such as *actigraphy or polysomnography*, in order to improve the accuracy of the data and minimize the risk of bias.

CONCLUSIONS

The level of *sleep hygiene* in patients with Diabetes Mellitus in Babakan Sari Village is still insufficient. More than half of the respondents showed moderate to poor sleep behavior, reflecting that healthy sleep habits have not become an integrated part of the daily lives of DM sufferers in the region. The majority of people with Diabetes Mellitus also experience low sleep quality, as reflected by the high *Pittsburgh Sleep Quality Index* (PSQI) score. Sleep disorders experienced include difficulty maintaining sleep, often staying awake at night, and the appearance of tiredness during the day. This condition is strongly related to an unsupportive sleep environment and less conducive nighttime habits. Statistical analysis showed a positive and significant correlation between *sleep hygiene* behavior and sleep quality ($r = 0.620$, $p < 0.001$). This indicates that the better *the sleep hygiene* practices applied by the sufferers, the higher they will have the more optimal sleep quality. These findings provide empirical evidence that *sleep hygiene* plays an important role in improving sleep quality for individuals with diabetes mellitus. Therefore, health workers need to integrate *sleep hygiene education* into primary services, with simple, visual, and culturally appropriate materials so that they are easy for the public to understand. Family, community, and government policy support is also important to strengthen the implementation of healthy sleep behaviors. Follow-up research is recommended using a long-term design to evaluate the sustainability of interventions as well as incorporating other variables such as psychological conditions, therapies undertaken, and physical activity levels to provide a more comprehensive picture.

CONFLICT OF INTEREST

The author hereby expressly declares that there is no conflict of interest in this study. The study was conducted independently without the influence of external parties and using standardized instruments that have been validated.

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AUTHOR'S CONTRIBUTION

Gina Utami: Conceptualization, data collection, analysis, writing original draft, and final editing.
Neti Juniarti: Supervision, funding acquisition, and methodological guidance.
Citra Windani Mambang Sari: Supervision and resource provision.

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