

The relationship between anxiety levels and sleep quality in patients with type 2 Diabetes Mellitus at the Bulu Lor community health center in Semarang City

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Abstract

Background: Type 2 diabetes mellitus (DM) is a chronic disease that often triggers psychological problems such as anxiety, which in turn affects patients' sleep quality.

Objective: This study aims to determine the relationship between anxiety levels and sleep quality in patients with type 2 DM in the service area of the Bulu Lor Community Health Center in Semarang City.

Methods: This study employed a quantitative design with a cross-sectional analytical approach. The sample consisted of 76 respondents selected using purposive sampling. The instruments used were the Zung Self-Rating Anxiety Scale (ZRAS) to measure anxiety and the Pittsburgh Sleep Quality Index (PSQI) to measure sleep quality.

Results: The study found that the majority of respondents experienced severe anxiety (38 individuals, 50%) and poor sleep quality (69 individuals, 90.8%). The bivariate statistical test yielded a p-value of 0.006 (< 0.05) with a correlation coefficient of 0.311.

Conclusion: This study demonstrates a significant, positive, but weak association between anxiety levels and sleep quality. The higher the anxiety level, the poorer the patient's sleep quality. Healthcare professionals are encouraged to provide education on stress management and relaxation techniques to improve the quality of life for patients with type 2 diabetes.

Keywords

anxiety level; diabetes mellitus type 2; sleep quality

1. Introduction

Diabetes mellitus (DM) is a chronic disease that can lead to various complications, including both macrovascular and microvascular complications. One of the most serious complications is cardiovascular disease. If not properly managed, this condition can increase the risk of hypertension and myocardial infarction (Rizani et al., 2018). According to data from the International Diabetes Federation (IDF), the number of people with diabetes worldwide is projected to continue rising, from 537 million in 2021 to 643 million in 2030 and reaching 784 million by 2045. These figures indicate that in 2021, approximately 537 million people worldwide aged 20–79 were living with diabetes. In Indonesia, the prevalence of diabetes mellitus also shows an alarming trend. In Central Java Province, the prevalence of diabetes was recorded at 13.67% in 2020, decreased to 11.0% in 2021, and then rose again to 15.6% in 2022. This situation indicates that diabetes mellitus remains a significant public health issue in Central Java. The city of Semarang is one of the areas with the highest number of diabetes mellitus cases in the province, ranking third with a total of 55,075 cases. (Basri et al., 2020). Furthermore, based on data from the Semarang City Health Department's Integrated Reporting System (SIRANDU DKKS), diabetes mellitus ranked fifth among the top ten most common diseases at community health centers in 2020, with 44,492 cases. Meanwhile, from January through September 2021, diabetes mellitus ranked sixth, with 32,081 cases (Dwi Nugroho et al., 2022).

Patients with diabetes mellitus often experience anxiety related to their condition. This anxiety can disrupt sleep quality because, even though patients try to rest, their sleep cycles become restless and they wake up frequently. If this persists over a long period, anxiety can lead to poor sleep patterns. Additionally, anxiety triggers the autonomic nervous system's response to perceived threats, even though these threats are often nonspecific. This condition can increase the risk of insomnia. Therefore, the management of insomnia should not only focus on the sleep disorder itself but also consider biological and emotional factors, medical conditions, and poor sleep habits that contribute to the onset of the disorder (Wahid et al., 2016). In patients with type 2 diabetes mellitus, anxiety is generally triggered by concerns about the possibility of disease complications. Limited knowledge about type 2 diabetes mellitus, coupled with feelings of uncertainty, despair, depression, and anxiety following diagnosis, further exacerbates patients' psychological condition (Nugroho and Auliya, 2024; Tang et al., 2019). Sleep disturbances experienced by patients can negatively impact their health status and slow the healing process. Individuals who are ill generally require more sleep than healthy individuals because sleep plays a crucial role in restoring energy and optimizing bodily functions. Additionally, during sleep, the body's cells undergo repair and regeneration processes; thus, good sleep quality is a key factor in supporting patients' recovery (Basri et al., 2020).

Nurses play a vital role as providers of nursing care in helping to control the prevalence of diabetes mellitus through promotive and preventive efforts. One of the key steps that can be taken is to provide health education to the patient's family or close relatives. This education aims to enable families to recognize risk factors, assess the patient's balance and gait, train for flexibility, improve physical balance and coordination, and create a safer environment to prevent injuries. Thus, family members—including children, grandchildren, in-laws, and other relatives—need to possess adequate knowledge and skills to play an active role in supporting care and reducing the risk of complications in patients with diabetes mellitus (Made et al., 2023a).

Based on a preliminary study conducted on June 18–19, 2025, at the Bulu Lor Community Health Center in Semarang, data from the medical records unit showed that over the past three months, an average of 939 patients with type 2 diabetes mellitus received care, or approximately 313 patients per month. Interviews with 10 patients revealed that 7 patients expressed concern about their condition. Additionally, all respondents (10 patients) reported disturbances in their rest and sleep due to the symptoms of diabetes mellitus they were experiencing. These conditions caused patients to feel restless and increasingly anxious about their health, thereby leading to a decline in sleep quality. Based on these findings, the researchers were interested in examining

the relationship between anxiety levels and sleep quality in patients with type 2 diabetes mellitus in the service area of the Bulu Lor Community Health Center in Semarang City.

2. Methods

2.1 Research Design

This study employed a quantitative analytical design with a *cross-sectional* approach to analyze the relationship between anxiety levels as the independent variable and sleep quality as the dependent variable in patients with type 2 diabetes mellitus.

2.2 Setting and Samples

The study was conducted in July 2025 within the service area of the Bulu Lor Community Health Center in Semarang City. The study population consisted of all patients with type 2 diabetes mellitus in the service area of the Bulu Lor Community Health Center. Based on medical record data, the average number of patients over the past three months reached 939, or approximately 313 patients per month. Calculations using the Slovin formula resulted in a sample size of 76 respondents.

Sampling was conducted using *purposive sampling* based on the following inclusion criteria: patients with type 2 diabetes mellitus who experienced anxiety and sleep disturbances, had visited the community health center more than once, were willing to participate, were able to communicate effectively, and were in a conscious state. Exclusion criteria included patients who refused to participate or had verbal communication barriers. The *purposive sampling* technique was chosen because it allows researchers to obtain respondents who align with the study's objectives (Sugiyono, 2020) .

2.3 Measurement and data collection;

The study used two main instruments: an anxiety assessment instrument and a sleep quality instrument. The anxiety instrument used was the Indonesian version of the *Zung Self-Rating Anxiety Scale* (SAS/ZRAS) adapted by Anggi Setyowati. This questionnaire consists of 20 questions, comprising 15 psychological questions and 5 physiological questions. Scoring for this questionnaire uses a Likert scale with values ranging from 1 to 4, where a score of 1 indicates "never" and a score of 4 indicates "almost all the time." 29 The interpretation of scores on this questionnaire is as follows: a total score of 20–39 indicates no anxiety; a total score of 40–47 indicates mild anxiety; a total score of 48–55 indicates moderate anxiety; and a total score of 56–80 indicates severe anxiety.

The sleep quality instrument used the Indonesian version of the *Pittsburgh Sleep Quality Index* (PSQI) by Anggi Setyowati. This questionnaire consists of 18 questions grouped into 7 components: subjective sleep quality, sleep duration, sleep latency, sleep efficiency, daytime sleep disturbances, and the use of sleep aids. Scoring is based on a Likert scale ranging from 1 to 3, where a score of 3 indicates an extreme negative response. The interpretation of scores on this questionnaire is as follows: a score of ≤5 indicates that sleep quality falls into the "good" category, while a score >5 indicates that sleep quality falls into the "poor" category. This means that the higher the score, the poorer the sleep quality. Validity and reliability tests showed a calculated *r* value of 0.36–0.56 with a table *r* value of 0.349, a *p*-value < 0.05, and a Cronbach's alpha of 0.72, with individual item coefficients ranging from 0.69 to 0.72. Thus, the Indonesian version of the PSQI questionnaire is valid and reliable for use.

2.4 Data analysis;

The validity test for the anxiety scale yielded a calculated *r* value of 0.043 with a table *r* value of 0.349 and a *p*-value < 0.05, and the reliability test yielded a Cronbach's alpha value of 0.658 for the 20 items; thus, the Indonesian version of the SAS/ZRAS questionnaire is valid and reliable for use. Meanwhile, the validity and reliability tests for the sleep quality instrument showed

calculated r values ranging from 0.36 to 0.56 with a table r value of 0.349 and a p -value < 0.05 , as well as a Cronbach's alpha value of 0.72, with individual item values ranging from 0.69 to 0.72. Thus, the Indonesian version of the PSQI questionnaire is valid and reliable for use.

2.5 *Ethical considerations.*

Please describe the ethical issues in the study, including how informed consent was obtained from respondents/participants. Provide a statement of approval from the health research ethics committee, including its reference number. The researchers have submitted a permit application to the Widya Husada University Ethics Committee and have received ethical approval under number 01.024/ETK/UWH/VI/2026.

3. Results

3.1. Description of the Study Location

The service area of the Bulu Lor Community Health Center (Puskesmas) covers 3.42 km². The Bulu Lor Community Health Center is located in Semarang Utara Subdistrict, which consists of 9 urban villages, 5 of which fall within the service area of the Bulu Lor Community Health Center. The service area of the Bulu Lor Community Health Center comprises the urban villages of Bulu Lor, Plombokan, Purwosari, Panggung Kidul, and Panggung Lor. Administratively, the service area encompasses 5 (five) neighborhoods, namely: Bulu Lor, Plombokan, Purwosari, Panggung Kidul, and Panggung Lor. The neighborhood with the largest area is Panggung Lor, covering 140 hectares. Meanwhile, the neighborhood with the smallest area is Purwosari, covering 34 hectares.

3.2. Respondent Characteristics

The research results show that the majority of respondents were in the 31–40 age range, totaling 46 people (60.5%), while respondents aged 41 and older numbered 30 people (39.5%). Based on employment characteristics, the majority of respondents worked in the private sector—45 people (59.2%)—followed by civil servants (PNS), totaling 19 people (25%). The smallest group of respondents consisted of those who were not employed, totaling 12 people (15.8%).

3.3. Anxiety Levels

Based on the research results, the majority of respondents fell into the severe anxiety category, totaling 38 people (50%). Respondents with moderate anxiety numbered 34 (44.7%), while the mild anxiety category had the fewest respondents, totaling 4 people (5.3%).

3.4. Overview of Sleep Quality

The distribution of sleep quality shows that the majority of respondents—69 people (90.8%)—fall into the poor sleep quality category, while only 7 respondents (9.2%) fall into the good sleep quality category.

3.5. The Relationship Between Anxiety Levels and Sleep Quality

Based on the analysis results, a significant relationship was found between sleep quality and anxiety levels in patients. However, the strength of this relationship falls into the weak category, as indicated by a correlation coefficient of 0.311. A positive correlation coefficient indicates that the two variables share the same direction of relationship. Furthermore, the significance value (Sig., 2-tailed) of 0.006 (< 0.05) indicates that the relationship between sleep quality and anxiety levels is statistically significant.

4. Discussion

Based on the research results, the majority of respondents were in the 31–40 age group, totaling 46 people (60.5%). This finding differs from studies conducted by Imelda (2019) and Tri Anggoro and Aeni (2018) at Pertamina Bintang Amin Husada Hospital in Bandar Lampung. In those studies, the age group over 65 years was the largest, comprising 90 respondents (55.6%). This difference in the age characteristics of the respondents suggests that diabetes mellitus is no longer primarily found among the elderly but is increasingly occurring in younger age groups. This trend is believed to be linked to unhealthy lifestyle changes, such as an unbalanced diet, lack of physical activity, and rising obesity rates, which have led to an increase in type 2 diabetes among people of working age.

Physiologically, age is one of the factors that plays a role in increasing the risk of developing diabetes mellitus. The aging process causes a decrease in the body's cells' sensitivity to insulin, thereby reducing the body's ability to regulate blood glucose levels. In addition, the gradual decline in organ function—particularly after age 40—including that of the pancreas, which plays a role in insulin production, also contributes to the increased risk of diabetes mellitus (Hidayat et al., 2021; Sutanegara and Budhiarta, 2000).

Based on occupational distribution, the majority of respondents worked in the private sector, totaling 45 people (59.2%). The next largest group consisted of civil servants (PNS), numbering 19 people (25%), while unemployed respondents constituted the smallest group, totaling 12 people (15.8%). These results align with a study conducted by Arania, Triwahyuni, Prasetya, & Cahyani (2021), which showed that the majority of respondents were employed—79 people (62.7%)—while 47 respondents (37.2%) were unemployed. Employment status is known to influence the risk of developing diabetes mellitus. Individuals whose jobs primarily involve light or low levels of physical activity tend to expend less energy. Consequently, excess energy is stored as body fat, which can increase the risk of obesity—a predisposing factor for diabetes mellitus (Mulyanto et al., 2023).

The majority of respondents experienced severe anxiety, totaling 38 people (50%). Furthermore, 34 respondents (44.7%) reported moderate anxiety, while mild anxiety was the least common category, comprising 4 people (5.3%). The high proportion of respondents experiencing severe anxiety is likely influenced by various other factors not examined in this study. These factors include gender, environmental conditions, an individual's ability to cope with and resolve demands or burdens, new experiences, and personality type. Individuals with ambitious, competitive, and perfectionist personalities tend to be more prone to anxiety than those with other personality types. However, these factors were not analyzed further in this study (Basri et al., 2020; Imelda, 2019).

Anxiety can trigger an increase in cortisol levels in the blood, which contributes to the progressive development of insulin resistance, leading to elevated blood glucose levels. If stress persists over a long period and is not properly managed, this condition can develop into depression. Depression in people with diabetes is associated with poor adherence to treatment, increased healthcare costs, and a higher risk of mortality (Mulyanto et al., 2023). People with diabetes are also vulnerable to various negative psychological responses, such as feelings of anger, worthlessness, worry, and sadness, which can be triggered by various factors. Mental health disorders, such as anxiety, stress, and hopelessness, not only affect psychological well-being but can also worsen physical health. Research shows that anxiety and depression occur about twice as frequently in people with diabetes compared to those without diabetes (Donkor et al., 2022; Nugroho and Sucipto, 2022).

In addition, fluctuations in blood glucose levels can cause discomfort, restlessness, and nervousness. Chronic stress is one of the main underlying factors contributing to anxiety. When a person experiences stress, activation of the sympathetic nervous system causes an increase in heart rate and the release of norepinephrine. This physiological response also raises blood glucose levels to provide energy to meet the body's metabolic needs during times of stress.

Therefore, early detection and management of anxiety and depression in patients with type 2 diabetes mellitus are crucial for improving quality of life and extending life expectancy. Efforts to reduce anxiety can be made by addressing its underlying causes, including through psychological mechanisms such as defense mechanisms, projection, identification, dissociation, repression, and substitution (Basri et al., 2020; Superdock et al., 2024).

The study results indicate that the majority of respondents experienced poor sleep quality—69 individuals (90.8%)—while only 7 individuals (9.2%) reported good sleep quality. An individual's sleep quality is influenced by various factors, both internal and external. These factors include physiological and environmental conditions, such as the presence of illness, physical activity and fatigue, academic stress levels, medication use, nutritional status, motivation, environmental conditions, gender, and lifestyle, including habits such as social media use, coffee consumption, and smoking. Type 2 diabetes mellitus, which was previously more common among the elderly, is now increasingly found among young adults aged 20–40 years. The rise in cases within this age group indicates that various risk factors—such as unhealthy lifestyles, high stress levels, poor sleep quality, poor dietary habits, and low physical activity—contribute to the development of the disease (Respati et al., 2021). These findings are supported by research indicating that sleep disturbances can reduce the body's glucose tolerance and increase the risk of insulin resistance (Dwi Nugroho et al., n.d.; Made et al., 2023b).

Individuals with type 2 diabetes mellitus also frequently experience various symptoms, such as excessive thirst, frequent urination (polyuria), and neuropathic pain, which can disrupt sleep quality (Hooke and Linder, 2019; Koracevic et al., 2020). Poor sleep quality not only reduces quality of life but can also worsen blood glucose control, thereby increasing the risk of complications such as cardiovascular disease, hypertension, and kidney damage. In addition, psychological conditions such as stress and depression contribute to worsening sleep quality while also hindering blood glucose control. Sleep disturbances can also cause fatigue, reduce motivation to engage in physical activity, and ultimately worsen the condition of type 2 diabetes mellitus (Fuadah et al., 2024; Sulana et al., 2020).

The results of this study indicate a significant association between anxiety levels and sleep quality in patients with type 2 diabetes. Individuals with type 2 diabetes often experience symptoms such as excessive thirst, frequent urination, and nerve pain that disrupt sleep (Rahmawati and Rizona, 2021). These symptoms can trigger anxiety in people with diabetes. Anxiety about high blood sugar levels, diabetes-related issues, and other aspects of living with diabetes is a common experience for anyone living with this condition (Guldemir and Hizli-Guldemir, 2025; Sulana et al., 2020). Fluctuations in blood sugar levels can potentially cause pain and nervousness. Chronic stress reactions are the root cause of anxiety. An increased heart rate is a primary symptom of stress, which triggers the sympathetic nervous system to produce norepinephrine.

Anxiety disorders can be defined as a group of conditions associated with excessive anxiety symptoms consisting of physiological, behavioral, and emotional reactions. When a person experiences anxiety, the central nervous system produces several neurohormones such as gamma-aminobutyric acid (GABA), serotonin, norepinephrine, and dopamine. These hormones are neurochemicals that play a role in maintaining a state of wakefulness. Changes in the levels of these neurochemicals in the body can disrupt the sleep-wake cycle (Metwally El-Sayed et al., 2026). Since people can, in principle, modify their environment, people with diabetes must be able to adapt to their health condition to alleviate the anxiety they experience. Difficulties arise when a person is unable to adapt to their condition, as evidenced by these questions.

Persistent anxiety can affect sleep quality. Most young adults often experience irregular sleep patterns. Changes in sleep quality are caused by the demands of daily activities, which result in reduced time for sleep, leading to excessive fatigue during the day. Quality sleep is essential for everyone to remain healthy while carrying out daily activities (Frida et al., n.d.; Metwally El-Sayed et al., 2026).

Sleep quality refers to the sleep and wake-up times that result in a feeling of refreshment and vitality upon waking. The quality of rest can serve as an indicator of whether a person is experiencing stress. Suboptimal sleep quality has the potential to adversely affect the health of individuals with diabetes mellitus, including an increased risk of complications such as diabetic neuropathy and cardiovascular disorders. In addition, prolonged sleep disturbances can also hinder the wound healing process and increase insulin resistance, making blood glucose levels difficult to control (Rahmawati and Rizona, 2021). Therefore, stress management is a crucial aspect of diabetes mellitus care to improve patients' sleep quality. Healthcare providers play a vital role in educating patients about stress management, such as through relaxation techniques, meditation, and psychosocial support to help patients better manage their stress. Additionally, it is important for patients to maintain a regular sleep schedule and adopt healthy sleep habits, such as avoiding caffeine before bedtime, creating a comfortable sleep environment, and engaging in light physical activity during the day to improve sleep quality (Imelda, 2019; Sulana et al., 2020).

5. Implications and Limitations

5.1. Implications

a. Theoretical Implications

The results of this study are expected to enhance knowledge regarding the relationship between anxiety levels and sleep quality in patients with type 2 diabetes mellitus. They can also serve as a reference for future researchers working on related topics, particularly in the field of health.

b. Practical Implications

The results of this study are expected to broaden knowledge and experience regarding anxiety levels and sleep quality in patients with type 2 diabetes mellitus.

c. For Future Researchers

It is hoped that this study can serve as a reference for the development of future research on anxiety levels and their impact on sleep quality in patients with type 2 diabetes mellitus.

5.2. Limitations

This study has several limitations. First, the use of a cross-sectional study design can only describe the relationship between sleep quality and anxiety levels at a single point in time, so it cannot explain a cause-and-effect relationship. Second, this study did not control for several confounding factors that could influence sleep quality or anxiety levels, such as duration of diabetes, glycemic control (HbA1c), the presence of diabetic complications, the use of certain medications, chronic pain, depression, or other comorbidities. Third, the limited number of participants and the restricted study location mean that the findings cannot yet be generalized to the entire population of type 2 diabetes patients with varying characteristics. Therefore, future studies are recommended to use a longitudinal or cohort design with a larger sample size, involve multiple healthcare facilities, and account for confounding factors to provide a more comprehensive understanding of the relationship.

6. Conclusion

- a. The level of anxiety among patients with type 2 diabetes mellitus in the service area of the Bulu Lor Community Health Center in Semarang City was classified as severe, with 38 (50%) individuals. Additionally, 34 (44.7%) respondents had moderate anxiety levels. Respondents with mild anxiety levels were the smallest group, numbering 4 (5.3%). This indicates that the majority of respondents experienced severe anxiety.
- b. Meanwhile, the majority of respondents—69 (90.8%)—reported poor sleep quality, while only 7 (9.2%) reported good sleep quality.

- c. The results of the bivariate analysis yielded a Sig (2-tailed) value of 0.006; since this value is less than 0.05, there is a significant relationship between sleep quality and anxiety levels.

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Author Contributions

The first author was responsible for conducting the research, collecting and analyzing data, and drafting the initial manuscript. The second author provided guidance on research design, refined the methodology, supervised the research process, interpreted the results, made substantial revisions to the manuscript, and approved the final version of the manuscript prior to publication. All authors approved the final version of the manuscript and are responsible for the integrity of the research.

Conflict of Interest

The authors declare that there are no conflicts of interest in the research, writing, or publication of this article. The entire research process was conducted independently without influence from any party that could affect the research results.

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Table

Table 1. Respondent Characteristics

No	Data Type	Category	Frequency	Percentage
1	Age	31–40 years	46	60.55
		>40 years	30	39.5%
2	Employment	Private sector	45	58.2%
		Civil Servant	19	25%
		Unemployed	12	15.8%

Table 2. Respondents' Anxiety Levels

Anxiety	Frequency	Percent (%)
Mild	4	5.3
Moderate	34	44.7
Heavy	38	50
Total	76	100

Table 3. Respondents' Sleep Quality

Sleep Quality	Frequency	Percent (%)
Poor	69	90.8
Good	7	9.2
Total	76	100

Table 4. Relationship Between Anxiety Levels and Sleep Quality

Variables		Sleep Quality				P-value	R
		Poor		Good		Total	
		N	%	N	%	N	%
Anxiety Level	Mild	4	5.3	7	9.2		
	Moderate	34	44.7	0	0		
	Weight	38	50	69	90.8	76	100