The Correlations between Body Mass Index and Sleep Quality with Fasting Blood Glucose Levels among Nursing Students at Universitas Brawijaya

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Abstract. Lifestyle changes among adolescents and young adults, including unhealthy dietary habits and poor sleep quality, affect nutritional status and blood glucose regulation. Body Mass Index (BMI) and sleep quality are considered factors influencing fasting blood glucose levels. This study aimed to examine the relationship between BMI and sleep quality with fasting blood glucose levels and to identify the more dominant influencing factor among students of the Nursing Science Program at Universitas Brawijaya. An analytic observational study with a cross-sectional design was conducted involving 192 students selected through total sampling. BMI was obtained from measurements of body weight and height, sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), and fasting blood glucose levels were measured using a glucometer. Data were analyzed using the Spearman Rank correlation test. The results showed no significant association between BMI and fasting blood glucose levels ($r = 0.015$; $p = 0.840$). However, sleep quality demonstrated a significant negative correlation with fasting blood glucose levels ($r = –0.145$; $p = 0.044$). These findings indicate that sleep quality has a more significant association on fasting blood glucose levels than BMI. This study concludes that improving sleep quality plays an important role in maintaining fasting blood glucose control among students and should be promoted as an early preventive measure against metabolic disorders.

Keywords: Body Mass Index, Sleep Quality, Fasting Blood Glucose, College Students.

1 Introduction

Diabetes mellitus is now a serious threat to the young adult population (18-35 years old). Young adulthood, spanning the ages of 18-35, is a crucial transition period from adolescence to adulthood, marked by various changes in lifestyle, social roles, and health behaviors. Demographic data obtained from the Statistics Indonesia in 2023 indicates that the 15-34 age group comprises approximately 33% of Indonesia's total population. With this substantial population, the health of young adults has a significant impact on long-term national health progress [1].

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According to WHO data, 2023 saw a 46% increase in diabetes cases in this age group over the past decade, with Indonesia ranking 6th in the world in terms of the number of sufferers. This phenomenon is concerning considering that this productive age group represents 28.7% of Indonesia's population [2].

The main risk factors contributing to the development of diabetes in young adults and adolescents are an abnormal Body Mass Index (BMI) and poor sleep quality. BMI serves as a metric that can provide a direct assessment of an individual's nutritional status by taking into account height and weight. According to Wahyuni et al. (2022), it is crucial to use BMI to determine whether someone is obese, both of which are major risk factors for metabolic disorders [3].

In addition to BMI, sleep quality has also been recognized as an important factor influencing the risk of obesity and diabetes. Sleep is a crucial biological need, allowing the body time to recover and repair systems, including metabolism. Decreased sleep duration and poor sleep quality can lead to hormonal dysfunction, such as decreased levels of the hormone leptin, which controls satiety, and increased levels of the hormone ghrelin, which increases appetite [4]. Decreased sleep can also increase levels of the stress hormone cortisol, which contributes to insulin resistance and impaired glucose metabolism. A study by Cassidy et al. (2017) indicated a strong correlation between reduced sleep duration and increased obesity prevalence in adults [5].

College students, as a dynamic and productive segment of young adults, are a group vulnerable to sleep problems due to the pressures of study, social interactions, and lifestyle changes. Maharani (2016) reported that 70.6% of college students sleep less than the recommended eight hours per day. This situation is associated with an increased risk of obesity and metabolic disorders [6]. Furthermore, poor sleep quality has been linked to high fasting blood glucose levels and an increased risk of prediabetes and diabetes, according to various studies. Several studies support a correlation between sleep quality and blood glucose levels. Studies by Istigfarin et al. (2021) and Kurnia et al. (2017) showed that low sleep quality was significantly correlated with increased fasting blood glucose levels in college students [7], [8]. Conversely, a study by Amroh (2022) showed insignificant results, indicating that this phenomenon may be influenced by contextual factors such as the type of activity, academic stress, and lifestyle [9].

While various studies have analyzed the correlation between BMI, sleep quality, and blood glucose levels, most have focused on older populations or the general public. Research specifically focusing on college students, especially in Indonesia, is still very limited. Yet, young adults with abnormal blood glucose levels are at risk of developing complications more quickly and severely than older age groups [10]. Therefore, early monitoring of risk factors such as BMI and sleep quality is crucial to prevent disease progression. A more specific research on university students, particularly nursing students in Indonesia, remains very limited. Therefore, this study is urgently needed to address data gaps and provide relevant scientific evidence for public health development, particularly at the university level. The aim of this study is to determine the relationship between body mass index and sleep quality with fasting blood glucose levels in Nursing Science students at Brawijaya University.

2 Methods

This study employed a cross-sectional design using a non-experimental analytical observational approach. The population consisted of 1,113 students aged 15–18 years at SMAN 5 Malang. The sample size was determined using the Slovin formula, yielding a minimum of 265 respondents; however, a total of 308 respondents were included during data collection. A non-probability sampling technique with purposive sampling was applied.

Data collection was conducted from July 15 to October 18, 2024, at SMAN 5 Malang, East Java. The duration of internet use was measured using the Modified Internet Addiction Test (IAT), which consists of 12 items assessing average daily internet use on weekdays and weekends. Parent–adolescent communication was measured using the Parent–Adolescent Communication Scale (PACS), consisting of 20 items.

The Modified Internet Addiction Test (IAT) was tested for validity and reliability in this study. All items were found to be valid ($p < 0.05$), and the instrument demonstrated acceptable reliability (Cronbach's alpha > 0.60). Meanwhile, the Parent–Adolescent Communication Scale (PACS) was adopted from previous studies that have established its validity and reliability [11]. The relationship between internet use duration and parent–adolescent communication was analysed using the Spearman rank correlation test.

3 Results

This study employed a sample of 192 individuals who met the inclusion criteria. The study was conducted from August to October 2025.

3.1 Demographic Characteristics

The demographic characteristics of the study participants, including age, gender, residence type, weekly fast food consumption, and frequency of physical exercise are presented in table 1. These characteristics provide an overview of the sample and serve as a basis for interpreting the study findings

Table 1. Demographic Characteristic

Characteristics	Category	(n=308)	%
Age	20	68	68
	21	35,4	35,4
	22	95	95
Gender	Female	173	90,1
	Male	19	9,9
Residence type	Lodging	121	63
	Parents house	71	37
Weekly fast food consumption (serving)	Never	7	3,6

	1-2	128	66,7
	3-4	53	27,6
	>4	4	2,1
Weekly physical exercise	Never	17	8,9
	1-2	137	71,4
	3-4	27	14,1
	>4	11	5,7

Based on Table 1, the majority of participants were 21 years old, with 95 (49.5%), the majority were female, with 173 (90.1%), the majority lived in boarding houses/dormitories. Most respondents consumed fast food 1-2 times per week, with 128 (66.7%), and engaged in physical activity 1-2 times per week, with 137 (71.4%).

3.2 BMI, Sleep Quality, and Fasting Blood Glucose Distribution

The distribution of participants according to body mass index (BMI), sleep quality assessed using the Pittsburgh Sleep Quality Index (PSQI), and fasting blood glucose (FBG) categories are presented in table 2. These descriptive data provide an overview of the participants' nutritional status, sleep quality, and glycemic profile, serving as the basis for subsequent analyses examining the relationships among these variables.

Table 2. Distribution of BMI, Sleep Quality, and Fasting Blood Glucose Distribution

Category	(n=192)	%
BMI category		
Underweight	2	1
Normal	109	56,8
Overweight	28	14,6
Obese	53	27,6
PSQI score		
Good	57	29,7
Poor	135	70,3
BG category		
Low	26	13,5
Normal	159	82,8
Pre diabetes	7	3,7
Diabetes	0	0

Based on Table 2 regarding the participants' BMI, it was found that 2 respondents (1%) had an underweight BMI, 109 respondents (56.8%) had a normal BMI, 28 respondents (14.6%) had an overweight BMI, and 53 respondents (27.6%) had an obese BMI.

The frequency tabulation of sleep quality indicators using the PSQI, shows that the majority of respondents reported poor sleep quality (70.3%). Meanwhile, 57 respondents (29.7%) reported good sleep quality.
In terms of BG, participants had low FBG levels, while the majority (159 respondents (82.8%) had fasting blood glucose levels within the normal range. Seven respondents (3.7%) were identified as prediabetic, with FBG levels between 100 and 125 mg/dL. No participants had FBG levels above 125 mg/dL, which is classified as diabetes.

3.3 Analysis of the Relationship Between Body Mass Index and Fasting Blood glucose Levels

The Spearman Rank test was used to examine the correlation between BMI and increased FBG levels in Nursing Science students at Brawijaya University.

Table 3. Analysis of the Relationship Between Body Mass Index and Fasting Blood glucose Levels

Variables	Correlation coefficient	P value
BMI	0,015	0,840
FBG		

The Spearman test results indicated a correlation value of r = 0.015 with a p value of 0.840 (p > 0.05). This p value, which is well above the significance limit, indicates that there is no significant correlation between BMI and increased fasting blood glucose levels in Nursing students at Brawijaya University. Furthermore, a very small correlation value approaching zero indicates that the direction of the relationship is almost non-existent or very weak.

3.4 Analysis of the Sleep Quality and Fasting Blood glucose Levels

Table 4. Analysis of the Sleep Quality and Fasting Blood glucose Levels

Variables	Correlation coefficient	P value
Sleep quality	-0,145	0,044
FBG		

The Spearman test showed a p-value of 0.044 (p < 0.05) with r = –0.145, indicating a significant correlation between sleep quality and fasting blood glucose levels, with a negative correlation. This means that the poorer the sleep quality, the greater the likelihood of increased FBG levels in students.
From the analysis, it can be concluded that sleep quality has a more significant association on GDP levels compared to BMI, as its significance value is lower (p = 0.044) compared to BMI (p = 0.840).

Therefore, HA is accepted, meaning there is a difference in the level of influence between BMI and sleep quality on fasting blood glucose levels, with sleep quality contributing significantly to increased blood glucose levels in Nursing Science students at Brawijaya University.

4 Discussion

Theoretically, BMI can actually affect fasting blood glucose levels through the mechanism of insulin resistance. Individuals with a high BMI typically have more visceral fat, which is pro-inflammatory. Visceral fat produces cytokines such as TNF-α and IL-6, which can cause low-grade chronic inflammation and decrease insulin sensitivity. This condition interferes with insulin's ability to transport glucose into cells, thereby increasing blood glucose levels, including during fasting. Furthermore, an imbalance in adipose hormones such as leptin and adiponectin in obese individuals also plays a role in increasing the risk of insulin resistance and elevated blood glucose levels.
However, in adolescence and young adulthood, the body's compensatory mechanisms are still functioning well. The pancreas in this age group is generally still able to produce enough insulin to compensate for the mild decrease in insulin sensitivity that may occur due to increased BMI. This is one reason why many studies, including this one, have not found a significant relationship between BMI and fasting blood glucose levels. In adolescents and young adults, uncontrolled BMI can trigger various potential health problems. Overweight and obesity at this age have been shown to increase the risk of insulin resistance, hypertension, dyslipidemia, and metabolic syndrome at a younger age than the general population. Individuals with a high BMI are also at greater risk of chronic low-grade inflammation, which disrupts insulin function and increases fasting blood glucose level[13]. Research by Hossain et al. (2025) confirmed that increased BMI in the 18–25 age group was significantly associated with increased fasting blood glucose levels, suggesting that metabolic disorders can emerge even before entering adulthood[14].
In this study, of the 192 respondents, the majority of students were in the normal BMI category, namely 109 students (56.8%). The remainder were obese (53 respondents (27.6%), overweight (28 respondents (14.6%), and underweight (2 respondents (1%). These results indicate that although the majority of students have a BMI within the healthy range, a significant proportion (42.2%) are above normal weight, which can put them at risk for various health problems in late adolescence and young adulthood.
This finding aligns with a study by Putri et al. (2021), which found that most Indonesian college students have a normal BMI, but cases of overweight and obesity are starting to increase due to high-calorie diets and low physical activity [12]. Research by Sulistyorini & Pratiwi (2020) also showed that although health students have sufficient nutritional knowledge, not everyone is able to adopt a lifestyle that supports a balanced BMI [13].
Among college students, poor sleep quality is often influenced by the habit of staying up late to complete assignments and using gadgets late into the night. Research by Salsabila et al (2025) showed that 78% of college students experience poor sleep quality,

which leads to physical fatigue, decreased concentration, and metabolic changes, including increased blood glucose levels [14]. A similar situation was observed in this study, where participants with poor sleep quality tended to have higher fasting blood glucose levels than those with good sleep quality.

Poor sleep quality in adolescents and young adults can trigger various long-term health problems, such as metabolic disorders, obesity, insulin resistance, cognitive decline, chronic fatigue, and increased academic stress.

A study by Depner et al. (2019) explained that poor sleep quality can optimize sympathetic nervous system activity, causing a surge in cortisol, and decreasing insulin sensitivity [15]. Increased cortisol due to sleep deprivation inhibits glucose uptake by cells and encourages the liver to produce more glucose, resulting in increased fasting blood glucose levels. This is in line with a study by Joo et al. (2020) [16].

Sleep quality can affect fasting blood glucose levels through several key physiological mechanisms. First, sleep disturbances disrupt the body's circadian rhythm, which regulates the production of metabolic hormones such as insulin, cortisol, and melatonin. When the circadian rhythm is disrupted, insulin sensitivity decreases, preventing the body from using glucose effectively. Second, sleep deprivation increases sympathetic nervous system activity, which puts the body in a state of "alertness," triggering increased glucose production by the liver through gluconeogenesis. Third, poor sleep quality also affects the balance of leptin and ghrelin—two hormones that regulate satiety and appetite. An imbalance in these hormones can increase appetite and the consumption of high-calorie foods.

A study by Yilmaz et al. (2017) also supports these findings by showing that students with high PSQI scores tend to have higher fasting glucose levels due to academic stress, staying up late, and irregular sleep patterns [17]. However, these results differ from the findings of Salsabila et al (2025), who stated that sleep quality does not always correlate directly with fasting blood glucose levels due to confounding variables such as sugary beverage consumption, physical activity, and psychological stress, which are more dominant in influencing glucose regulation [14].

Although there are differences in results across studies, this research shows that sleep quality has a stronger association on fasting blood glucose levels compared to BMI. The statistical significance of sleep quality ($p = 0.044$) is lower than for BMI ($p = 0.840$), which may indicate that sleep disturbances play a greater role in increasing fasting blood glucose levels in college students. This is in line with the findings of Ratwani et al (2025), who stated that sleep disturbances are an important factor in impaired glucose regulation, even in individuals with a normal BMI [18].

Another important implication concerns health education and counselling. Nurses play a role in providing health education regarding the importance of maintaining good sleep patterns as a way to maintain the body's metabolic balance. Students need to be educated about the benefits of adequate sleep, academic stress management, sleep hygiene techniques, study schedule management, and reducing device use before bed. Appropriate education can help students realize that poor sleep quality not only causes fatigue but also impacts stable blood glucose levels.

Within educational institutions, this research also has implications for health promotion. Universities can collaborate with healthcare professionals to develop programs

such as sleep quality awareness campaigns, time management training, seminars on the relationship between stress and metabolism, and the provision of mental health counseling services. These programs are important considering that college students are a group vulnerable to sleep disturbances due to academic stress. Furthermore, this research emphasizes the importance of non-pharmacological interventions, such as relaxation exercises, increased light physical activity, limiting caffeinated beverage consumption in the evening, and establishing more regular eating patterns, as preventive measures for metabolic disorders.

5 Conclusion

In conclusion, most Nursing students at Brawijaya University had a normal body mass index (BMI), while the majority reported poor sleep quality. Most participants also had normal fasting blood glucose (FBG) levels, with only a small proportion exhibiting elevated FBG. Statistical analysis revealed no significant association between BMI and FBG levels ($p = 0.840$, $r = 0.015$). In contrast, sleep quality showed a significant negative correlation with FBG levels ($p = 0.044$, $r = –0.145$), indicating that poorer sleep quality was associated with higher fasting blood glucose levels, although the strength of the correlation was weak. Overall, sleep quality demonstrated a stronger relationship with fasting blood glucose than BMI, suggesting that sleep quality may be a more relevant factor than BMI in relation to glycemic status among nursing students.

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