

# Effects of Sleep Quality Towards Blood Glucose Levels As At Type Ii Diabetes Mellitus Patients

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## ABSTRACT

**Background:** The estimated that by 2040 there will be over 642 million people with diabetes in the world and 80% of these people will live in developing countries. Patients with T2DM are reported to have various sleep abnormalities compared to healthy control subjects.

**Purpose:** To investigate the sleep quality of patients with type 2 diabetes (T2D) and its impact on random Blood Glucose test.

**Methods:** Using a convenience sampling method, 61 patients with T2D were recruited. The Pittsburgh Sleep Quality Index (PSQI) was used to evaluate the sleep quality.

**Results:** the analysis using Pearson product moment correlation showed that the average sleep quality of type II diabetes mellitus patients was  $9.46 \pm 3.069$  and the average blood glucose level was  $235.46 \pm 39.880$  mg / dL. On the results of the statistical test obtained p-value = 0,000 ( $p < 0.05$ ), meaning that it is statistically believed there is a correlation between the quality of sleep with blood glucose levels of type II diabetes mellitus patients. The correlation value obtained was 0.659 positive direction with strong relationship strength

**Conclusion:** There is a correlation between the quality of sleep and blood glucose levels of people with type II diabetes mellitus.

**Keywords:** Type II diabetes mellitus, Sleep quality, Blood glucose levels

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## Introduction

The onset of type 2 diabetes mellitus (T2DM) is associated with many lifestyle factors [1-2]. It is estimated that by 2040 there will be over 642 million people with diabetes in the world and 80% of these people will live in developing countries [3-4]. This means that every six seconds there is one DM sufferer who dies. WHO predicts the number of people with DM in Indonesia from 8.4 million in 2000 to around 21.3 in 2030 [5-7].

Currently Indonesia is ranked the fourth largest sufferer of DM after China, India, America [8]. In 2017 there were an estimated 425.000 people affected by diabetes while in 2016 there were 387.000 According to Dr. Reihana diabetes in Lampung Province is ranked second in non-communicable diseases in 2017 (9). The 2015 Metro City Health Profile stated that people with diabetes mellitus who were outpatient at the Puskesmas had been ranked fifth out of the top ten diseases, reaching 374 patients [10]. Based on data recorded in the Head of Surveillance & Epidemiology Section of the Metro City Health Office, it was shown that the number of new cases of diabetes mellitus reached 682 cases spread over 11 (eleven) health center [10].

According to the International Diabetes Federation, 80% of people with diabetes live in low-income countries. Diabetes mellitus causes complications, disability, and premature death [11,12]. Patients with T2DM are reported to have various sleep abnormalities compared to healthy control subjects [13].

Sleep is a normal condition of changing levels of consciousness as long as the body is resting. Nearly one in three of the general population has trouble sleeping in each year. This disorder may be secondary to situations, environment, stressors or may be associated with disease [14]. Any disease that causes pain, physical discomfort, or mood problems, such as anxiety or depression can cause sleep problems. After someone has repeatedly awakened

to urinate, causing sleep becomes difficult. This condition is most common in people with diabetes mellitus [15]. Patients with T2D have high sleep disorder rate negatively impacting glycaemic Control [16]. There is strong evidence supporting the relationship between sleep quality and glycemic control. Sleep disturbance, particularly impaired sleep quality, could potentially influence glycemic control in adults with T2DM [17]. studies conducted in type 2 DM patients showed an association between type 2 DM and difficulty in starting to sleep ( $r = 0.29$ ,  $p < 0.05$ ) and difficulty maintaining sleep ( $r = 0.24$ ,  $p < 0.05$ ). The difficulty of starting and maintaining sleep is partly due to complaints of pain and nocturia [18].

## METHOD

This type of research is quantitative, the design of this study used a cross sectional approach. The population in this study were patients with Type II diabetes mellitus in the Metro Community Health Center Working Area as many as 61 people. Statistical tests using parametric Pearson Product Moment.

## RESULT

### Table 1

**Frequency Distribution of Characteristics of Patients with Diabetes Mellitus Type II by sex, education and employment**

No	Characteristics	Frequenc y	Percentag e (%)
<b>A</b>	<b>Gender</b>		
	1 Man	31	50,8
	2 Women	30	49,2
	<b>Total</b>	<b>61</b>	<b>100</b>
<b>B</b>	<b>Education</b>		
	1 higher education	4	6,6
	2 High school	14	23,0

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3	Junior high school	19	31,1
4	Elementary school	24	39,3
<b>Total</b>		<b>61</b>	<b>100</b>
<b>C Work</b>			
1	Civil servants	2	3,3
2	Entrepreneur	19	31,1
3	Housewife	28	45,9
4	Traders	1	1,6
5	Farmer	11	18,0
<b>Total</b>		<b>61</b>	<b>100</b>

Based on table 1 above, it can be seen that out of 61 people, most people with diabetes mellitus were male, as many as 31 people (50.8%), seen from the level of education of most elementary school graduates as many as 24 people (39.3%) and seen from work, most of them are entrepreneurs, as many as 27 people (39.7%).

**Table 2**  
**Sleep Quality Distribution of Type II Diabetes Mellitus Patients**

Variable	Mean	SD	Minimum-Maximum	CI; 95%
Sleep quality of type II diabetes mellitus sufferers	9,46	3,069	4-15	8,67-10,25

Based on table 2, it can be explained that the average score of sleep quality for patients with type II diabetes mellitus in the Central Metro Community Health Center Work Area is  $9.46 \pm 3.069$ . The highest sleep quality score was 15 and the lowest score was 3. At 95% confidence intervals it was believed that the average sleep quality score for people with diabetes mellitus was between 6.28 to 7.52.

**Table 3**  
**Distribution of Blood Glucose Levels in Type II Diabetes Mellitus Patients**

Variable	Mean	SD	Minimum-Maximum	CI; 95%
Blood glucose levels of type II diabetes mellitus patients	235,46	39,880	157-307	225,25-245,67

Based on table 2, it can be explained that the average blood glucose level of people with type II diabetes mellitus is  $235.46 \pm 39.880$  mg / dL. The highest blood glucose level was 307 mg / dL and the lowest was 157 mg / dL. At a 95% confidence interval it is believed that the average blood glucose level of people with type II diabetes mellitus is between 225.25 mg / dL and 245.67 mg / dL.

**Table 4**  
**Relationship between Sleep Quality and Blood Glucose Level in Patients Type II Diabetes Mellitus**

Variable	Mean	SD	p-value	r
Sleep quality	9,46	3,069	0,000	0,604
Blood glucose level	235,46	39,880		

Sleep quality	9,46	3,069	0,000	0,604
Blood glucose level	235,46	39,880		

Based on Table 4, it can be seen that the results of the analysis using Pearson product moment correlation showed that the average sleep quality of type II diabetes mellitus patients was  $9.46 \pm 3.069$  and the average blood glucose level was  $235.46 \pm 39.880$  mg / dL. On the results of the statistical test obtained p-value = 0,000 ( $p < 0.05$ ), meaning that it is statistically believed there is a correlation between the quality of sleep with blood glucose levels of type II diabetes mellitus patients. The correlation value obtained was 0.659 positive direction with strong relationship strength, meaning that the worse the quality of sleep, the blood glucose levels of people with type II diabetes mellitus can increase.

### RUSULT

#### 1. Sleep Quality for Patients with Type II Diabetes Mellitus

The results showed that the average sleep quality score of patients with type II diabetes mellitus in the Central Metro Health Center Work Area was  $9.46 \pm 3.069$ . The highest sleep quality score was 15 and the lowest score was 3. At a 95% confidence interval it was believed that the average sleep quality score for people with diabetes mellitus was between 6.28 to 7.52.

Sleep is a normal condition of changing levels of consciousness as long as the body is resting. Sleep is characterized by a decrease in response to the environment [14]. People who suffer from sleep disorders and lack insulin production in the blood causes an increase blood glucose and aggravate diabetes. On the other hand, Sleep disorders can facilitate the hypotheses of the first physical injury system to release extra glucocorticoids. As a result, glucose production increases, while its consumption decreases affecting the glycemic control [19,20]. Several hypotheses have been suggested to explain the association between sleep problems and diabetes. Sleep restriction has potential effects on neuroendocrine and metabolic hormones [21-22].

The results of this study are in line with the research conducted by Arifin which shows that the average quality of sleep quality of type 2 DM patients who were respondents in the study was 8.25 (95% CI: 7.79-8.71) which meant poor sleep quality [23].

Based on the description of the results of the above research it can be explained that sleep is a routine resting activity that is very important for the human body for brain tissue, functions of the organs of the human body because it can restore energy and affect the body's metabolism. Sleep has an important role for the body because during sleep the body will take care of our physical and mental health. In the results of the study, the average quality of sleep for patients with diabetes mellitus included poor ( $> 5$ ), which is in the range between 8.67 to 10.25, this can occur because every disease causes physical discomfort, or mood problems, like anxiety or depression can cause sleep problems. In addition, people with diabetes mellitus generally experience nocturia or urination at night so they can interfere with sleep and the sleep cycle. As a result of frequent awakening to urination, diabetics will find it difficult to maintain good quality sleep.

#### 2. Blood Glucose Levels of Type II Diabetes Mellitus Patients

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Based on the results of data processing it is known that the average blood glucose level of people with type II diabetes mellitus is  $235.46 \pm 39.880$  mg / dL. The highest blood glucose level was 307 mg / dL and the lowest was 157 mg / dL. At a 95% confidence interval it is believed that the average blood glucose level of people with type II diabetes mellitus is between 225.25 mg / dL and 245.67 mg / dL.

Blood sugar is the body's fuel needed for the work of the brain, nervous system, and other body tissues. Blood sugar contained in the body is produced by foods that contain carbohydrates, protein, and fat. On average, normal blood sugar levels are 8 hours before meals or after waking up in the morning, 70 - 110 mg / dl, 2 hours after eating 100 - 150 mg / dl, and random blood sugar 70 - 125 mg / dl. The occurrence of diabetes mellitus is due to a chronic metabolic disorder characterized by an increase in blood glucose (hyperglycemia), caused by an imbalance in supply and insulin requirements. Insulin in the body is needed to facilitate the entry of glucose in cells so that it can be used for metabolism and cell growth. Reduced or absent insulin makes glucose retained in the blood and lack of glucose which is needed in the continuity and function of cells. It is said that diabetes mellitus is if the blood glucose level has reached  $> 200$  mg / dL [22].

The results of this study are in line with Suratno's study showing that blood glucose levels before bedtime showed the lowest score was 80 mg / dl, the highest score was 500 mg / dl, an average of 168 mg / dl, and a standard deviation of 73.65 mg / dl. Furthermore, after sleep, the lowest blood glucose level was 105 mg / dl, the highest was 412 mg / dl, an average of 175 mg / dl [23].

Based on the description of the results of the above research it can be explained that the average blood sugar level of people with diabetes mellitus is quite high, which is in the range 225.25 to 245.67 mg / dl. Increased blood sugar levels alone occur due to an imbalance in supply and insulin requirements which causes disruption of chronic metabolism which is marked by an increase in blood glucose. Insulin in the body is needed to facilitate the entry of glucose in cells so that it can be used for metabolism and cell growth. Reduced or absent insulin in diabetics makes glucose retained in the blood so that there is an increase in blood sugar levels.

### 3. 3. The Relationship between Sleep Quality and Blood Glucose Levels in Diabetes Mellitus Patients

The results of hypothesis testing prove that in the Pearson product moment correlation test the average sleep quality of type II diabetes mellitus patients is  $9.46 \pm 3.069$  and the average blood glucose level is  $235.46 \pm 39.880$ . On the results of the statistical test obtained  $p$ -value = 0,000 ( $p < 5$  0.05), meaning that it is statistically believed there is a correlation between the quality of sleep with blood glucose levels of type II diabetes mellitus patients. The correlation value obtained was 0.659 positive direction with strong relationship strength, meaning that the worse the quality of sleep, the blood glucose levels of people with type II diabetes mellitus can increase.

Hormone epinephrine and norepinephrine have an important role in increasing glucose levels in the blood. Epinephrine, also known as adrenaline, works as a neurotransmitter. Transfer of signals between neurons and body cells is regulated by epinephrine. Adrenaline is

released by the adrenal gland during extreme stress situations or excitement. Norepinephrine is released by noradrenergic neurons and acts as a neurotransmitter in the central nervous system and is sympathetic. Increased levels of norepinephrine are associated with anxiety, stress, high blood pressure and hyperactivity. Release of adrenaline and noradrenaline increases heart rate and breathing. This causes inhibition of insulin excretion which causes an increase in glucose and fatty acid levels in the blood [24].

The results of other studies showed that there was a proven relationship between insomnia and an increase in fasting blood glucose levels in DM patients in the inpatient ward Dr. Moewardi, with a relatively strong level of relationship, the  $p$ -value is 0,000 and the  $r$  count is 0.516 [25].

Najatullah's research and other researchers showed a correlation between the quality of sleep and blood glucose control in type 2 diabetes mellitus patients in which type 2 diabetes mellitus patients with poor sleep quality had poor blood glucose control compared to good quality sleep [26]; Sakamoto, R (2018) [27]; Chasens (2013) [28]; Cunha (2008) [28]; Reutrakul (2013) [29]; Tang (2014) [30].

Based on the description of the results of the above research, it can be explained that the quality of sleep for patients with type II diabetes mellitus has a positive relationship with blood sugar levels, where the worse the quality of sleep for people with diabetes mellitus, the blood sugar levels will tend to increase. This can occur because the poor quality of sleep will affect the release of hormones that cause stress and anxiety, namely the hormone cortisol, epinephrine and norepinephrine. The hormone cortisol plays a role in the use of glucose and fat in the body's metabolism to provide energy. In addition, the hormone cortisol functions to control stress. The hormone cortisol also helps maintain blood pressure to remain normal, while controlling blood glucose levels by releasing insulin. While the release of the hormone epinephrine (adrenaline) and noradrenaline will increase heart rate and breathing, this causes inhibition of insulin excretion resulting in an increase in glucose levels and fatty acids in the blood. Thus, sleep has an important effect on the brain and utilization of glucose in the blood, so poor quality of sleep can clearly affect blood glucose tolerance.

### CONCLUSIONS AND RECOMMENDATIONS

There is a correlation between the quality of sleep and blood glucose levels of people with type II diabetes mellitus. People with diabetes mellitus should try to control their blood glucose levels by maintaining diet and maintaining good sleep quality.

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