

THE RELATIONSHIP OF SLEEP QUALITY WITH BLOOD SUGAR LEVELS OF TYPE-2 DIABETES MELLITUS CLIENTS

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ABSTRACT

This study aims to determine the relationship between sleep quality and blood sugar levels in patients with type 2 diabetes mellitus. This research method uses a narrative review with PRISMA guidelines. The databases used are PubMed, CINAHL, and Garuda Portal, with inclusion criteria being randomized controlled trials (RCT), quasi experiments, cohort studies, cross-sectional studies, published in 2012-2022, full text, and articles in Indonesian and English. The keywords used are Diabetes mellitus AND Sleep quality AND blood glucose and the Garuda Portal database uses the keywords Diabetes mellitus AND sleep quality AND blood sugar levels. The results of the study obtained 12 articles that met the criteria, with each article discussing the relationship between sleep quality and blood sugar levels in patients with type 2 diabetes mellitus. The largest number of respondents was 3,249 respondents and the smallest number of respondents was 32 respondents. A total of 12 articles, 6 articles from Indonesia and 1 article each from China, Taiwan, Iran, Korea, Pakistan and Japan. Conclusion, there is a significant relationship between sleep quality and blood sugar levels in patients with type 2 diabetes mellitus. The relationship between sleep quality and blood sugar levels is that the worse the sleep quality, the higher the blood sugar levels.

Keywords: Diabetes Mellitus, Blood Glucose, Sleep Quality

INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic disease characterized by increased blood sugar levels or hyperglycemia which can cause problems with the work of the eyes, heart, blood vessels, eyes, kidneys and nerves. Almost 90% of diabetes types are dominated by type 2 diabetes mellitus (WHO, 2021). Diabetes mellitus is a serious problem, as evidenced by the increasing incidence of diabetes mellitus every year. The incidence of diabetes mellitus can be caused by several factors including lifestyle, physical activity, uncontrolled eating patterns, and sleep patterns (Setyawati et al., 2020; PERKENI, 2020).

The prevalence of diabetes mellitus sufferers reaches 422 million with a death rate of 1.5 million sufferers every year throughout the world, most of whom live in low and middle income countries (WHO, 2021). According to Basic Health Research (Riskesdas), which collected data in 2018, the results showed that there was an increase in the prevalence of diabetes mellitus in children aged >15 years by 2%. Indonesia itself is in seventh place with the most diabetes mellitus sufferers in the world, reaching 10.7 million.

Type 2 diabetes mellitus is often experienced in adults and can be caused by excessive weight gain or obesity, sleep quality, poor physical activity and diet (IDF, 2021). Sleep is a basic need that must be fulfilled by every human being, including creating quality sleep. The quality of sleep is very influential on human health, both physically and psychologically. Rest is a very important physiological process for humans and has a big influence on a person's

psychology and physical health because during sleep the body's organs are resting so that the body becomes fresh again. Sleep is also very important for people with diabetes mellitus (Gozashti et al., 2016; Tentero et al., 2016).

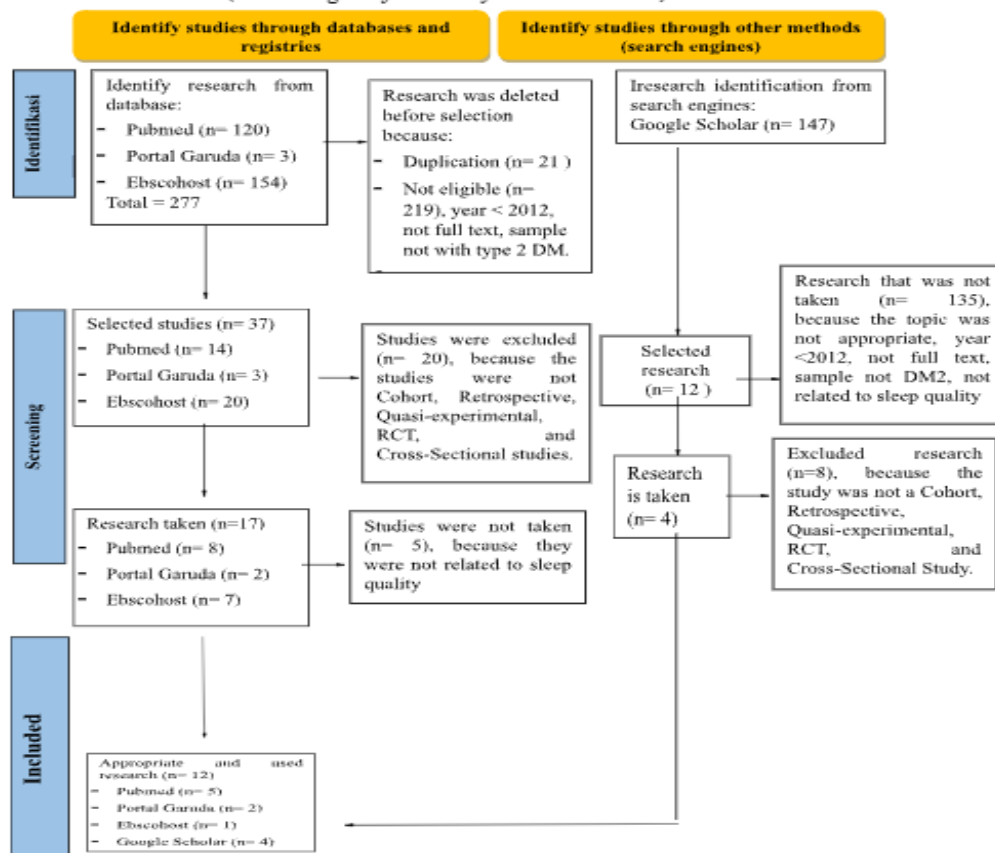
Sleep quality is said to be good if they do not show signs of sleep deprivation and do not experience problems in sleeping and feel satisfied with their sleep and do not show symptoms such as restlessness, appearing lethargic, the appearance of black marks around the eyes, red conjunctiva, and frequently yawning or feeling sleepy. the head feels dizzy. The condition of lack of sleep is often found among teenagers, adults and the elderly, especially people with diabetes mellitus, so it has an impact on blood sugar levels and other health problems (Tentero et al., 2016).

METHODS

The method that will be used to answer research questions is the *Narrative Review method*. This method is used to identify and summarize what has been previously described, avoid duplication, and search for new studies that have not yet been addressed. The *Narrative Review* method aims to identify or handle questions and selection criteria to be included in the synthesis so that they can be determined accurately.

This method is useful for gaining a broad perspective on a topic. The systematics of writing a narrative review according to is divided into 4 writing stages, namely identification of research topics, identification of search strategies, identification of inclusion and exclusion criteria, identification of study quality, and data synthesis.

PRISMA 2020 (Flow Diagram for New Systematic Reviews)



RESULTS

Number of articles obtained using *the database PubMed, CINAHL, and Garuda Ristekdikti* totaling 424 articles. The articles were then re-selected including title, abstract, suitability of inclusion and exclusion criteria. The inclusion criteria set were patients with type 2 diabetes mellitus, publication year 2012-2022 (last 10 years), the research design used was quantitative research (*cross sectional study*), articles in English and Indonesian, and availability of *full text articles*. Meanwhile, the exclusion criteria in this literature study are literature studies, unpublished full text and duplication . So the results obtained were 12 articles, 6 articles from Indonesia, and 1 article each from China, Taiwan, Iran, Korea, Pakistan and Japan. In the articles reviewed, respondents were type 2 diabetes mellitus patients, totaling 4,997 from 12 articles. The largest number of respondents was 3,249 respondents, and the smallest number of respondents was 32 respondents.

Table. 1
Results of article analysis

Author's Name, Article Title, Type of Literature	Year	Aims	Findings
Tsai et al., The impact of subjective sleep quality on glycemic control of type 2 diabetes mellitus	2012	To investigate the relationship between sleep quality and glycemic control and its impact in type 2 diabetes mellitus patients in an Asian population.	Hasil penelitian menunjukkan 18 (39,1%) klien memiliki kontrol glikemik yang baik dan 28 (60,9%) klien memiliki kontrol gula darah yang buruk, didefinisikan dengan HbA1c \geq 7% So it is concluded that this study shows that poor sleep quality is significantly correlated with worse glycemic control in patients with type 2 diabetes mellitus.
Wayan et al., The Relationship between Sleep Quality and Physical Activity and Blood Sugar Levels in Type II Diabetes Mellitus Patients at the Internal Medicine Polyclinic at Sultan Imanuddin Hospital, Pangkalan Bun.	2020	To determine the relationship between sleep quality and physical activity with blood sugar levels in type II diabetes mellitus patients at the Internal Medicine Polyclinic at Sultan Imanuddin Hospital Pangkalan Bun	Almost all respondents who had poor sleep quality were caused by frequently waking up at night, frequently feeling like urinating and being hungry at night. The results of the analysis show that there is a relationship between sleep quality and blood sugar levels, p value = 0.027, there is a relationship between physical activity and blood sugar levels, p value = 0.049.
Zhu et al., Sleep quality and its impact on glycemic control in patients with type 2 diabetes mellitus.	2014	To determine the sleep quality of type 2 diabetes mellitus patients and its impact on glycemic control	In this study, the sleep quality of diabetes mellitus clients was poor with a PSQI score of 8.30 ± 4.12 . The incidence rate of sleep disorders was 47.1%. Patients with HbA1c 7% had significantly lower global and factor PSQI scores ($p < 0.01$) than the control group. The conclusion of the research results is that patients with type 2 diabetes mellitus have a high level of sleep disturbances which have a negative impact on glycemia control.
Gozashti et al., Sleep Pattern, Duration and Quality in Relation	2016	This study aims to evaluate the relationship between	From the research results, the average sleep duration of respondents at night was 1.5-6.6 hours at night and 0.6-1.3 hours during the

to Glycemic Control in People with Type 2 Diabetes mellitus.		sleep quality, duration, and sleep patterns, including naps in diabetes sufferers and their glycemic control.	day, a linear negative correlation with HbA1c. this means that patients who divide their sleep time into more than one segment over 24 hours have better diabetes control. The total PSQI score produced was 7.5 ± 3 scores. 26% of participants slept well ($PSQI \pm 5$). The total PSQI score showed that there was a correlation between sleep quality and glycemic control.
Cho et al., Sleep Disorders and Glucoregulation in Type 2 Diabetes Patients	2014	To determine the relationship between sleep quality and glucoregulation In people with type 2 diabetes mellitus	Hasil penelitian menunjukkan 301 klien (49,0%) memiliki kualitas buruk dibuktikan dengan hasil skor PSQI yaitu ≥ 5 . Meanwhile, the average HbA1c is 7.8%. The conclusion of this study is that there is a relationship with sleep quality as evidenced by the sleep quality score obtained being >5 and the average HbA1c obtained being 7.8%.
Farooque et al., Frequency of Poor Sleep Quality in Patients with Diabetes Mellitus and Its Relation to Glycemic Control.	2020	This study aims to determine the frequency of poor sleep quality and its relationship with glycemic control in diabetes mellitus patients	The results of this study showed that 57% (n=188) of participants were found to have poor sleep quality ($PSQI > 5$) and 70.8% had poor glycemic control and glycemic control ($HbA1c > 7$). But the results showed there was no significant difference experienced in PSQI scores between participants with controlled diabetes and those with uncontrolled diabetes. The conclusion from the research results is that it does not show a significant relationship between sleep quality and glycemic control.
Basri et al., The Relationship between Sleep Quality and Fasting Blood Glucose Levels in Type II Diabetes Mellitus Patients at the Kasi-kasi Community Health Center, Makassar City.	2020	The aim of the research was to determine the relationship between sleep quality and fasting blood sugar levels in patients with type 2 diabetes mellitus	The sleep quality of research respondents showed that 12 respondents (21.8%) had good sleep quality and 43 respondents (78.2%) had poor sleep quality. It can be concluded that the majority of respondents have poor sleep quality. In this study, 40 respondents (72.7%) had high blood glucose levels and 15 respondents (27.3%) had normal blood sugar levels. It was concluded that there was a relationship between sleep quality and blood glucose levels in type 2 DM patients
Umam et al., The Relationship between Sleep Quality and Blood Glucose Levels in Type 2 Diabetes Mellitus Sufferers at the Besuk Health Center, Probolinggo.	2020	To determine the relationship between sleep quality and blood sugar levels in clients with type 2 diabetes mellitus	The research results showed that the sleep quality of type 2 diabetes mellitus clients was 63 respondents (60.6%) showed poor sleep quality, and 41 respondents (39.4%) had good sleep quality. The description of the blood sugar levels of the respondents showed that 68 respondents (65.4%) had poor blood sugar levels and 36 respondents (35.6%) showed good blood glucose levels. Statistical test results show that clients with type 2 diabetes mellitus tend to have poor sleep quality which causes blood sugar levels to increase.
Kurnia et al., Relationship between sleep quality and fasting blood glucose levels in type 2 diabetes mellitus patients at the	2017	The aim of the research was to determine the relationship between sleep quality and fasting blood glucose levels in patients with	The results of the study showed a picture of the sleep quality of the respondents, namely 43 respondents (63.2%) showed poor sleep quality and 25 respondents (36.8%) showed good sleep quality. Meanwhile, 46 respondents (67%) showed blood glucose levels. 6%) had poor blood sugar levels and 22 respondents

Pancaran Kasih GMIM Hospital, Manado.		type 2 diabetes mellitus	(32.4%) showed moderate blood sugar levels. Conclusion: The results of the study show that there is a relationship between sleep quality and fasting blood sugar levels in patients with type 2 diabetes mellitus.
Purwono et al., The Effect of Sleep Quality on Blood Glucose Levels as in Type 2 Diabetes Mellitus.	2020	To investigate the sleep quality of patients with type 2 diabetes mellitus (T2D) and its impact on random blood glucose testing	Analysis using product moment person correlation shows that the average sleep quality of type 2 diabetes mellitus patients is disturbed with an interval score of between 6.28-7.52. Statistically, the results of the research show that there is a relationship between sleep quality and blood glucose levels in people with type 2 diabetes mellitus.
Sakamoto et al., Usual sleep quality and glycemic control in type 2 diabetes in Japan.	2018	Sleep duration that is too short or long is associated with type 2 diabetes mellitus patients, but information about the relationship between sleep quality and diabetes mellitus is still limited, therefore the aim of the research carried out is to investigate the relationship between sleep quality and glycemic control.	Most of the respondents' sleep quality was poor as evidenced by the results obtained, namely an average PSQI score ≥ 5 which shows that the patient's sleep quality was poor, while the respondents' glycemic control was poor, indicated by HbA1c $\geq 7.9\%$. So it was concluded that there was a relationship between sleep quality and the patient's glycemic control.

Sleep Quality of Clients with Type 2 Diabetes Mellitus

Sleep quality has several aspects including qualitative and quantitative aspects, such as the duration of time needed to fall asleep, frequency of awakening and subjective aspects in the form of sleep depth and satisfaction. Of all the studies found, it shows that poor sleep quality occurs in patients with type 2 diabetes mellitus.

Blood Glucose Levels of Clients with Type 2 Diabetes Mellitus

The research results show that there is a relationship between sleep quality and increased blood sugar levels. Sleep affects pancreatic beta cells and insulin sensitivity. The role of insulin production, insulin sensitivity, glucose use and glucose tolerance during the night is influenced by sleep and circadian rhythms. This results in insulin resistance and an increase in blood sugar levels.

DISCUSSION

Sleep Quality of Clients with Type 2 Diabetes Mellitus

Sleep quality has several aspects including qualitative and quantitative aspects, such as the duration of time needed to fall asleep, frequency of awakening and subjective aspects in the form of sleep depth and satisfaction. Of all the studies found, it shows that poor sleep quality occurs in patients with type 2 diabetes mellitus. This is supported by research conducted which states that the cause of decreased sleep quality in patients Diabetes mellitus is caused by symptoms such as polyuria or urinating at night, polydipsia, frequent feeling of thirst, and others. The results of the analysis of the 12 articles as a whole show that type 2 diabetes mellitus patients have poor sleep quality as evidenced by the PSQI results which

obtained an average score of >5 , which means that the respondents were indicated to have poor sleep quality.

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The research results of the entire article explain that all type 2 diabetes mellitus sufferers have high blood sugar levels. The condition of high blood sugar levels is caused by impaired insulin secretion (Megi, 2021). Blood glucose has an important role for the human body, namely to meet the energy needs of all cells throughout the body (Romadoni & Septiawan, 2016).

The condition of high glucose in diabetes mellitus patients is caused because insulin, which has a role in converting glucose into glucogen, cannot be produced by the body or the body cannot use the insulin produced properly so that there is not enough insulin in the blood, the body's cells do not get insulin, as a result Weakness begins to be broken down to make energy. According to research Basri et al., (2020) high blood sugar levels are caused by the patient's feelings of excessive anxiety, the discomfort experienced by the patient making it difficult to rest, and so on.

Blood sugar levels can be said to be normal if the glucose before eating is 70-130 mg/dl, and after eating it will rise to <140 , and fasting blood glucose is <100 mg/dl (Megi, 2021). In line with the research results obtained by Hamid et al., (2020) it was explained that the number of respondents with high blood sugar levels was 71 (71.6%) respondents and normal blood sugar levels were 28 (25.7%) respondents and blood sugar levels Low blood pressure: 2 respondents (2.7%) had high blood sugar levels caused by impaired insulin secretion.

From research results in several articles, it was found that almost the majority of respondents had poor blood sugar levels, the cause of poor blood sugar levels was due to impaired insulin function. Blood sugar levels are said to be bad, as can be seen from an HbA1c value $\geq 7\%$.

Relationship between Sleep Quality and Blood Sugar Levels

There are several factors that can influence the blood sugar levels of people with type 2 diabetes mellitus, including an unhealthy lifestyle, client knowledge, poor diet, obesity and poor sleep quality (Saleha et al., 2022; Umam et al., 2020). These results are in accordance with research conducted Sumah (2019) which found that the relationship between sleep quality and blood sugar levels when using the *chi square test* produced a *p value* of 0.000, this score is significant ($p < 0.05$).

Poor sleep quality affects insulin resistance related to disruption of the glucose regulatory component and changes in the hormone ghrelin which regulates appetite, increasing, so that the patient's blood sugar levels increase. It can be concluded that there is a relationship between sleep quality and blood sugar levels in type 2 diabetes mellitus patients at the Internal Medicine Polyclinic at RSUD dr. M. Haulussy Ambon.

The relationship between sleep quality and current blood sugar levels is due to poor sleep quality experienced by patients with type 2 diabetes mellitus. Factors that influence poor sleep quality include polyuria and nocturia, resulting in increased sympathetic nerve activity,

cortisol and growth hormone (GH) levels.) increase. These two hormones in the blood can form glucose and cause blood glucose levels to increase (Sumah, 2019).

The results of the analysis show a p value = 0.027, which means that H1 is accepted, where there is a relationship between sleep quality and blood sugar levels in type 2 diabetes mellitus patients at the Internal Medicine Polyclinic at Sultan Imanuddin Pangkalan Bun Regional Hospital (Hamid et al., 2020).

The results of research conducted Purwono et al., (2020) show that there is a relationship between the sleep quality of type 2 diabetes mellitus patients and blood glucose levels as evidenced by the statistical results of p value = 0.00 ($p < 0.05$). The correlation value obtained was 0.659 in the positive direction with strong strength, which means that the worse the quality of sleep in people with type 2 diabetes mellitus, the higher the glucose levels will be. This increase in glucose levels is influenced by the hormones epinephrine and norepinephrine. Increased norepinephrine is associated with anxiety, stress, high blood pressure and hyperactivity.

According to research results Surani (2015) the main cause of sleep disorders in diabetes mellitus patients is waking up at night to urinate or what is usually called nocturia. Nocturia in DM patients is due to dissolved diuresis or increased urine production. In line with the results of research conducted that disturbed sleep quality is influenced by increased psychological disorders, these sleep disorders make it difficult to control diabetes in diabetes patients (Mills et al., 2019; Keskin et al., 2015).

Sleep is associated with dysregulation of neuroendocrine control of appetite. A mechanism that relates weight gain to decreased sleep quality may be due to hyperactivity of the orexin system. During sleep the orexin system is active along with excessive sympathetic nerves, causing an increase in appetite and resulting in an increase in blood sugar levels (Bener et al., 2018; Khandelwal et al., 2017).

However, there were differences found in research conducted Farooque et al., (2020) there was a high prevalence of sleep disorders in diabetes mellitus patients, but the results showed that no significant differences were observed in PSQI scores between participants with controlled diabetes and those with uncontrolled diabetes. controlled glycemic control.

CONCLUSION

Based on the results of *the review* that has been carried out, from 11 articles it was found that there is a relationship between sleep quality and blood sugar levels in type 2 diabetes mellitus patients. The relationship between sleep quality and blood sugar is that the worse the quality of sleep, the more blood sugar levels will increase. However, there is 1 article which states that there is no significant relationship between sleep quality and blood sugar levels in patients with type 2 diabetes mellitus.

SUGGESTION

The advice we can give to future writers is to analyze the latest journals to see how sleep quality is related to blood sugar levels.

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