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Original Research Article

Influence of sleep quality and other associated factors on glycemic control among diabetic patients: A hospital-based study

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ABSTRACT

Background: The glycemic control of diabetes patients is influenced by a variety of risk factors, some of which are adjustable and others of which are not. Diabetes and sleep quality are most frequently correlated in both directions.

Aims and Objective: To evaluate the quality of sleep and pinpoint the risk factors for inadequate glycemic control in individuals with diabetes.

Materials and Methods: This cross-sectional study included seventy consecutive patients who met the inclusion criteria. The Pittsburgh Sleep Quality Index (PSQI) scale was used to evaluate the quality of sleep. Siemens- ID 29984, dimension RxL Max, Architect plus ABBOT (ci 4100), completely automatic seven-part cell-counter by Horiba Pentra Dx and Siemens ADVIA Centaur XPT (Immonoassay system) were utilized for the biochemical tests.

Results: Of the 70 participants in the study, 22 patients [31.4%] reported having good sleep quality, while 15 patients [21.4%] had average sleep quality and 33 patients [47.1%] had poor sleep quality. Patients with managed and uncontrolled blood sugar showed varying degrees of sleep quality; 48.4% and 17.9% showed good sleep quality, 29% and 15.4% showed moderate sleep quality, and 22.6% and 66.7% showed poor sleep quality. A statistically significant difference ($p<0.001$) was seen in the sleep quality of the two groups.

Conclusion: In summary, the results of our study suggested that diabetics with poor sleep quality are more likely to have poor glycemic control. A significant modifiable risk factor for improved glycemic management in diabetic patients is sleep quality.

1. Introduction

People undergo a variety of physiological and cognitive alterations when they sleep, including decreased peripheral vascular resistance and cardiac output, which lower blood pressure because of decreased sympathetic activity, hypo- and hyperventilation, and hormone secretion. Leptin hypersecretion during sleep deprivation causes an increase in food consumption, particularly in carbs, which may worsen or promote obesity. Notably, diabetes mellitus and other chronic degenerative disorders are predisposed to obesity.[1]

According to reports, people with diabetes have increased rates of obstructive sleep apnea (OSA), everyday tiredness, and negative outcomes.[2] Studies have shown varying percentages of sleep difficulties among T2DM patients, ranging from 42% to 71%.[3] Patients with chronic

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systemic illnesses, such as diabetes mellitus, need better sleep than anybody else. Research indicates that up to one-third of patients had concurrent sleep disturbances, compared to fewer than one-tenth of controls.[4]

It has been demonstrated that sleep loss raises blood glucose levels because it decreases glucose metabolism and raises cortisol levels. In addition to making diabetes worse by raising blood sugar levels, it can increase the chance of developing diabetes.[5] Long-term effects could include the development of pre-diabetes or perhaps diabetes. Normal people maintain a balance between their blood glucose uptake and insulin release while they sleep, demonstrating neither elevated nor decreased blood glucose levels. But low blood glucose levels in diabetes patients impede this kind of equilibrium.

Sleep and diabetes mellitus are said to be correlated in both directions. Numerous studies have shown that diabetes has a negative impact on patients' sleep patterns and significantly reduces their ability to maintain appropriate glucose control. These consequences can then negatively impact the patients' health-related quality of life.[6]

Little consideration is given to this component in the clinical care of the diabetic population in India, despite the strong and well-established link between diabetes and the negative effects of sleep deprivation and the good impact of adequate management of sleep-related disorders in the diabetes population. This is explained by the dearth of research describing the frequency of sleep disturbances in the diabetic population and the negative effects they have both in our setup and in India. The need for research to close this significant knowledge gap is urgent. In light of this, the current study is being carried out in Jammu to evaluate the effects of sleep length and quality on glycemic management in patients with type 2 diabetes mellitus.

2. Aims and Objective

1. To evaluate the quality of sleep that people with type 2 diabetes get.
2. To determine which diabetes patients' risk factors for inadequate glycemic control are.

3. Materials and Methods

The current study was carried out for a year, starting in December 2019 and ending in November 2020, at the Government Medical College & Hospital in Jammu's Postgraduate Department of Physiology in partnership with the Department of Medicine. The study included seventy type-2 diabetic patients, aged more than eighteen, from both genders who were visiting GMC Jammu. Patients who were willing to participate in the study and were seen in the GMC & Hospital, Jammu medical OPD were chosen as subjects.

Patients with significant co-morbidities or disabilities, patients with type 1 diabetes or gestational diabetes, patients with a history of drug or painkiller addiction, and patients who were aphasic and unable to cooperate during assessment were excluded from the study.

A pre-made proforma was used to gather all the pertinent data. Every participant had a thorough clinical assessment, which included physical examinations. Biochemical variables such blood glucose levels while fasting and after meals. Tests for hepatic and renal function, lipid profiles, and glycated hemoglobin (HbA1c) were assessed. Siemens-ID 29984; dimension RxL Max; Architect plus ABBOT (ci 4100); completely automatic seven-part cell-counter by Horiba Pentra Dx; and Siemens ADVIA Centaur XPT (Immonoassay system) were the auto-analysers utilized for these tests.

The Pittsburgh Sleep Quality Index (PSQI), a validated self-administered questionnaire, was used to assess sleep length and pattern.[7] Nineteen questions make up the PSQI score, which assesses various variables linked to sleep quality in the month prior. The 19 questions were split into "seven component scores," with each question being placed on a "0-3 scale." At the time, the seven factors were compiled to provide a global PSQI score (0–21); higher scores indicate lower sleep quality. The Pittsburgh Sleep Quality Index was graded and scored in accordance with the established scoring guidelines.

3.1. Ethical consideration

All study participants provided written informed permission, and patient confidentiality was maintained. The study was carried out with approval from the GMC Jammu Institutional Ethics Committee.

3.2. Statistical methods

The collected data was combined, input into a Microsoft Excel spreadsheet, then exported to the data editor of SPSS Version 20.0. The categorical variables were summarized as percentages, while the continuous variables were expressed as Mean ± SD. The chi-square test was utilized to evaluate the relationship between glycemic control and other parameters. It was decided that a p value of less than 0.05 was statistically significant.

4. Results

Table 1: Quality of sleep-in study patients

PSQI	Number	Percentage
Good (≤ 5)	22	31.4
Average (6-7)	15	21.4
Poor (≥ 8)	33	47.1
Total	70	100

Mean±SD (Range)=7.5±3.44 (2-16)

Table 2: Showing association of different variables with glycemic control in study patients

	HbA1c ≥ 7(Un-controlled) N (%)	HbA1c < 7(Controlled) N (%)	Odds Ratio (95% CI)	P-value
Age (Years)				
< 50	19 (61.3)	12 (38.7)	1.504 (0.577-3.918)	0.402
≥ 50	20 (51.3)	19 (48.7)		
Gender				
Male	21 (55.3)	17 (44.7)	0.961 (0.373-2.477)	0.934
Female	18 (56.3)	14 (43.7)		
Smoking Status				
Smoker	13 (59.1)	9 (40.9)	1.222 (0.440-3.396)	0.701
Non smoker	26 (54.2)	22 (45.8)		
BMI				
≥ 25	17 (62.9)	10 (37.1)	1.623 (0.607-4.340)	0.334
< 25	22 (51.2)	21 (48.8)		
Hypertension				
Yes	8 (61.5)	5 (38.5)	1.342 (0.391-4.605)	0.761
No	31 (54.4)	26 (45.6)		
Family History of Diabetes				
Present	7 (41.2)	10 (58.8)	0.459 (0.151-1.396)	0.165
Absent	32 (60.4)	21 (39.6)		
Dyslipidemia				
Present	8 (66.7)	4 (33.3)	1.742 (0.472-6.433)	0.528
Absent	31 (53.4)	27 (46.6)		

Table 3: Showing association of sleep quality (PSQI) with glycemic control in study patients

	PSQI				P-Value
	Good (≤ 5) N (%)	Average (6-7) N (%)	Poor (≥ 8) N (%)	Total N (%)	
HbA1c < 7	15 (48.4)	9 (29.0)	7 (22.6)	31 (100)	0.001
HbA1c ≥ 7	7 (17.9)	6 (15.4)	26 (66.7)	39 (100)	

Of the seventy study participants, twenty-two patients (31.4%) had average sleep quality (PSQI score of 6-7), fifteen patients (21.4%) had good sleep quality, and thirty-three patients (47.1%) had poor sleep quality (PSQI score of greater than 8).

39 patients in the research groups had a Hba1c greater than 7, while 31 patients had a normal Hba1c of less than 7. Table 2 indicates that patients who were younger than 50 years old, smokers, obese, hypertensive, and dyslipidemia patients had higher rates of uncontrolled blood sugar. The percentage difference was not statistically significant, though. Compared to people without a family history of diabetes, those with a history of the disease were less likely to experience uncontrolled blood sugar levels. According to statistics, the difference was not substantial.

In the study groups, of the 31 patients with Hba1c of less than 7, 15 patients [48.4%] had good sleep quality, 9 patients [29%] had average sleep quality, and 7 patients [22.6%] had poor sleep quality. Of the 31 patients with good glycemic control, 9 patients [29%] had good sleep quality, and 7 patients [22.6%] had poor sleep quality. Of the 39 patients who had poor glycemic control (Hba1c of greater than 7), 26 patients [66.7%] had poor sleep quality (PSQI score of greater than 8), 6 patients [15.4%] had average sleep quality (PSQI score of 6-7), and 7 patients [17.9%] had good sleep quality (PSQI score of less than 5). A statistically significant difference ($p < 0.001$) was seen in the quality of sleep between the two groups.

5. Discussion

A major public health issue that affects millions of individuals globally is type 2 diabetes mellitus. Type 2 diabetes is becoming epidemically prevalent in urban India. Long-term consequences and significant morbidity and mortality are caused by the condition. The goal of the current study was to determine how type 2 diabetes patients' glucose control was affected by the quantity and quality of their sleep. We also looked for additional potential risk factors for diabetes that is not under control.

Out of the 70 patients in our study, 22 patients [31.4%] had average sleep quality (PSQI score of 6-7), 15 patients [21.4%] had good sleep quality, and 33 patients [47.1%] had poor sleep quality (PSQI score of greater than 8). The PSQI score average was 7.5±3.44. This result was in line with the study by Htut NH et al.,[8] which found

that 48.4% of participants had poor sleep quality. In a similar vein, 51.9% of the study participants had poor sleep quality, according to Obaid ZH et al.[9] Similarly, the mean PSQI score of 7.5±3 reported by Gozashti MH et al.[10] was in line with the outcomes of our investigation. Sakamoto R et al.[11] study from 2013 found that 47.6% of the patients had poor sleep quality, which supported our findings. Similarly, Knutson KL et al.[12] found a mean PSQI score of 7±3.8 in their investigation, which was also in line with our study's findings. In contrast, 64% of the patients in Kodakandla K et al.'s study[13] reported having poor-quality sleep. Variations in the outcomes could be attributed to nutritional, geographic, racial, and ethnic factors.

5.1. Association of Sleep Quality [PSQI] with Glycemic Control

In our study, patients with poor glycemic control included 26 patients [66.7%] with poor sleep quality (PSQI score of greater than 8); in contrast, only 7 patients [22.6%] from the group with good glycemic control had bad sleep quality (PSQI score of larger than 8). Regarding the quality of their sleep, there was a statistically significant difference between the two groups (p value = 0.001). Our findings concurred with those of the Kodakandla K et al. study[13] where 48.4% of patients with inadequate glycemic control had poor sleep quality. In a similar vein, 64% of patients with inadequate glycemic control reported having bad sleep quality, compared to 36% of those with good sleep quality. Additionally, 72.2% of patients with good glycemic control reported having good sleep, compared to 27.8% who reported having bad sleep. Our findings were supported by the significant statistical difference (p = 0.004) in sleep quality between the two groups. Our findings also aligned with the research carried out by Htut NH et al.,[8]) Sakamoto R et al.'s findings from 2013 were comparable. Similarly, Martorina W.[14] and others discovered that, with a p value of less than 0.001, low sleep quality is linked to poor glycemic management. Similarly, poor sleep quality was revealed to be an independent predictor of poor glycemic control by Knutson KL et al.[3] in their study. With a p-value of less than 0.001, 67% of the patients with poor glycemic control reported having poor sleep quality. Numerous additional research also made similar observations. Hur et al.,[15] Azharuddin M et al.,[16] Lee and associates,[17] Obaid ZH and colleagues.[9] Gozashti MH et al.,[10] in contrast, observed no association between inadequate sleep quality and inadequate glycemic management, which contradicted our findings.

In addition to low-quality sleep, we also discovered that patients under 50 years old, smokers, obese, hypertensive, and dyslipidemia patients were more likely to have uncontrolled blood sugar, as Table 2 illustrates. The percentage difference was not statistically significant, though. Compared to people without a family history of diabetes, those with a history of the disease were less likely to experience uncontrolled blood sugar levels. Once more, there was no statistically significant difference.

6. Conclusion

In summary, the results of our study suggested that diabetics with poor sleep quality are more likely to have poor glycemic control. The findings of our research suggest that improved sleep quality is a novel and significant modifiable risk factor for improved glycemic control in individuals with diabetes. In light of this, healthcare providers ought to be urged to pay attention to patient complaints and sleep patterns in order to spot and treat latent hypoglycemic control and enhance the quality of sleep and life for this population.

7. Limitations of the Study

Our study had few limitations. Firstly, it was not carried out on a large representative population. Secondly, due to current covid-19 pandemic situation the diabetic patients with stable parameters visited the hospital less often. Lastly, the sleep time and sleep quality were self-reported.

8. Source of Funding

None.

9. Conflict of Interest

None.

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