

A Cross-Sectional Study on the Assessment of Sleep Quality and Associated Factors Among Diabetes Mellitus Patients

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Sleep is a fundamental factor associated with chronic illness. Lack of quality sleep and the extent of sleep may affect several aspects of physical, emotional, and cognitive health. The study aims to assess sleep quality and associated factors in subjects diagnosed with diabetes mellitus using Pittsburgh Sleep Quality Index Questionnaire (PSQI). An eight-month prospective cross-sectional study involving 356 patients with diabetes mellitus was carried out. The patient data collection form was prepared per the study's needs. Patients' responses to questionnaires about their sleep quality, anxiety, depression possibility, and physical activity were recorded. The data were analysed using a statistical tool for the social sciences (SPSS) version 28.0. Among 356 subjects enrolled, 43 (12%) had poor sleep quality, rest of the 313 (88%) patients had good sleep quality. Poor sleep quality was observed between the age group of 51-70 years. When compared to women, men were generally shown to have poor sleep quality. When compared to patients with mild and moderate anxiety, it was observed that most of the subjects with severe anxiety had poor sleep quality. Poor sleep quality was reported by the majority of patients who tested positive for depression and inadequate physical activity. The study concluded that diabetes mellitus does not significantly affect sleep quality in most patients. However, patients with low physical activity, severe anxiety and depression had poor sleep.

Keywords: Anxiety; Depression; Diabetes mellitus; Prospective cross-sectional, Pittsburgh Sleep Quality Index Questionnaire; Sleep.

The human body and mind must function properly, which requires sleep. It is produced after a time of wakefulness based on a circadian rhythm and homeostatic pressure. ¹ Humans spend about 30% of their lives sleeping, making sleep an essential living component. ² This is an essential component of well-being and health because it supports cognitive capacity, physiology, emotional

management, physical development, and standard of living. It aids in altering the body temperature, cardiovascular, also hormonal activity, leading to a much-needed restoration and the right operation of the body system. ³ In addition to being linked to several diseases and ailments, inadequate sleep has also been linked to subpar performance and occupational mishaps. ¹

One of the main health issues for diabetics is poor sleep. Its symptoms include trouble falling asleep and staying asleep, a disrupted sleep-wake cycle, excessive somnolence, and dysfunctions related to sleep and sleep stages. Poor sleep quality is a medical condition that affects sleep patterns.⁴ Sleep issues have been linked to poorer glycaemic management in type 2 diabetes patients and are risk factors for diabetes.⁵ But it's becoming more widely acknowledged that pathologic sleep disruption and insufficient sleep could also have serious negative cardiovascular effects.²

Numerous studies have found that insulin use, aging, a lower score on activity (personality) traits, low income, smoking, increased morbidities and a higher body mass index, and depressive symptoms were significantly associated with poor health-related quality of life in adults with type II diabetes mellitus. Meanwhile, many studies have shown that type II diabetes mellitus frequently includes sleep problems.⁶

However, how poor sleep quality affects functional well-being in persons with type 2 diabetes is still unknown.⁷ To evaluate the sleep quality and key factors among patients with diabetes mellitus, this study was conducted.

MATERIALS AND METHODS

Using a convenience sample technique, a prospective cross-sectional study was conducted for eight months (October 2021–June 2022) in the Department of General Medicine, Justice K S Hegde Charitable Hospital, Mangaluru. The trial received institutional ethical committee (IEC) approval and was also registered in the Clinical Trial Registry of India (CTRI/2021/09/036851) with reference number NGSMIPS/IEC/16/2021. The proportion of poor sleep quality (p) = 0.365 and precision (d) = 0.05 (0.5%) at the 95% confidence level were used to compute the sample size. 356 samples were revealed to be the necessary number. The study included adults older than 18 years of age having an inpatient or outpatient medical history of diabetes mellitus. Patients who refused to provide consent were not included.

A patient data collection was prepared to collect all the necessary demographic details like age, gender, diagnosis, family history and social habits. Pittsburgh Sleep Quality Index (PSQI),

Generalized Anxiety Disorder Item 7 (GAD-7), Patient Health Questionnaire Item 2 (PHQ-2), and International Physical Activity Questionnaire Item 7 (IPAQ-7) were used to gather data regarding sleep quality, anxiety, depression possibility and physical activity respectively. The Statistical Package for Social Sciences (SPSS) version 28.0 was used to analyse the data. Binary logistic regression was used to find the association between the risk factors and sleep quality. Statistically significant was considered at the p -value < 0.05 .

RESULTS

Sociodemographic details of the study subjects

A total of 356 participants, 215 (60.4%) of whom were men, and 141 (39.6%) of whom were women. Age between 61-70 was a majority with 107 (30.05%), followed by only 2 (0.56%) belonging to the 18-30 category. 291 (81.74%) patients didn't have any habits, 38 (10.67%) patients had a history of alcohol consumption, 14 (3.93%) patients were smokers and 13 (3.65%) patients had a history of both smoking and alcohol consumption. The majority of the patients ($n=135$, 37.92%) had hypertension as a common co-morbidity. Out of 356 patients, almost 153 (42.98%) patients had a family history of diabetes mellitus with one or more blood relatives being diabetic and 252 patients had hypertension with some other co-morbidities such as kidney, heart, liver, and lung-related issues. In addition, 321 patients followed a mixed diet, whereas only 35 had a vegetarian diet. The details are depicted in Table 1.

Sleep quality of study subjects

The results of the PSQI scale show that 163 (45.78%) subjects rated their sleep quality as very good, whereas 4 (1.12%) subjects rated it as very bad. The details are presented in Table 2.

PSQI results

The sleep quality was assessed by using the PSQI questionnaire. PSQI includes seven components namely subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, step disturbances, use of sleeping medication and daytime dysfunction. Each component's score ranges from 0 to 3 points, here "0" refers to no difficulty and 3 refers to severe difficulty.

In our study, it was observed the majority of the subjects (84.83%) took 15 mins to fall asleep after getting into bed. The average sleep duration for subjects was 8 hours 23 mins. The majority of the subjects, 317 (89.04%), had a sleep duration of more than 7 hours. Only a few subjects had less than 6 hours of sleep. Out of 356 subjects, the majority, 354 (99.43%), had good sleep efficacy. Out of 356 subjects, 243 subjects experienced sleep disturbance once a week. Overall, 339 (95.22%) subjects didn't use any medication for sleep and a few subjects consumed the medicines for sleep at least 1 time a week. 250 (70.22%) of the 356 participants reported having daytime dysfunction

at least once or twice per week. It was observed that the majority of the subjects, 313 (87.92%), had good sleep quality and only 43 subjects had poor sleep quality. The details of PSQI results are summarised in table 3.

Depression and anxiety among the study subjects

PHQ-2 & GAD-7 questionnaires were used to assess depression and anxiety. PHQ-2 comprises two questions. The score ranges for each question from 0 to 3 and the total score for PHQ-2 ranges from 0 to 6. If the score is ≥ 3 considered that the individual is likely to have depression. GAD-7 includes seven questions, and for each

Table 1. Socio-demographic details

Variables	Category	Frequency (n)	Percentage (%)
Sex	Male	215	60.4
	Female	141	39.6
Age group (In years)	18-30	2	0.56
	31-40	4	1.12
	41-50	65	18.25
	51-60	103	28.93
	61-70	107	30.05
	71-80	73	20.5
Social habits	No habits	291	81.74
	Alcoholic	38	10.67
	Smoking	14	3.93
	Alcoholic + Smoking	13	3.65
Family history of diabetes mellitus	Present	153	42.98
	Absent	203	57.02
Co-morbidities	Hypertension	135	37.92
	Hypertension + Kidney related disease	19	5.33
	Hypertension + Heart related disease	60	16.85
	Hypertension + Heart related disease + Kidney related disease	6	1.68
	Hypertension + Liver related disease	4	1.12
	Hypertension + Lung related disease	19	5.33
	Others	9	2.52
Diet	Vegetarian	35	9.84
	Mixed	321	90.16

Table 2. Subjective Sleep Quality

Subjective Sleep Quality	Frequency (n)	Percentage (%)
Very Good	163	45.78
Fairly Good	164	46.06
Fairly Bad	25	7.02
Very Bad	4	1.12

question, the score ranges from 0 to 3 and the total score for GAD-7 ranges from 0 to 21. Anxiety is further categorized into four types based on the score ranges including minimal anxiety (0-4), mild anxiety (5-9), moderate anxiety (10-14), and severe anxiety (15-21). Analysis of depression and anxiety among the participants showed that 61(17.13%) of them had depression, whereas 169 (47.47%) had major anxiety. The details are presented in Table 4.

Factors associated with sleep disturbance among study subjects

Our study's findings showed that men (7.86%) had a higher likelihood of having trouble sleeping than women (4.21%). Poor sleep quality was more in the age group of 61-70 years compared to 71-80 years, which is 1.059 times greater than that of the reference age group (71-80). In the majority of subjects, it was seen that social habits did not affect sleep quality. It was

Table 3. PSQI results

Variables	Category	Frequency (n)	Percentage (%)
Sleep latency	0–15 minutes (0)	302	84.83
	16–30 minutes (1)	42	11.79
	31–60 minutes (2)	11	3.08
	>60 minutes (3)	1	0.28
Sleep duration	>7 hours	317	89.04
	6–7 hours	33	9.26
	5–6 hours	6	1.68
	<5 hours	0	0
Sleep efficacy	e"85%	354	99.43
	75–84%	1	0.28
	65–74%	0	0
	<65%	1	0.28
Sleep disturbance	Never (0)	3	0.84
	1 time a week (1)	243	68.25
	1–2 times a week (2)	105	29.49
	e"3 times a week (3)	5	1.40
Used sleep medication	Never (0)	339	95.22
	1–2 once a week (1)	13	3.65
	3 times a week (2)	4	1.12
Daytime dysfunction	No problem (0)	37	10.39
	1–2 times a week (1)	250	70.22
	3 times a week (2)	65	18.25
	>3 times a week (3)	4	1.12
Overall sleep quality	Good	313	87.92
	Poor	43	12.07

Table 4. Depression and anxiety among the patients

Variable	Category	Frequency (n)	Percentage (%)
Depression	Yes	61	17.13
	No	295	82.87
Anxiety	Minimal	29	8.14
	Mild	129	36.23
	Moderate	169	47.47
	Severe	29	8.14

Table 5. Factors associated with sleep disturbance

Variables	Poor Sleep Quality		OR 95% CI	P-value
	YES	NO		
Gender				
Male	28	187	0.795 (0.408-1.548)	0.500
Female	15	126	Ref	Ref
Age				
18-30	0	2	.000	0.999
31-40	0	4	.000	0.999
41-50	8	57	0.998 (0.361-2.760)	0.997
51-60	12	91	0.928 (0.369-2.330)	0.873
61-70	14	93	1.059 (0.432-2.594)	0.900
71-80	9	64	Ref	Ref
Social Habits				
No Habits	37	254	1.748 (0.444-5.189)	0.597
Alcoholic	4	34	1.412 (0.143-13.913)	0.768
Smoking	1	13	0.923 (0.052-16.456)	0.957
Alcoholic + Smoker	1	12	Ref	Ref
Diet				
Mixed	40	281	1.518 (0.444-5.189)	0.505
Vegetarian	3	32	Ref	Ref
Diabetes mellitus with co-morbidities	31	221	1.075 (0.529-2.186)	0.841
Diabetes mellitus without co-morbidities	12	92	Ref	Ref
Family History				
Present	19	134	0.946 (0.498-1.797)	0.864
Absent	24	179	Ref	Ref
Anxiety				
Minimal	4	25	1.080 (0.338-3.452)	0.897
Mild	19	110	0.609 (0.187-1.983)	0.410
Moderate	15	154	1.302 (0.312-5.436)	0.717
Severe	5	24	Ref	Ref
Depression Possibility				
Present	9	52	0.753 (0.341-1.66)	0.482
Absent	34	261	Ref	Ref
Physical Activity				
Low	15	87	0.899 (0.442-1.825)	0.767
Moderate	22	142	0.414 (0.153-1.118)	0.082
High	6	84	Ref	Ref

observed that subjects with a mixed diet had 1.518 times greater poor sleep quality compared to those with a vegetarian diet. It was observed that poor sleep quality was more in subjects with co-morbidities (8.76%) compared to subjects without co-morbidities (3.37%). When compared to patients without a family history of diabetes mellitus, those with a 0.946 times higher likelihood of experiencing poor sleep quality. Comparing participants with individuals with other categories

of anxiety, those with severe anxiety have a larger percentage (17.24%) of subjects with poor sleep quality. When compared to individuals without depression, subjects who tested positive for depression were 0.753 times more likely to have poor sleep quality. When compared to people who were more physically active, subjects with low levels of physical activity had a 0.899-times higher likelihood of having poor sleep quality. The details are presented in table 5.

DISCUSSION

Sleep quality should be assessed chiefly in subjects suffering from any chronic illness as it will affect psychological, physical and cognitive health in a multifaceted way. In the department of general medicine, 356 participants took part in a cross-sectional study to assess the sleep quality of subjects diagnosed with diabetes mellitus and to perceive if any relation exists between other factors such as anxiety, depression, and physical activity. Other factors such as gender, age, family history, social habits, diet, and other co-morbidities were also considered for assessing these factors and the quality of sleep.

According to the study's findings, men (60.40%) outnumbered women (39.60%) in the population. This outcome was discovered to be comparable to one from a study by Edmealem A *et al.*, where 53.4% of them were men.⁸ Most participants were between the ages of 61 and 70, which is consistent with the research done by Birhanu TT *et al.*³ It indicates that the prevalence of diabetes increases with that age. Furthermore, 10.67% of the participants were alcoholics, and 3.93% were smokers. However, it contradicted the Dong D *et al.*, study, where 17.3% of participants were smokers and 11.9% were alcohol drinkers.⁹ Alcoholism leads to impaired secretion of insulin and reduced insulin sensitivity over a period of time and ultimately leads to the development of diabetes.¹⁰

Only 12.07% of the patients in the study had poor sleep quality, compared to an overall incidence of good sleep quality of 87.92%. The values of poor sleep quality were significantly lower compared to a study conducted in Ethiopia (36.5%)⁸, Pittsburgh (55%)¹¹, and China (33.6%)⁹ Turkey (67.9%).¹² The discrepancies in the result might be due to sociocultural differences, a different measurement tool, the difference in sampling technique and the setting in which the study was carried out. In our study, 95.22% of the participants reported that they have never used sleep medication, reflecting rational medication usage by the patients and the physicians.

According to the current study, 47.47% of the patients showed significant anxiety, while 17.13% experienced mild depressive symptoms. However, in descriptive research carried out by

Yücel, ^a.Ç. *et al.*, 19.8% of the patients exhibited anxiety, while 13.6% of the patients experienced mild depressive symptoms.¹² The prevalence of depression and anxiety may be related to participants' perceptions of sickness, their fear of hospitals, and intrusive procedures used in therapy. In a multivariable logistic regression analysis, patients with social habits did not have much effect on their sleep quality. However, compared to those who followed a vegetarian diet, those who followed a mixed diet had 1.518 times more nights of bad sleep.

Participants who had co-morbid conditions were 1.075 more likely to have poor sleep than participants who did not have co-morbid conditions. It had a similar trend to a study conducted in Ethiopia.¹³ Similar to a study by Edmealem A *et al.*, which found that patients with anxiety were four times more likely to have bad sleep habits, the subjects with significant anxiety (17.24%) were more likely to experience poor sleep quality.⁸ Patients who tested positive for depression were 0.753 times more likely to experience poor sleep than patients who did not. This was in contrast to a survey performed by Birhanu TT *et al.* It was observed that patients with low physical activity had more poor sleep quality (14.70%) compared to patients with high physical activity. It could be justified since many research studies show that physical activity directly correlates to sleep quality.³

The results of the study have a few limitations. No objective measurements of sleep were used to inspect the quality of sleep. Since it was a cross-sectional study, it could not rule out the possibility of a cause-effect relationship. Lastly, the greater sample size would have provided more statistical power to the study.

CONCLUSION

The study's findings indicate that a smaller percentage of the participants had sleep disturbances. Poor sleep quality was observed more among elderly subjects. Factors such as gender, age, diet, comorbidities, depression, severe anxiety, and inadequate physical activity all impacted sleep quality even though they were not statistically significant. We propose that counselling sessions for patients with depression and anxiety would

enhance the participants' quality of sleep.

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