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Comparative Study on Quality of Sleep and Glycaemic Control in Patients with Type 2 Diabetes Mellitus

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Abstract: ***Background: Diabetes is one of the rigorous health crises of the twenty-first century. Population growth, sedentary lifestyle, obesity, unhealthy diet and habits, and short sleep duration are common risk factors which would lead to increase in prevalence of diabetes. In this background, the aim of this study was to determine the effect of sleep quality among glycaemic controls. Method: A cross sectional study was conducted among 43 poor and good glycaemic controls in the Father Muller Medical College Hospital. Cut-off of Glycated haemoglobin level < 7 was considered as good glycaemic control. Pittsburgh Sleep Quality Index (PSQI) and Epworth Sleep Scale (ESS) self-reported instruments were used to assess sleep quality. Results: Out of total, 75.6% had poor sleep quality and 46.5% had daytime sleepiness symptoms. The study showed that score of PSQI subscales and ESS was higher and statistically significant among poor glycaemic controls compared counterpart. There was significant associations of sleep quality with family history of diabetes (p value = 0.016) and duration of diabetes (p value =0.024). Conclusion: Sleep disorder is common in diabetic patients and as a bidirectional relationship between glycaemic controls with sleep disorders. Therefore, it is important to address sleep problems for eliminating the complications caused by sleep disorder which may in return lead to better glycaemic control as well as improvement in quality of life***

Keywords: quality of sleep, glycaemic control, risk factors, day time sleepiness, quality of life

1. Introduction

Epidemiological transition has taken place from Communicable to Non-Communicable Diseases (NCDs) across regions and countries. Diabetes is considered to be one of the common types of NCDs suffered by most of the people. Therefore, diabetes is one of the rigorous health crises of the twenty-first century (1). The prevalence of diabetes is growing rapidly especially in low-and middle-income countries (2). In 2019, 74 percent of global mortality rate was due to diabetes and it stood ninth as reason for mortality (2). Population growth, sedentary lifestyle, obesity, unhealthy diet and habits, stress, depression and short sleep duration are common risk factors which would lead to increase in prevalence of diabetes (3).

Longer working hours and increased employment shift have leaded to sleep disorders in individual's life. Sleep disorders are defined as difficulties in falling asleep or staying asleep as well as having no restful sleep (4). Sleep is an essential and fundamental biological process for good health and quality of life (5). It is the time when the body secretes many important hormones that affect growth, sleep, regulates energy, metabolic and endocrine functions (6). Sleeping for a shorter or longer period of time can increase diabetes complications (7). They contribute to poor glycaemic control, diabetic neuropathy and overnight hypoglycaemia (4). Corresponding with the high prevalence of diabetes is the occurrence of sleep disturbance which is caused due to various physical and psychological factors (8). Thus, bidirectional relationship is found between diabetes and with sleep disorders (4). In this background, the aim of this study is to determine the effect of sleep quality and relationship among diabetic patients.

2. Materials and Method

A cross sectional study was conducted in the Father Muller Medical College Hospital which is a multispecialty teaching general hospital during the period of April 2022 to June 2022. The sample size was calculated based on the study conducted by Khakurel G etal. (5). With 95% confidence interval, 90% power, 32.6% and 68.9% was the proportion of poor sleep quality disorder respectively among the patients with good and poor glycaemic control. Resulting in 43 study participants in each group. The study commenced after obtaining the ethical clearance from Institutional Ethical Committee. The written informed consent was obtained from the study participants and the study was conducted in accordance with the Declaration of Helsinki.

Patients above age 18 of either sex were included. The study participants diagnosed with type 1 diabetes, patients with pre-existing diagnosed psychiatric disorder or undergoing treatment for psychiatric symptoms, patients with debilitating medical illness, Pregnant and breastfeeding mothers, shift workers were all excluded from the study. MINI plus scale was used to rule out the psychiatric comorbidities (9). The study participants were grouped into the following two group: poor and good glycaemic control. Individuals who have an HbA1c concentration of ≥7% wereconsidered as poor glycaemic control. Whereas, other group had HbA1c concentration of <7%. (5)

Pittsburgh Sleep Quality Index (PSQI) and Epworth Sleep Scale (ESS) self-reported instruments were used to assess sleep quality (10, 11). PSQI consists of 19 items which has seven subscales such as sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction over the months' time. These subscales are combined to get a total sleep quality score. The PSQI score ranges from 0 to 21 with

higher scores (PSQI > 05) indicating poor sleep quality. The ESS consists of 8 questions which measures daytime sleepiness. Each question is rated on a scale of 0 to 3. The ESS score ranges from 0 to 24. The ESS scores ≥ 10 indicates daytime sleepiness symptoms.

The data was analysed using the SPSS version 22.0. Categorical variables were presented as frequencies and percentages whereas continuous variables were presented as median and interquartile range. The Kolmogorov-Smirnov test was used to check the normality for continuous variables. Mann Whiney U test was used to compared PSQI factors among glycaemic controls. Chi square test/ Fishers exact test was used to compare study variables between good and poor sleep quality. P value <0.05 was considered to be statistically significant.

3. Results

Table 1: Baseline characteristics of the study variables

Study variables		Frequency (n=86)	Percentage (%)
Gender	Female	19	22.1
	Male	67	77.9
Age (In years)	18-25	14	16.3
	26-40	17	19.8
	41-60	55	64.0
Marital Status	Single	24	27.9
	Married	62	72.1
Type of family	Joint	56	65.1
	Nuclear	30	34.9
Family history of diabetes	Present	40	46.5
	Absent	46	53.5
Smoking habits	Yes	17	80.2
	No	69	90.7
Treatment	Oral	78	90.7
	Insulin	5	5.5
	Both	3	3.5
Duration of diabetes (in years)	≤ 5	39	45.3
	>5	47	57.7
PSQI	Poor sleep quality (>5)	65	75.6
	Good sleep quality (≤5)	21	24.4
Daytime sleepiness symptoms	Yes	40	46.5
	No	46	53.5

A total of 86 participants were included in the study. Out of which 77.9% were males and most (64%) belonging to the age group 41 to 60 years. About 46.5% had family history of diabetes. Majority (90.7%) were on oral treatment, 5.5% were on Insulin and 3.5% were on both oral and Insulin treatment. About 57.7% had diabetes for more than 5 years. Out of total, 75.6% had poor sleep quality and 46.5% had daytime sleepiness symptoms. (Table 1)

Table 2: Comparison between PSQI factors among poor and good glycaemic controls

PSQI factors	Poor glycaemic control (n=43)	Good glycaemic control (n=43)	Test statistics	P value
Subjective sleep quality	2 (1, 3)	1 (0, 1)	-4.700	0.0001*
Sleep latency	2 (1, 2)	1 (0, 1)	-4.074	0.0001*
Sleep duration	2 (1, 2)	1 (0, 2)	-2.858	0.004*
Sleep efficiency	0 (0, 1)	0 (0, 0)	-2.995	0.003*
Sleep disturbances	2 (2, 3)	1 (0, 1)	-6.549	0.0001*
Use of sleeping medications	1 (1, 2)	0 (0, 1)	-3.729	0.0001*
Daytime dysfunctions	2 (1, 3)	1 (01)	-5.988	0.0001*
Global PSQI score	12 (11, 14)	6 (0, 7)	-5.434	0.0001*

*p value <0.05 is considered statistically significant;
Statistical test used: Mann-Whitney U test
Median (IQR) is reported

The study consists of 43 patients each with good glycaemic (HbA1c <7) and poor glycaemic control (HbA1c ≥ 7) respectively. While comparing across the groups all the seven PSQI factors such as Subjective sleep quality, Sleep latency, Sleep duration, Sleep efficiency, Sleep disturbances, Use of sleeping medications and Daytime dysfunctions was found to be statistically significant. Overall, Global PSQI score was higher (median score=12) among poor glycaemic control compared to good glycaemic control (median score= 6) and the difference was found to be statistically significant. (Table 2)

Table 3: Association of study variables among poor and good glycaemic controls

Study variables		Poor glycaemic control (n=43)	Good glycaemic control (n=43)	Chi Square value	P value
PSQI	Poor sleep quality (>5)	37 (43.0)	28 (35.6)	5.10	0.024*
	Good sleep quality (≤5)	6 (7.0)	15 (17.4)		
Daytime sleepiness symptoms	Yes	28 (32.6)	12 (14.0)	12.0	<0.001
	No	15 (17.4)	31 (36.0)		

*p value <0.05 is considered statistically significant;
Statistical test used: Chi-square test
n (%) is reported

Table 3, While comparing the patients with poor and good glycaemic control, there was significant difference in sleep quality and the association was found to be statistically significant (p value =0.024). similarly, there was significant association in daytime sleepiness symptoms between the two groups (p value <0.001)

Table 4: Association of study variables among poor and good glycaemic controls

Study variables		Poor sleep quality (>5) n=65	Good sleep quality (≤5) n=21	Chi Square value	P value
Gender	Female	16 (84.2)	3 (15.8)	0.984	0.321
	Male	49 (73.1)	18 (26.9)		
Age (In years)	18-25	12 (85.7)	2 (14.3)	3.51	0.173
	26-40	15 (88.2)	2 (11.8)		
	41-60	38 (69.1)	17 (30.9)		
Marital Status	Single	19 (79.2)	5 (20.8)	0.232	0.630
	Married	46 (74.2)	16 (25.8)		
Type of family	Joint	46 (82.1)	10 (17.9)	3.75	0.053
	Nuclear	19 (63.3)	11 (36.7)		
Family history of diabetes	Present	35 (87.5)	5 (12.5)	5.76	**0.016***
	Absent	30 (65.2)	16 (34.8)		
Smoking habits	Yes	13 (76.5)	4 (23.5)	0.009	0.924
	No	52 (75.4)	17 (24.6)		
Duration of diabetes	≤5	25 (64.1)	14 (35.9)	5.09	**0.024***
	>5	40 (85.1)	7 (14.9)		
Treatment	Oral	58 (74.4)	20 (25.6)	-	-
	Insulin	5 (100.0)	0		
	Both	2 (66.7)	1 (3.33)		

*p value <0.05 is considered statistically significant;
Statistical test used: Chi-square test

While comparing the patients with poor and good sleep quality, there was significant associations of sleep quality with family history of diabetes (p value =0.016) and duration of diabetes (p value =0.024). i.e., those with poor sleep quality had longer duration of diabetes. Other factors such as gender, age, marital status, type of family and smoking habits had no significant association with sleep quality (Table 4)

4. Discussion

The present study was performed to compare the quality of sleep and glycaemic control in type-2 diabetic individuals. The sleep quality was measured using PSQI and ESS, self-reported instruments. About 75.6% of the study population had poor sleep quality with PSQI >5. In an earlier study, PSQI of ≥8 was categorised as poor and the prevalence was 58.7% (5). In other studies, the prevalence of poor sleep quality was 64.3%, 55.6%, and 74% (4, 6, 7). The different cut off points and varied socio-economic status may be the reasons for different prevalence in these studies. Sleep disorders are very common in the present time and prolonged disorders may have implication in cardiovascular, neurological and metabolic diseases (4). Both development and control of diabetes mellitus is associated with poor quality of sleep (4).

The present study showed that global PSQI score of 12 is seen in people having poor glycaemic control. It is true that poor glycaemic control is implicated in nocturia and there by disturbing the night sleep. This is the possible reason for higher PSQI score. The neuropathy and associated pain may also disturb the night sleep (8). In an earlier work, the PSQI score had no correlation with glycaemicindices (7). We have observed an association between both PSQI score as well as day time sleeping symptoms with the glycaemic control. Increased day time sleeping may also be the reason for poor quality of sleep in the night. The sleep disturbance in diabetic individuals may be due to multiple effects on the central nervous system causing altered neurobehavioral and neurotransmitter functioning, autonomic functions which cause hormonal imbalance (12). We observed an association between poor sleep quality with the duration of diabetes. As the duration of diabetes increases, there are all the possibilities of worsening of glycaemic control and development of various complications like neuropathy, nephropathy which may disturb the quality of the sleep.

Thus, in the present study, it was observed that there is an association between the glycaemic control and the sleep quality. This observation may be taken in to consideration while treating a diabetic patient.

Conclusion

Poor sleep patterns are common in type 2 diabetes mellitus patients. Diabetic patients with poor glycaemic control and those who have had the condition for a longer period of time have significantly poorer sleep quality. Therefore, it is important to address sleep problems for eliminating the complications caused by sleep disorder which may in return lead to better glycaemic control as well as improvement in quality of life.

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