ORIGINAL ARTICLE

QUALITY OF SLEEP AND ITS ASSOCIATED FACTORS AMONG DIABETICS AND NON DIABETICS

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Background: Diabetes mellitus is the metabolic state which has shown a persistent global rise in numbers. It is therefore necessary to closely assess all aspects of this state. Sleep quality and diabetic control have a relation where both can affect each other. Therefore, we aim to study the quality of sleep and factors affecting it in our diabetic population. The objective of the study was the identification of quality of sleep and factors affecting it in the diabetic and non diabetic adult population. **Methods**: In this comparative cross sectional study quality of sleep was evaluated in all the patients through the Pittsburgh Sleep Quality Index. Statistical analysis was conducted with the SPSS-23. **Results:** The total number of study participants were 250 adults (18 years and above), where 125 were diabetics, while 125 were non diabetics. In Diabetic group, the total number of patients with impaired sleep was 65 (52%). In non-diabetic group, impaired sleep was found in 70 (56%) individuals. The mean age of diabetics was 55.2±11.6 years and non-diabetics was 37.23±12.017 years. Prevalence of restless leg syndrome and depression among diabetics was 33 (26.4%) and 30 (24.0%) respectively and in non-diabetic was 20 (16.0%) and 63 (50.4%). Impaired sleep quality was associated with the use of cell phones before going to bed (*p*-value: 0.01) and watching television until late at night in both groups. Impaired sleep is seen more commonly in uncontrolled DM (RR:1.462 and CI: 0.531 to 4.025) **Conclusion:** Impaired sleep and uncontrolled DM has a direct relation and the prevalence of Restless leg syndrome (RLS) is higher in Diabetics. Addressing the factors impairing sleep can improve sleep quality and have beneficial effects on the sufferers from this metabolic state.

Keywords: Sleep; Diabetes Mellitus; Restless leg syndrome; Depression; Cell phone

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INTRODUCTION

The risk of developing diabetes associated with sleep disturbances is comparable to that of traditional risk factors.[1,2] Sleep has its contribution not only to the quality of life but also to diabetic control.[3,4] The factors leading to impaired diabetes control should be identified and addressed accordingly. The quantitative estimates of the associations between measures of quantity and quality of habitual sleep and the incidence of type 2 diabetes in studies around the world show a clear and consistent pattern of increased risk of developing type 2 diabetes at either end of the distribution of sleep duration and with qualitative disturbances of sleep. The risk varies between 28% in people who report habitual sleep of <5–6 hour/night and 84% in those with difficulties in maintaining their sleep.[5,6]

The prevalence of diabetes among South Asians adults is 6.9%.[7] Whereas a recent study by Aziz ul Hassan Aamir reports prevalence as 17%.[8]. However, to our knowledge, no studies have been conducted in our country regarding the sleep aspect of the diabetic population. So, we attempted to study the prevailing status of our population.

The rationale of this study is to compare the sleep-in diabetic patients with that in a healthy non-diabetic group and identify the factors which influence sleep adversely in diabetics in comparison with non-diabetics. Thus, bringing health care provider's (HCPs) attention to those aspects of the diabetes care which can improve the quality of sleep and concomitantly the control of diabetes among their patients, thus leading to a better quality of life.

MATERIAL AND METHODS

This is a Comparative cross-sectional study. It was conducted in Fatima Memorial Hospital (FMH), Lahore, starting from July 2018 till July 2019.

All diabetics and healthy individuals more than 18 years of age willing to participate, cognitively fit to answer the questionnaire were included. Individuals with a history of acute trauma, infection, or hospitalization in the last month, incomplete responses to the questionnaire, profession/occupation requiring major working hours during the night were excluded.

The sample of the study consisted of 125 diabetic patients and 125 healthy individuals. A consecutive sampling technique was used. The subject's demographic and other relevant information were recorded on a questionnaire developed in the English language. For each patient, we recorded data regarding age, gender, duration of diabetes, and use of medications. Fasting blood glucose (FBG), postprandial

blood glucose (PPBG), and glycosylated haemoglobin (HbA1c) values were recorded from their case sheets. All the study patients were on anti-diabetic medications, either insulin or oral hypoglycaemic agents, or both.

Quality of sleep was evaluated in all the patients through the Pittsburgh Sleep Quality Index (PSQI)[9], which is a validated questionnaire that assesses sleep quality and disturbances over a month long period. PSQ scoring is added to yield one global score with a range of 0-21 points, 0 indicating no difficulty, and 21 indicating severe difficulties. Depression screening was done with the Patient Health Questionnaire (PHQ-2).[10] To identify Restless leg syndrome (RLS), 2012 Revised IRLSSG Diagnostic Criteria for RLS was used.[11]

Ethical approval was obtained from the Institutional Review Board (IRB). All participants were informed about the study and were told that their participation was voluntary and it was assured to them that their participation will be kept anonymous.

Statistical analysis was conducted with SPSS version 23. Quantitative variables were expressed as mean±standard deviation, and qualitative variables were expressed as percentage values. Relative risk with confidence interval was calculated. The *p*-value of less than 0.05 was considered significant.

RESULTS

The total number of study participants were 250, where 125 (50%) were diabetics, while 125 (50%) were healthy non- diabetic individuals. The demographic features of the two groups are presented in table 1. Among non-diabetic population 60 (48%) were married, 46 (36%) of them had children less than 3 years and among the diabetic population 123 (98%) were married, 119 (95%) of them had children less than 3 years.

Comparison of sleep quality among Diabetic and Non - Diabetic with personal habits that can affect sleep quality is presented in table-2. The use of cell phones was significantly related to impaired sleep quality in diabetic (*p*-value = 0.016) and non-diabetic group (*p*-value = 0.019).

Restless Syndrome was more prevalent in diabetics 26% versus 16% in non-diabetic. Prevalence of RLS in diabetics was 33 (26%) out of these 18 (54%) had impaired sleep and depression was in 30 diabetics (24%) out of these 19 (63%) had sleep impairment. However, the relation of depression and RLS with impaired sleep did not show statistical significance.

The factors affecting sleep quality in diabetics are presented in table-2 and 3. Impaired sleep was associated with 20 patients who use (74%) cell phone before bedtime (RR/CI 1.613 (1.183-2.199)), 22 (73%) of those who watch TV till midnight, and 19 (63%) (RR/CI 1.620 (1.190-2.207) of patients with depression (RR/CI 1.308 (0.929-1.842)). In the upper middle-income group out of 12 those with poor sleep were 10 (83%). Out of 33 patients who had RLS, 18 (54%) had impaired sleep (RR/CI 1.068 (0.737-0.155)). Among a total of 65 patients who had impaired sleep, 50 (77%) patients were with uncontrolled diabetes (RR: 1.462 and CI: 0.531 to 4.025).

The characteristics of individuals with PSQ score ≥10 are shown in table-4. Among non-diabetics 82% were late night cell phone users and 65 % had depression screening positive. Among diabetics, 81% had uncontrolled diabetes.

Table-1: Comparison of sleep quality among diabetics and non-diabetics with demographic features of two groups

Variables		Non - Diabetic			Diabetics		
		Normal sleep 60 (48%)	Impaired Sleep 65 (52%)	RR(CI)	Normal sleep 55 (44%)	Impaired Sleep 70 (56%)	RR(CI)
Age		53.53±11.80	56.77±11.264		40.93±13.20	34.33±10.185	
Gender							
	Male	21 (40.4%)	31 (59.6%)	1.28 (0.918-1.784)	34 (45.9%)	40 (54.1%)	0.919 (0.673-1.254)
	Female	39 (53.4%)	34 (46.6%)		21 (41.2%)	30 (58.8%)	
Children							
	Yes	57 (47.9%)	62 (52.1%)	1.04 (0.460-2.362)	28 (48.3%)	30 (51.7%)	0.866 (0.631-1.190)
	No	3 (50.0%)	3 (50.0%)		27 (40.3%)	40 (59.7%)	
	Night	0	0		1 (0.08%)	3 (2.4%)	
Socio-Economic Status							
	Low Income	13 (56.5%)	10 (43.5%)		20 (51.3%)	19 (48.7%)	
	Lower Middle Income	8 (53.3%)	7 (46.7%)		12 (29.3%)	29 (70.7%)	
	Upper Middle Income	2 (16.7%)	10 (83.3%)		12 (38.7%)	19 (61.3%)	
	High Income	3 (42.9%)	4 (57.1%)		10 (76.9%)	3 (21.1%)	

Table-2: Comparison of sleep quality among diabetics and non-diabetics with personal habits that can affect sleep quality

Personal Habits:		Diabetic			Non - Diabetic		
		Normal sleep 60 (48%)	Impaired Sleep 65 (52%)	RR (CI)	Normal sleep 55 (44%)	Impaired Sleep 70 (56%)	RR (CI)
Tea more than three cups	Yes	28 (50.0%)	28 (50.0%)	0.932 (0.663–1.312)	30 (47.6%)	33 (52.4%)	0.878 (0.643–1.199)
	No	32 (46.4%)	37 (53.6%)		25 (40.3%)	37 (59.7%)	
Coffee more than three cups	Yes	1 (12.5%)	7 (87.5%)	1.765 (1.283–2.429)	4 (3.2%)	4 (3.2%)	0.886 (0.453–1.805)
	No	59 (50.4%)	58 (49.6%)		51 (40.8%)	51 (40.8%)	
Cold drinks more than 5 per weeks	Yes	4 (50%)	4 (50%)	0.959 (0.469–1.959)	9 (27.3%)	24 (72.7%)	1.445 (1.086–1.948)
	No	56 (47.9%)	61 (52.1%)		46 (50%)	46 (50%)	
Use of cell phone	Yes	7 (25.9%)	20 (74.1%)	1.613 (1.183-2.199)	32 (36.8%)	55 (63.2%)	1.602 (1.047–2.450)
	No	53 (54.1%)	45 (45.9 %)		23 (60.5%)	15 (39.5%)	
Watching TV till mid night	Yes	8 (26.7%)	22 (73.3%)	1.620 (1.190–2.207)	15 (42.9%)	20 (57.1%)	1.029 (0.731–1.447)
	No	52 (54.7%)	43 (45.3%)		40 (44.4%)	50 (55.6%)	
Smoking	Yes	10 (71.4%)	4 (28.6%)	0.520 (0.223–1.211)	3 (37.5%)	5 (62.5%)	1.125 (0.642–1.971)
	No	50 (45%)	61 (55%)		52 (44.4%)	65 (55.6%)	
Depression	Yes	11 (36.7%)	19 (63.3%)	1.308 (0.929–1.842)	23 (36.5%)	40 (63.5%)	1.312 (0.955–1.803)
	No	49 (51.6%)	46 (48.4%)		32 (51.6%)	30 (48.4%)	
Restless leg syndrome	Yes	15 (45.5%)	18 (54.5%)	1.068 (0.737–0.155)	12 (60%)	8 (40%)	0.677 (0.387–1.186)
	No	45 (48.9%)	47 (51.1%)		43 (41%)	62 (59%)	

Table-3: Factors affecting sleep quality in Diabetics.

		Normal sleep	Impaired Sleep	Total
Number		60	65	125
Diabetes controlled	Yes	17 (13.6%)	15 (12%)	32 (25.6%)
	No	43 (34.4%)	50 (40%)	93 (74.4%)
Diabetes Duration	Less than 10 years	33 (26.4%)	45 (36%)	78 (62.4%)
	More than 10 years	27 (21.6%)	20 (16%)	47 (37.6%)
Treatment	OHG	30 (24.0%)	46 (36.8%)	76 (60.8%)
	Insulin	18 (14.4%)	15 (12.0%)	33 (26.4%)
	Diet	1 (0.8%)	2 (1.6%)	3 (2.4%)
	Multiple	11 8.8%)	2 (1.6%)	13 (10.4%)

Table-4: Characteristics of the group with PSQ score ≥10

Total number	Gender M/F	Depression	RLS	Cell phone use	Diabetes controlled Yes: No	Diabetes years since diagnosis <5: ≥5
Non-Diabetic						
17(14%)	11:6 65%: 35%	11 (65%)	(3) 18%	14 (82%)		
Diabetics						
21(17%)	12: 9 57%:43%	(4) 19%	(6) 29%	(4) 19%	4:17 19%:81%	8: 13 38%:62% RR(CI): 1.818 (0.848 -3.898)

DISCUSSION

Sleep disturbances have been associated with increased diabetes risk and researchers claim that quality of sleep has a role in impaired diabetes control. Therefore, in our study, we tried to identify the factors which can adversely affect sleep quality. A global PSQI score greater than 5 yielded a diagnostic sensitivity of 89.6% and specificity of 86.5% (kappa = 0.75, *p* less than 0.001) in distinguishing good and poor sleepers.[12] We found that 52 % of diabetics had PSQ score 5 or above indicating impaired sleep quality. A study done from the USA by Faith in adults with type 2 diabetes more than half of the participants (55%) were "poor sleepers" according to the Pittsburgh Sleep Quality Index.[13] Similar results are reported in a study from Ethopia.[14] Study done by Rajendran *et al*[15] in south Asian Indian diabetics showed an even higher percentage, 69%. Similarly, high values, 71.0%,[16,] and 69%[17] are reported in other studies.

Among our healthy non-diabetic participants, the PSQ score of ≥5 indicating impaired sleep quality was found in 56% whereas among diabetics it was 52%. The factors identified which probably attributed to high PSQ among otherwise healthy adults were frequent users of the cellular phone before retiring to sleep and watching television till late night. 82% of healthy individuals with a PSQ score of more than 10 were cell phone users till late night (*p*-value =0.01). Surprisingly the depression screening was positive in 50% in this relatively younger age group with a mean age of 37 years, likely another factor contributing towards poor sleep

quality. A study by Thomee S[18] in young people on the use of mobile phone and health impact showed the prevalence of depression as per gender 24% and 28% and sleep disturbance of 15% and 20% among men and women respectively. Our study shows a much higher number. Therefore, we recommend further detailed assessment studies to identify depression in this age group and the impacts of cell phone use on health.

We found that a longer duration of diabetes doesn't affect sleep quality as such, patients with PSQI score ≥5 were more in the group with DM of less than 10 years duration. Whereas study from Southeast Asia by Rajendran A[12], Cunha MC[13] *et al* from Brazil and Bing-Qian Zhu[19] reported that patients with time after diagnosis over 10 years had the poorest sleep quality.

Our study revealed better sleep quality in diabetics with controlled blood sugar as only 12% in this group had PSQ score ≥5 whereas 40% among uncontrolled diabetics had such a score (Table-3). However, this difference was not statistically significant. Cunha *et al* and Bing Qian have reported poor sleep quality for those with haemoglobin A1c >7% and normal body mass index (BMI).[16,19,20]

Among our study group, 21 (16.8%) subjects had a score ≥10 indicating arbitrarily poor sleep quality. Out of these 17 (81%) had uncontrolled diabetes. Thus, establishing a link between the two. Most of the individuals with this sleep score were from the age group of 40–59 years, 6 (28.5%) of them used cell phones till late night, 4 (19%) had depression and 6 (26%) had RLS. This indicates the adverse effects of these factors on the quality of sleep and diabetic control.

It is also known that depression and restless leg syndrome is more common a finding among diabetics. General population RLS prevalence surveys usually give a range from 1% to 12%, but most European ancestry studies suggest 10%.[21] The RLS prevalence in Korean adults considering RLS mimics is comparable to that in adults from other Asian countries (2–3%).[22–24]

Our study showed a higher prevalence of RLS among the group with diabetes, 26% versus 14% in the non-diabetic group however did not have statistical significance (*p*-value =0.06). The prevalence of RLS in diabetic patients (28.6%) was significantly higher than nondiabetic controls (7.1%) as reported by Mehdi Zobeiri.[25] Our findings in diabetics were similar however our percentage in non diabetics was higher. Later could be due to unidentified secondary causes among non-diabetic group or the presence of RLS mimics. Further studies are recommended in this respect.

Depression has been associated with higher levels of fatigue, poorer functional status, nonadherence to exercise, a healthy diet, and medications. Thus, can lead to negative effects on the control of diabetes. With the patient health questionnaire-2 screening test for depression[26], we report the prevalence of depression among diabetics to be 24% and in 63% of those who had impaired sleep. Previous studies have shown that the coexistence of mental disorders such as depression is considerably more frequent in people with T2DM than in the overall population, with a prevalence ranging from 15% to 24%[27,28] similar is our finding. An incidence rate of depression, 12.61 per 1000 persons per year during the first year after initiation of oral antidiabetic treatment is reported.[29] A meta-analysis of 16 studies examined depression as a consequence of diabetes by using data from longitudinal studies. It also revealed a greater cumulative incidence of depression in diabetes than in non diabetes groups.[30] Thus diabetes is a significant risk factor for the onset of depression.

These findings should alert practitioners to the importance of detection of depression in patients with T2DM, and the need to reduce the risk of depression with prevention programs.

RECOMMENDATIONS

Assessment of sleep quality and identification of factors affecting it should become part of the routine clinical visit for patients with diabetes. Sleep health is a new and important modifiable risk factor for better glycaemic control in type 2 diabetes patients. Health care providers should reinforce steps regarding sleep hygiene.

Our observation regarding the use of a cell phone, high positive screening for depression, and impaired sleep among younger healthy non-diabetic participants require further studies.

The principal limitation of our study was the number of cases that we recruited and analysed. A larger study sample with the involvement of different centers on the national or international level can improve the precision of results. Moreover, there were some demographic differences between the two groups we studied, especially the mean age, as otherwise, the majority of healthy people belong to the younger age group. However, this can be addressed in further studies.

CONCLUSION

Assessment of sleep quality and factors affecting it like inadequate blood sugar control, frequency of RLS, and depression among diabetics is important as it enables the doctors to focus on these aspects and consequently managing these will directly help their patients in improving sleep quality and indirectly diabetes control and quality of life.

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AUTHORS' CONTRIBUTION

RK: Conceptualization, analysis, literature review, write-up, proof reading. MH: Data analysis, write-up, literature review, proof reading. SB: Data collection, analysis. FF: Data collection, analysis. MSH: Data collection.

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