
HYPERGLYCEMIC IMPACT ON SLEEP QUALITY IN PATIENTS WITH TYPE 2 DIABETES MELLITUS-A CROSS SECTIONAL STUDY

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ABSTRACT

Background: Diabetes mellitus (DM) causes high morbidity and mortality and loss of quality of life significantly. It is an important public health concern. In epidemiologic studies, people with poor sleep quality are more prone to develop diabetes or metabolism disorder of glucose. Sleep has an important role for metabolic function and specifically homeostasis of glucose metabolism. Many studies have shown a correlation between increased diabetes risk and poor sleep quality or sleep deprivation. DM creates a negative effect impact on quality of sleep on patients. Prevalence of obesity and diabetes becomes greater among aged people, it is of vital importance to fix on sleep for overall medical management. This is aimed to determine hyperglycaemia with sleep quality among the patient.

Methods: This was a cross sectional study carried out at Ibrahim General Hospital, National Health Care Network (NHN), Mirpur-10, Dhaka during the period of January 2014 to December 2014. Total 129 respondents were selected purposively for this study. Semi-structured questionnaire was pretested first and then it was used for data collection. Pittsburgh Sleep Quality Index score (PSQI) was used to assess sleep quality. Statistical Package for Social Sciences (SPSS) version 22.0. was used for analysis of the collected data.

Results: Among 129 respondents, 98(76%) were male and 31(24%) were female. 93.8% respondents were married and rest 6.2% of them were unmarried. Mean(\pm SD) age was found 53.64(\pm 9.26) years and range 35 to 70 years. 79.1% of the respondents had co-morbidity of DM, 70(54.3%) had diabetes more than 10 years duration. Mean(\pm SD) of overall sleep quality score was 9.04(\pm 3.965) and range 1 to 18. Among the respondents of age group >64, 95.70% had poor sleep quality, 76.14% respondents sleep less than 6 hours in a day. So association between sleep quality and glycemic status of type 2 DM was significant($p < 0.05$).

Conclusion: The prevalence of high blood sugar level in Type 2 DM patients have poor sleep quality. Type 2 DM patients with high blood sugar level have to overcompensate kidneys to visit washroom more frequent and lead to disturbance in sleep. Type 2 DM patients with controlled blood sugar level have good sleep quality. It is evident from the study that Type 2 DM patients with high sugar level (Hyperglycaemia) frequently experience sleep difficulties.

Keywords: Pittsburgh Sleep Quality Index (PSQI), Diabetes Mellitus (DM), National Health Care Network (NHN).

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INTRODUCTION

Diabetes mellitus is a widespread disease. Rapid social and cultural changes such as aging of population, urbanization, change of dietary habit, lack or reduced physical activity and unhealthy behaviors, lead to quality of life compromised and decreased survival of affected individuals associated with Diabetes Mellitus.^{1,2} Diabetes and sleep are intricately connected. Basic precondition for healthy functioning of human mind and body is sleep and also it is essential for life. Metabolic errors occur due to defects in sleep quality and quantity. Sleep is closely connected to mental and emotional health and all diseases particularly chronic diseases like diabetes creates emotional reactions which can also affect sleep quality negatively. Sleep was respected and honored from the ancient time. Rapid urbanization and modern life style has generated several diseases like Type 2 diabetes mellitus, cardiovascular disorders and sleep disorders. Among them sleep disorders occupy prime positions. These three disorders are closely inter-related.³

Diabetes mellitus is a group of metabolic disorders. Organ fat, obesity, advanced age are risk factors which have been associated to sleep related respiratory disorders.³ Disorder of sleep orchestrate a crucial role for initiation and development of diabetes via neuro - endocrine metabolic pathway. Diabetic patients who have disorder of sleep either impaired quantity or quality of sleep, progresses to reduce in insulin sensitivity and subsequently leads to hyperglycaemia and finally diabetes mellitus. On the contrary, disorder in sleep enhances hypothalamic-pituitary-adrenocortical axis and causes extra glucocorticoid release. Currently majority of studies related to sleep with diabetes are focused on obstructive sleep respiratory disease. Evaluated methods of some

epidemiological studies are complex in nature and are usually difficult to use ubiquitously in practice. More so, few domestic studies were found to address the impact disorder of sleep in diabetic patients. Study was aimed to explore more evidence to verify linkage between sleep and control of glucose level. Quality of sleep and its footprint over control of blood glucose level with Type 2 diabetes patients was analyzed and make a foundation for related interventions in practice.⁴

Sleep deprivation inhibits insulin production ultimately cortisol level increases. In the distant future it may induce to a pre-diabetes state or even to full-blown diabetes.⁶ In epidemiologic studies, reported people who have lack or reduced sleep quality and quantity was more prone to diabetes or disordered glucose metabolism. It was found in laboratory studies that short-tenure deprivation of sleep created remarkable diversity in blood glucose metabolism, level of hormone, activity of autonomic nervous system and other variables, which are plausible mechanisms. And thus sleep loss can make contribution in the development of diabetes. Obstructive sleep apnea is commonly seen in diabetic patient and may be interlinked directly to increase risk of diabetes and make its control very difficult. Assessment of patients with diabetes has to be made in a well-articulated way for obstructive sleep apnea and screening should be done for diabetes in known case of obstructive sleep apnea. In our society adults usually sleep less and less. It is thought that sleep is no longer as strictly a restorative process for the body. It is well accepted that sleep is important for metabolic function maintenance and specifically also bears widely acceptance in glucose homeostasis, more so correlation between deprivation quantity or poor sleep quality and an increased risk of diabetes was revealed. Obesity and aging are both analogous

with poor sleep. Obesity and diabetes prevalence increases and elderly people's number becomes more. Obesity prevalence and number of Type 2 DM rises alarmingly throughout the globe and USA particularly in the past few decades. Explanation of such rapid hike of patients' number cannot be drawn attention by genetic pool alteration simply; Environmental, socioeconomic, behavioral, and demographic factors and the interaction between genetics and these factors are likely cause of it. High-calorie diets and sedentary life style and other environmental and behavioral factors could be reasons to obesity and diabetes epidemic. Recently conducted public opinion survey by US CDC, it was found around 29% of US adults report sleeping duration of seven hours per night and fifty to seventy millions have chronic disorder of sleep and wakefulness. Currently sleep curtailment is assumed partly self-imposed, mechanized stone life in modern era demands more time for work and less leisure activities and time for sleep. Sleep related quality has also curtailed in aged people and created more number of obesity and sleep related disorders. Moreover, Type 2 DM people have the tendency to bear poor or less sleep.⁵

MATERIALS AND METHODS

Cross sectional study was conducted at Ibrahim General Hospital, National Health Care Network (NHN), Mirpur-10, Dhaka during the period of January 2014 to December 2014. Type 2 Diabetes Mellitus patients reported at Out Patient Department of Ibrahim General Hospital, Mirpur-10, Dhaka. Total of 129 respondents were selected purposively for this study and a pre-tested questionnaire was used to collect data. Data collection purposes a Semi-structured questionnaire in Bangla was

used. Variables were identified at first according to the specific objective. Then indicators and appropriate scale of measurement for each variable was identified. An English questionnaire was used as research instrument. To assess sleep quality of life - the questionnaire the Pittsburgh sleep quality index version 4 was used. The Pittsburgh Sleep Quality Index (PSQI) score assessed sleep quality during the past month and contains 7 component scales: sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbance, use of sleep medication, and day time dysfunction. Each component is scored 0 to 3 yielding a global Pittsburgh Sleep Quality Index score ranging from 0 to 21 with highest score indicating worse sleep quality. The questionnaire was translated into Bangla. From Bangla scale was translated back in English. Small modification to the wording was made to ensure local understanding based on pilot testing of the questionnaire on 10 persons. All working days was used to collect data. After explaining the purpose of the study to the respondents data was collected by the researcher himself through face-to-face interview using research questionnaire. Descriptive statistics including mean, median, standard deviation, ranges for continuous data and frequencies and proportion for categorical data was calculated. For inferential statistics, chi-square test were used and in all tests, $p < 0.05$ was considered to be statistically significant. Data analysis was done through SPSS version 22.0.

RESULTS

This study was carried out at Ibrahim General Hospital, National Health Care Network (NHN), Mirpur, Dhaka among 129 patients.

Table-I: Socio demographic characteristics of the respondents (n=129)

Variables	Frequency	Percent
Sex of the respondents		
Male	98	76
Female	31	24
Marital Status of the respondent		
Married	113	93.8
Unmarried	16	6.2
Age: Mean \pm SD=53.64 \pm 9.26 years, Range=35 to 70 years		
Educational Status		
Illiterate	28	21.7
Primary education	18	14
Secondary education	31	24
Higher secondary and above	52	40.3
Monthly Family Income		
Low income group	33	25.6
Middle income group	40	31
High income group	56	43.4
Mean \pm SD: 26038.76 \pm 15019.93 Tk. (Range: 100000.00 to 60000.00 Tk.)		
Place of residence		
Urban resident area	102	79.1
Rural area	22	17.1
Peri-urban area	5	3.9
House Condition		
Brick built house	106	82.17
Tin shade house	22	17.05
Wood made house	1	0.78

It is evident from table-I that the mean(\pm SD) age of the respondents was 53.64(\pm 9.26) years and range 35-70 years. Majority portion of the respondents 98(76%) were male and 31(24%) were female. Among 129 respondents, 52(40.3%) were in the educational level of higher secondary and above, 31(24%) were at secondary level and 28(21.7%) were illiterate and rest 18(14.0%) were educated at primary

education. Higher proportion 56(43.6%) were in high income group, 40(31.0%) were in middle income group and rest 33(25.6%) were in low income group. 102(79.1%) were residing in urban areas, 22(17.1%) were in rural areas and rest 5(3.9%) were in peri-urban areas, 106(82.17%) respondents were living in brick-built house, 22(17.05%) were in tin-shed house and remaining 1(0.775%) was living in wood made house.

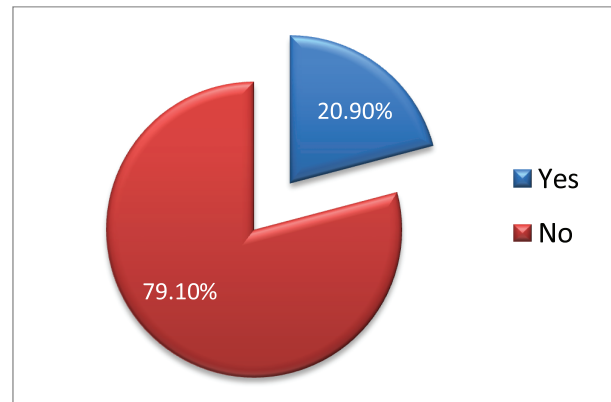


Fig-1: Distribution of the respondents by co-morbidity of DM (n=129)

Fig-1 shows that 79.1% of the respondents had co-morbidity of DM and rest of 20.9% had no such co-morbidity.

Table-II: PSQI Score of the respondents according to age group (n=129)

PSQI Score of the respondents	Age group of the respondents (In years)				Total n(%)	Significance
	35-44 n(%)	45-54 n(%)	55-64 n(%)	>64 n(%)		
Good sleep quality (score)	15(57.69)	7(20.59)	7(15.22)	1(4.3)	30(23.26)	$\chi^2=30.1938$ df=3 p=0.000
Poor sleep quality (score)	11(42.30)	27(79.41)	39(84.78)	22(95.70)	99(76.74)	
Total	26(100)	34(100)	46(100)	23(100)	129(100)	

Table-II shows that among the respondents of age group >64, 95.70% had poor sleep quality, then 84.78% of age group 55-64, 79.41% of age group 45-54 and 42.30% of age group 35-44 years. So with the increasing of age, quality of sleep became poor ($p<0.05$).

Table-III: Distribution of the respondents by duration of diabetes mellitus (n=129)

Duration of diabetes mellitus	Frequency	Percent
<10 years	59	45.7
> 10 years	70	54.3
Total	129	100.0

Table-III shows the duration of diabetes. More than 10 years diabetic duration among the respondents were 54.35% and 45.7% respondents with duration of diabetes less than 10 years.

Table-IV: Descriptive statistics of score of sleep disturbance and its domains (n=129)

Characteristics	Possible maximum score	Mean(SD)	Median	Range
Time to go for sleep after going to bed	3	2.121(.176)	2.00	1-3
Experience of getting up from sleep at night or early morning	3	2.33(.046)	2.00	1-3
Experience of desire to use bathroom in the morning of respondent	3	2.40(.034)	2.00	1-3
Experience of breathing discomfort	3	1.57(.095)	1.00	1-3
Experience of cough or snoring of respondent	3	1.57(.081)	1.00	1-3
Experience of feeling hot	3	1.33(0.698)	1.00	1-3
Experience of feeling cold	3	1.48(.782)	1.00	1-3
Experience of bad dream of respondent	3	1.07(0.379)	1.00	1-3
Experience of pain of respondent	3	1.84(.239)	1.00	1-3
Overall sleep quality: 9.04±3.965, Range 1 to 18				

Table-IV shows that mean (±SD) of sleep disturbance was 1.51(±.561). Out of 9 domains of sleep disturbance, highest score (2.40±.034)

was experience of using bathroom in the early morning or at midnight and lowest score (1.07±.379) for experience of bad dream.

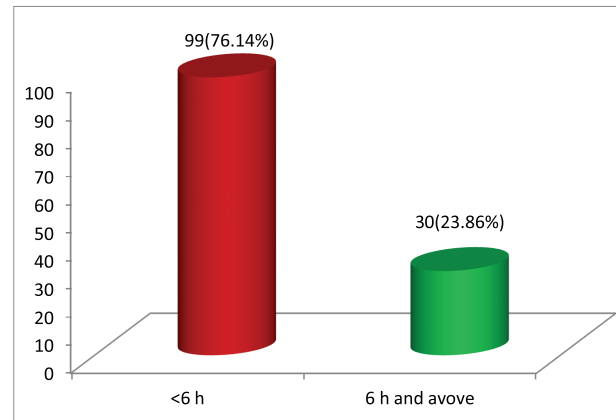


Fig-2: Distribution of the respondents by sleep duration (n=129)

Fig-2 shows that maximum (76.14%) respondents sleep less than 6 hours in a day.

Table-V: Association between sleep quality and glycaemic status of Type 2 DM respondents(n=129)

Glycemic Status (Fasting blood sugar level)(in mmol/l)	PSQI of the respondent n(%)		Total n(%)	Significance
	Good sleep quality	Poor sleep quality		
7 to <10	3(10)	30(30.30)	33(25.58)	χ ² =4.985 df =1 p =.021
≥ 10	27(90)	69(69.7)	96(74.42)	
Total	30(100)	99(100)	129(100)	

Table-V shows that most 69(69.7%) of respondents had poor sleep quality with High glycemic Status. Statistically association between sleep quality and glycemic status of the respondents was found significant (p<0.05).

DISCUSSION

The purpose of this study was to examine the relationship between sleep quality with Type 2 diabetes mellitus. One twenty nine (129) individuals with type 2 diabetic patients were

selected purposively and semi-structured questionnaire was used for assessing sleep quality. It was revealed that the mean (\pm SD) age of the respondents was 53.64(\pm 9.26) years (Table-I). The finding accorded with study done by Cunha, Zanetti and Hass (2008).⁶ They found mean age 62 years. Among the respondents 76.0% were male and 24.0% were female with a ratio of 3.15:1 (Table-I). This finding was not consistent with study done by Zaman.⁷ In their study 35% were male and 65% were female. Distribution of the monthly family income of the respondents showed majority 56(43.6%) were in high income group >30000 Tk. and mean monthly family income was Tk. 26038.76 \pm 15019.93. This was quite high in relation to per capita income in Bangladesh. This might be due to the location of place and nature of the study place. Out of 129 respondents 79.10% of the respondents lived in urban area, 17.1% lived in rural areas and 3.9% lived in peri urban areas (Table-I). This may be due to location of study place. Out of 129 respondents, 79.1% of the respondents had co-morbidity of DM and rest of 20.9% had no such co-morbidity (Fig-1). Duration of diabetes with more than 10 years respondents were 54.35% and 45.7% respondents with duration of diabetes less than 10 years (Table-III). It was not consistent with study conducted by Chunha et al.⁶ In their study 38% respondents had more than 10 years duration of diabetes mellitus and remaining 62% had less than 10 years duration of diabetes. Sleep quality of type 2 Diabetes mellitus of respondents were assessed using Pittsburgh Sleep Quality Index (PSQI). Mean(\pm SD) of overall sleep quality score was 9.04(\pm 3.965) and range 1 to 18 (Table-IV). It was not consistent with study done by Zaman A et al.⁷ In her study overall sleep quality score was 7.28 and SD \pm 3.06. But if in the present study PSQI > 5 was considered that means poor

sleep quality then this study could be consistent with study conducted by Zaman et al.⁷ Sleep disturbance, a domain of sleep quality of type 2 Diabetes Mellitus were assessed using Pittsburgh Sleep Quality Index. Mean(\pm SD) of sleep disturbance was 1.51(\pm .561). Out of 9 domains of sleep disturbance, highest score (2.40 \pm .034) had experience of using bathroom in the early morning or at midnight and lowest score (1.07 \pm .379) had experience of bad dream and it was ranging from 1 to 27 (Table IV). Age group >64, 95.70% had poor sleep quality, then 84.78% of age group 55-64, 79.41% of age group 45-54 and 42.30% of age group 35-44 had poor sleep quality. Quality of sleep became worst among the age group of 55-64 (Table-II). This study finding is more or less similar with the findings of Zaman et al.⁷ They conducted study in four groups started from < 30 years and eldest group \geq 50 years, among those groups sleep quality was worst among the eldest group. Among 129 respondents 70(54.26%) respondents had DM with >10 years duration and 59(45.74%) respondents had DM of <10 years duration. Most 69(69.7%) of the respondents had poor sleep quality with poor glycemic control. Statistically significant association was found between sleep quality and glycemic status of the respondents ($p < 0.05$)

CONCLUSION

Study was performed among type 2 diabetes patients in a selected hospital with the aim of determining their sleep quality. It is evident from the study that Type 2 DM patients with high glycaemic status had frequently experience in sleep difficulties. Most 69(69.7%) of the respondents had poor sleep quality with high glycemic Status in Type 2 DM. The findings also indicated that Type 2 DM patients with hyperglycemia has an impact on sleep quality.

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