

A Study to Assess Quality of Sleep in Type 2 Diabetes Mellitus Individuals

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Abstract: ***Aim:** To evaluate the sleep quality in type 2 diabetes mellitus individuals. **Method:** This observational study was conducted among 95 type 2 diabetes patients who are admitted in little flower Hospital, Angamaly, Ernakulam, Kerala. The sleep quality scores of the population were assessed by the Pittsburg sleep quality index (PSQI) and the incidence of sleep disorders among the groups were evaluated using the sleep disorder screening questionnaire. All data entered in excel analyzed using IBI sample size version 1.01. **Result:** Subjective sleep quality was rated as fairly good in only 1 sample and vast majority (64.2%) responded as fairly bad and 34.7% reported that their sleep quality is very bad. Vast majority of the study participants responded that their sleep latency, sleep duration habitual sleep efficiency, sleep disturbances and day time dysfunction is fairly bad ($\geq 60\%$) or very bad ($\geq 27\%$). In this study population, we have observed sleep apnea, insomnia and restless leg syndrome were present in all study samples and narcolepsy was present in 96.8% and it was absent on only 3.2%. **Conclusion:** Type 2 diabetes patients recruited for the study had poor sleep quality and prevalence of sleep disorders.*

Key words: Diabetes Mellitus, Pittsburg sleep quality index, Sleep latency, habitual sleep efficiency, narcolepsy

1. Introduction

Diabetes mellitus is a widespread disease, associated with rapid social and cultural changes, such as aging of population, urbanization, dietary changes, reduced physical activity, and unhealthy behaviors, leading to lower quality of life and decreased survival of affected individuals [1, 2].

Sleep is essential for life and maintenance of body functions. During sleep the body secretes many important hormones to regulate metabolic and endocrine functions [3, 4]. The main role of sleep is to restore whole body's balance, including the central nervous system, and it is a daily requirement [5].

Good sleep quality has a significant clinical importance in diabetes mellitus patients by regulating the level of insulin, the build-up of inflammatory cytokines, preserving body caloric intake, and decreasing the likelihood of unhealthy behavior [6].

Poor sleep quality is a leading health problem in the diabetic population. It presents as symptoms, characterized by difficulty in initiating and maintaining sleep, excessive somnolence, disturbed sleep-wake schedule and dysfunctions associated with sleep and sleep stages [7]. Poor sleep quality is a medical disorder of the sleep patterns with higher rates of poor sleep quality, excessive daytime sleepiness, and higher use of sleep medications [8].

Poor sleep quality in DM patients can be due to decreases in saturation level, pain, restless leg syndrome, nocturnal polyuria, and nocturnal hypoglycemia [9]. Poor sleep quality may bring about mental impairment and decrease the working capacity of individuals with DM. Evidence shows that poor sleep quality among DM patients was associated with factors such as age, gender, body mass index, noisy environments, smoking and drinking habits [10].

Poor sleep quality in DM patients can lead to no adherence to their recommended medication, insulin resistance, cardiovascular disease, mental impairment and decreases in working capacity [11, 12, 13]. It also impairs cognitive performance, and can lead to a higher risk of stroke and depression [14].

2. Materials and Methods

This observational study was conducted among 95 type 2 diabetes patients who are admitted in Little Flower Hospital, Angamaly, Ernakulam, Kerala. The sleep quality scores of the population were assessed by the Pittsburg sleep quality index (PSQI) and the incidence of sleep disorders among the groups were evaluated using the sleep disorder screening questionnaire. All data entered in excel analyzed using IBI sample size version 1.01.

Assessment of sleep quality

Using Pittsburgh sleep quality index (PSQI) questionnaire: The type 2 diabetic patients were given the PSQI questionnaire which is used as standardized tool to assess sleep quality and sleep disturbances over a 1-month time interval. It consists of a 19 individual items with seven "component" scores that assess: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. The score of each component was added up to obtain a GLOBAL PSQI score which finally determines the overall quality of sleep among the type 2 diabetic patients. Subjects with a score > 5 were poor sleepers and subjects with a score < 5 were having good quality of sleep.

Evaluation of sleep disorders

Using Sleep Disorder Screening Questionnaire (SDSQ): This questionnaire is a screening tool for sleep disorders mainly insomnia, narcolepsy, movement disorders and

obstructive sleep apnea. It is a 34 - item scale with 4 domains evaluating the presence of sleep disorders. Questions 1 - 12: indicates symptoms of sleep Apnea - a potentially serious disorder which leads to stop breathing repeatedly, often hundreds of times in the night during sleep. Questions 13 - 19: symptoms of insomnia, a persistent inability to fall asleep or stay asleep. Questions 20 - 27: symptoms of narcolepsy – a lifelong disorder characterized by uncontrollable sleep attacks during the day.

Inclusion Criteria

- Patient diagnosed with type2 diabetes mellitus duration more than 1 year.
- Patients take oral hypoglycemic medications and / or insulin in more than 6 months

Exclusion Criteria

- Patient suffering from any major disease like cancer and chronic infections, severe heart and lung diseases.
- Gestational diabetes mellitus or other type of diabetes mellitus.
- Type 2diabetic patient undergoing any surgery or continuous positive airway pressure.
- Mental illness or family history of mental illness.
- Patients take antidepressant drugs or medications for sleep disorder
- Acute diabetic complications.

Statistical Analysis

Descriptive statistics were used for the baseline characteristics of the data. Qualitative variables presented as counts and percentages and quantitative variables in mean and standard deviation. Correlation between blood sugar parameters and PSQI score were assessed by using Karl Pearson correlation as the data follows normality. Scatterplot were used for the presentation of correlation results. A p value less than 0.05 shows statistical significance. Data’s were entered in Microsoft excel and analyzed using SPSS version 28.00.

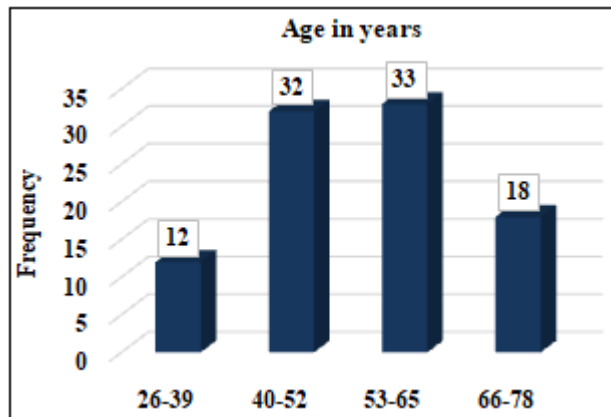
3. Results

This observational study was conducted among 95 type 2 diabetes patients to assess their quality of sleep. For the assessment of sleep quality, we have used Pittsburgh Sleep Quality Index questionnaire. Tabular and graphical presentation of data is given below.

Section I: Baseline characteristics of the study population
This section deals with the distribution of baseline parameters among the study population. The variables we considered are age, gender and blood sugar parameters. A detailed presentation of each parameter is presented below.

Table 1: Distribution of age among the study population

Age in years	Frequency	Percentage
Range, Mean±SD	26 - 78, 53.48±11.55	
26 - 39	12	12.7%
40 - 52	32	33.7%
53 - 65	33	34.7%
66 - 78	18	18.9%
Total	95	100.0%

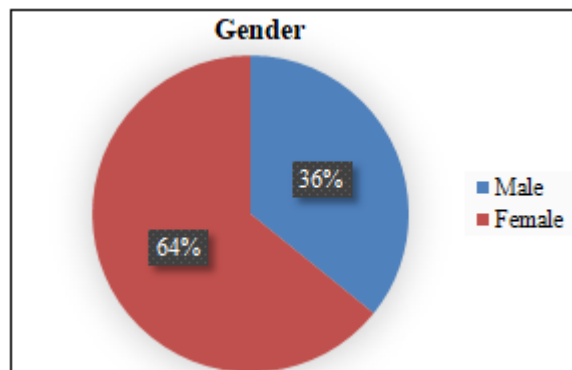


Graph 1: Age distribution of the study population

Table 1 and simple bar chart shows age distribution of the study population. Range of age varies from 26 to 78 years with an average of 53.48±11.55 years. We have classified the age into 4 categories with an interval size of 13 years. Only 12.7% belongs to the initial age group of 26 - 39 years, In the next age groups of 40 - 52 and 53 - 65, the distribution of samples distributed almost equally (33.7% & 34.7%) respectively.

Table 2: Distribution of gender among the study population

Gender	Frequency	Percentage
Male	34	35.80%
Female	61	64.20%
Total	95	100%

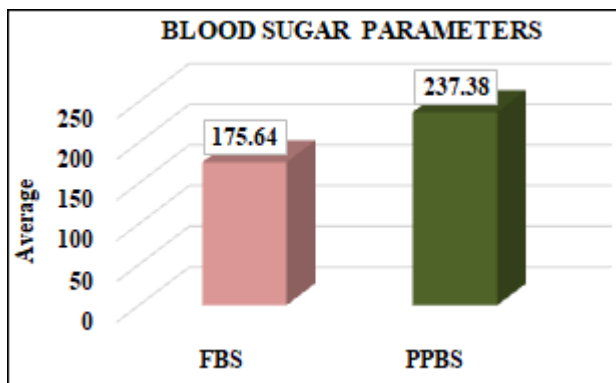


Graph 2: Gender distribution of the study population

Table 2 and pie chart shows gender distribution of the study population. Out of the 95 samples we studied 34 samples were males and 61 were females.

Table 3: Average distribution of blood sugar parameters in the study population

Blood sugar parameters	Range	Mean	SD
Fasting blood sugar (FBS)	122 - 250	175.64	26.13
Postprandial blood sugar (PPBS)	171 - 326	237.38	37.55



Graph 3: Blood sugar parameters in the study population

population the range of FBS scores varies from 122 - 250 with an average of 175.64 ± 26.13 , and PPBS varies from 171 - 326 with an average score of 237.38 ± 37.55 mg/Dl.

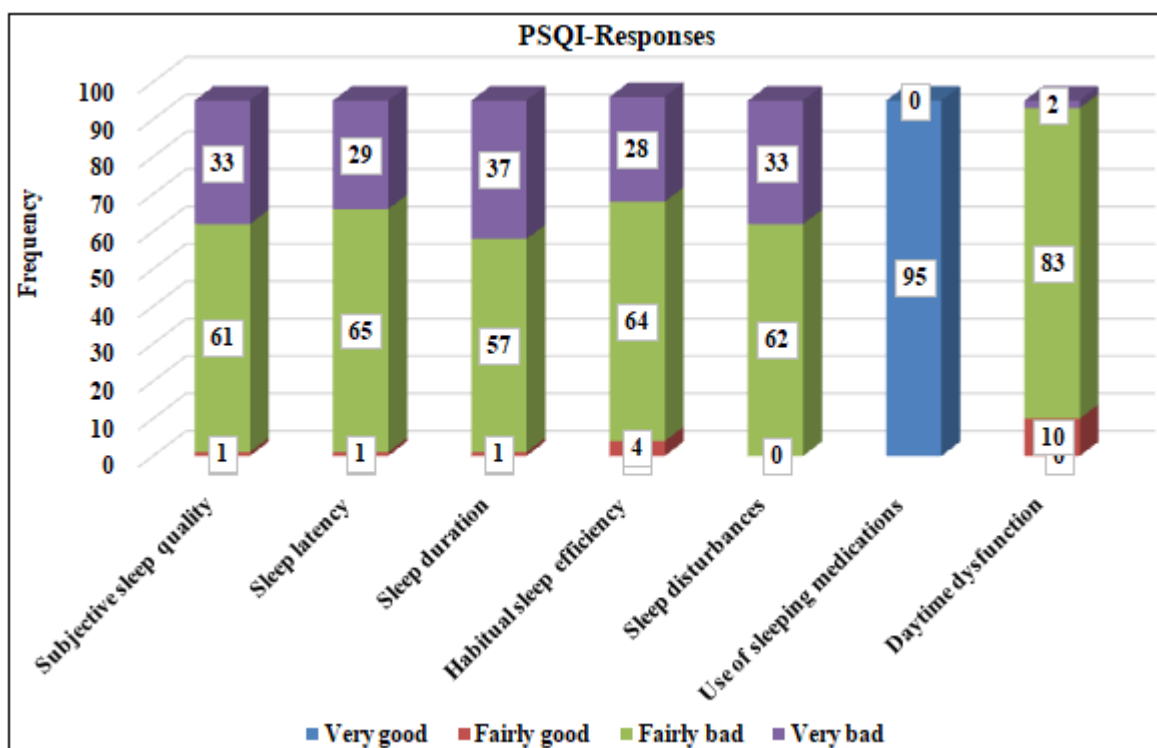
Section II: Assessment of sleep quality using PSQI scoring system and sleep disorder screening Index

This section deals with the presentation and relationship assessment sleep quality using PSQI scoring system. This 4 point Likert scale consist of seven components of which responses rated as 0 to 3 where 0 represents 'very good' sleep quality and a score 3 shows 'very bad' quality sleep. In this study the PSQI score ranges from 10 to 17 with an average of 13.48 ± 1.39 , which shows that all the respondent showed poor quality of sleep

Table 3 and simple bar chart shows distribution of blood sugar outcomes among the study population. In this study

Table 4: Presentation of PSQI responses among the study population

PSQI Queries	Very good, n (%)	Fairly good, n (%)	Fairly bad, n (%)	Very bad, n (%)
Subjective sleep quality	0	1 (1.1%)	61 (64.2%)	33 (34.7%)
Sleep latency	0	1 (1.1%)	65 (68.4%)	29 (30.5%)
Sleep duration	0	1 (1.1%)	57 (60%)	37 (38.9%)
Habitual sleep efficiency	0	4 (4.2%)	64 (67.4%)	27 (28.4%)
Sleep disturbances	0	0	62 (65.3%)	33 (34.7%)
Use of sleeping medications	95 (100%)	0	0	0
Daytime dysfunction	0	10 (10.5%)	83 (87.4%)	2 (2.1%)



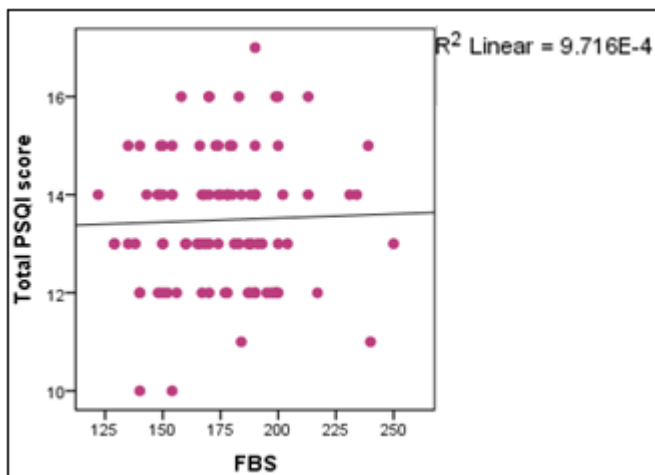
Graph 4: PSQI Responses among the study population

Table 4 and component bar diagram shows assessment of responses of PSQI components. Subjective sleep quality was rated as fairly good in only 1 sample and vast majority (64.2%) responded as fairly bad and 34.7% reported that there sleeps quality is very bad. Vast majority of the study participants responded that their sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances and day time dysfunction is fairly bad ($\geq 60\%$) or very bad ($\geq 27\%$). Those samples who use sleeping medications, all of them reported as their quality of sleep is very good.

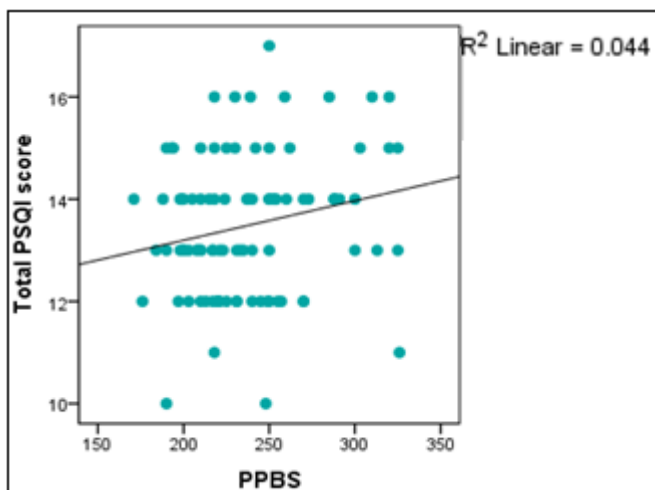
Table 5: Correlation between PSQI score with blood sugar parameters

Blood sugar parameters	PSQI Score	
	R Value	p Value
FBS	0.031	0.764
PPBS	0.209	0.042*

Karl Pearson correlation, $p < 0.05$ shows significance



Graph 5: Scatter diagram for PSQI score with FBS

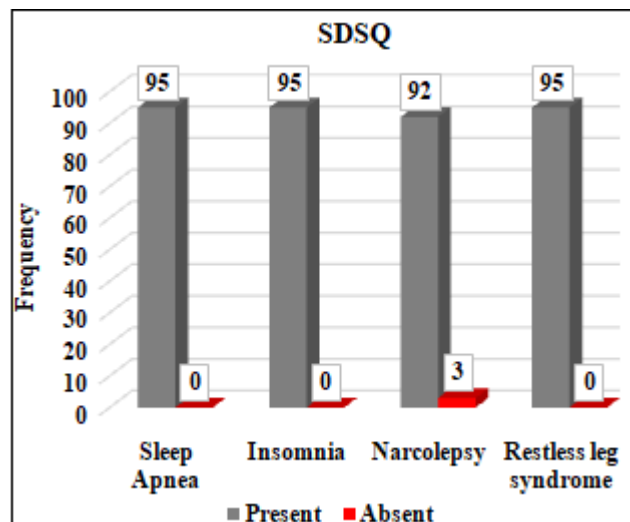


Graph 6: Scatter diagram for PSQI score with PPBS

Table 5 shows assessment correlation between PSQI score with FBS and PPBS. We have observed that FBS is not significantly correlated with PSQI (Graph 5) and PPBS showed a significant mild positive correlation with sleep quality ($R=0.209$, $p=0.042$) (Graph 6).

Table 6: Assessment of sleep disorder screening among the study population

Sleep Disorder Screening	n (%)	Range	Mean	Standard Deviation
Sleep Apnea, yes (n, %)	95 (100%)	3 to 9	5.41	1.037
Insomnia, yes (n, %)	95 (100%)	3 to 7	4.41	0.844
Narcolepsy	Yes	2 to 6	4.01	0.819
	No			
Restless leg syndrome, yes (n, %)	95 (100%)	3 to 5	3.91	0.730



Graph 7: Presentation of sleep disorder screening among the study population

Table 6 and multiple bar diagram shows the outcome assessment of sleep disorder screening questions. SDSQ had 4 components i. e., sleep apnea, insomnia, narcolepsy and restless leg syndrome. In this study population, we have observed sleep apnea, insomnia and restless leg syndrome were present in all study samples and narcolepsy was present in 96.8% and it was absent on only 3.2%.

4. Discussion

The assessment of sleep quality is a valuable approach to type 2 diabetes care as many patients can become aware their sleep quality is not as good as they thought. In the present study, sleep quality was assessed based on information obtained from all PSQI domains together. Thus, the patients' perception about their sleep quality will not necessarily correspond to a PSQI global score indicating adequate sleep quality.

Using PSQI scores with cutoff point global PSQI ≥ 8 for sleep evaluation in their study, the found that 81.0% of type 2 DM patients suffer from poor sleep quality. However, other studies which investigated this issue in diabetic patients, reported lower rates than them. For example, vigg et. al, cross sectional study in which the cutoff point PSQI was >5 , rated diabetic patients who complained of poor sleep quality at 71% [15]. Tsai et. al, reported that 34.8% of Asian type 2DM patients had poor sleep quality [16]. Depending on PSQI score greater than 8, Cappuccio et. al also found that 47.1% of type 2DM patients were poor sleepers. Additionally, according to PSQI score ≥ 5 , Kara and Kilic, whose PSQI score was ≥ 5 , rated poor sleep quality in diabetic patients at 63.3% [17].

Cho et. al reported the rate of 49%, and Rajendran et al rate was 69%. Another study done in USA by Luyster & Dunbar - Jacob reported 55% of patients to be poor sleepers (PSQI score >5) [18, 19].

5. Conclusion

In the study we came to the conclusion that the sleep quality and duration of sleep were affected in patients with type 2

diabetes mellitus. Among 95 patients, everyone had impaired sleep. Global PSQI should 64.2 0 % of type 2 diabetes mellitus patients fairly bad sleep and 34.7% of reported that there sleep quality is very bad and only 1% reported with good sleep quality and thus study stresses the importance of sleep in type 2 diabetes mellitus patients.

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