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Research Article

ASSESSMENT OF INDIVIDUAL SLEEP DISTURBANCES IN TYPE-2 DIABETES MELLITUS: AN INTERVENTIONAL STUDY

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Abstract:

Background: 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 behaviours, leading to lower quality of life and decreased survival of affected individuals. This study aims to evaluate the sleep quality in patients with type 2 diabetes mellitus (T2DM), and to assess the relevance of other factors to sleep quality.

Methods: A cross-sectional study was carried out at the Government general hospital, Ananthapuramu, during the period from December 2020 to May, 2021. A total of 384 patients with T2DM were recruited. Data were collected using the Pittsburgh sleep quality index (PSQI) and ESS to assess the sleep quality with a cutoff point of PSQI ≥ 8 . Participants' demographic background data were also recorded. Statistical analysis was conducted by using graph pad prism.

Results & discussion: Using Scale scores with cutoff point global PSQI ≥ 8 for sleep evaluation in our study, we found that 77.6% of T2DM patients suffer from poor sleep quality. Our study found that poor sleep quality was higher in employed diabetic patients, as compared to unemployed patients. This study showed that diabetic patients on insulin treatment were 2.17 times more likely to complain of poor sleep quality compared to patients receiving OHA only.

Conclusions: Effectiveness of patient counselling by clinical pharmacist which improves the sleep quality. Thus patients reporting with sleep difficulties should be screened for diabetes. Type 2 diabetes patients with poor glycaemic control should be assessed for sleep disorders and if present it should be corrected to achieve optimum control of blood sugar levels.

Keywords: Daytime dysfunction, Diabetes mellitus, ESS, Glycaemic control, PSQI, Sleep quality

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INTRODUCTION:

Brain is the primary organ that is highly dependent on sleep for its normal functioning than other organ systems. The immediate effect of both acute and chronic sleep deprivation is cognitive impairment. Apart from this sleep deprivation also causes mood changes and neuroendocrine changes. ¹ As a result of these changes the metabolic processes of the body are also altered when the individual suffers sleep deprivation particularly of the partial type. Many physiological indices are altered due to short term sleep restriction. Some of them are increase in BP,² sympathetic nervous system activation³, decreased levels of leptin⁴, high production of inflammatory markers.⁵ Numerous endocrine metabolic changes are also seen after sleep deprivation or sleep restriction. Some of these effects are increase in serum cortisol levels in an evening sample, decreased thyrotropin activity and above all the most important is the impaired glucose tolerance.⁶ This impaired glucose tolerance is the preliminary stage of diabetes mellitus. Behavioral sleep restriction has become a necessity nowadays due to globalization, lifestyle changes and work pattern modifications. Currently, there are authenticated evidences that behavioral sleep restriction has increased the incidence of obesity and diabetes. Three mechanisms are proposed for the development of obesity and diabetes in sleep deprived individuals. 1. alterations in glucose metabolism; 2. upregulation of appetite; 3. decreased energy expenditure.⁷ Sleep and diabetes have a bidirectional relationship. Poor sleep quality leads to diabetes and presence of a diabetic state leads to poor quality of sleep. The aim of the study is to assess the individual sleep disturbances in type 2 diabetic patients.

METHODOLOGY:

STUDY DESIGN: Prospective interventional study

STUDY SITE: Government general hospital, Ananthapuramu.

STUDY DURATION: 6 months (December 2020-May 2021)

STUDY POPULATION: Sample size was 384 patients of type 2 diabetic mellitus from tertiary care hospital in Ananthapuramu.

STUDY CRITERIA:

INCLUSION CRITERIA: Patients who are suffering from diabetics [>3 years] and on treatment for type 2 diabetes of any duration, both men and women in the age group of 30 -60 years were included in the study.

EXCLUSION CRITERIA:

- Patients regularly taking medications
- Psychiatric illness
- Patients with secondary infections
- Pregnancy and post-partum period

SAMPLE SIZE: 384 patients

RESEARCH TOOLS: Clinical evaluation of sleep quality in the study participants was done using self-reported questionnaires. The instruments used were

- Pittsburgh Sleep Quality Index (PSQI)
- Epworth Sleepiness Scale (ESS)

STATISTICAL ANALYSIS: Student's t-test is used when two independent groups are compared, while the ANOVA extends the t-test to more than two groups. Both methods are parametric and assume normality of the data and equality of variances across comparison groups.

RESULTS:

Table-1: Sleep Quality by Socio-Demographic Characteristics (N = 384)

Variable	Good sleeper (n = 86)		Poor sleeper (n = 298)		P-value
	No.	%	No.	%	
Gender					
Females	35	9.2	196	51	0.0016
Males	51	13.3	102	26.5	
Body mass index (kg/m ²)					
Normal	19	4.9	169	44	<0.0001
Overweight	57	14.8	108	28.1	
Obese	10	2.6	21	5.6	
Employment status					
Unemployed + retired	33	8.6	106	27.6	0.0315
Employed part time	7	1.8	28	6	
Employed full time	46	12	169	44	
Marital status					
Single	4	1	34	8.8	0.0245
Married	63	16.4	181	47.2	
Divorced	3	0.9	17	4.4	
Widowed	16	4.1	66	17.2	
Duration of diabetes (years)					
< 5	34	8.9	81	21	0.0078
5 – 10	22	5.8	90	23.5	
> 10	30	7.8	127	33	
Diabetic medication					
OHA	67	17.5	137	35.6	<0.0001
Insulin	19	4.9	161	42	

P-Value < 0.05- Significant

Overall, 384 individuals with more than half of them were females have participated in the study. Age ranged from 40-49 years (48.4%), 50-59 years (34.8%) and 60-69 years (16.6%). The majority 63.6% (n = 244) were married. Patients' average body mass index (BMI) was 32.67 kg/m² (SD: 6.1). In the sample, 188 patients (48.9%) were of normal BMI (18.5 - 24.99 kg/m²), 165 (43%) were overweight (BMI: 25 - 29.9 kg/m²), and the remaining 31 (8.1%) were obese (BMI ≥ 30 kg/m²). The mean diabetes duration was 10.3 years (SD: 7.38). Patients on oral treatment were 204 (53.1%). Unemployed or retired participants comprised 36%, 9% had part-time employment, and 55% were in full-time employment.

Table-2: Comparison of subjective sleep scores between before and after counselling

SCALE	GROUPING	SCORE	pValue
PSQI	BEFORE	5924	0.0041*
	AFTER	4683	
ESS	BEFORE	4797	0.0048*
	AFTER	3546	

*p-Value Significant at the level<0.05

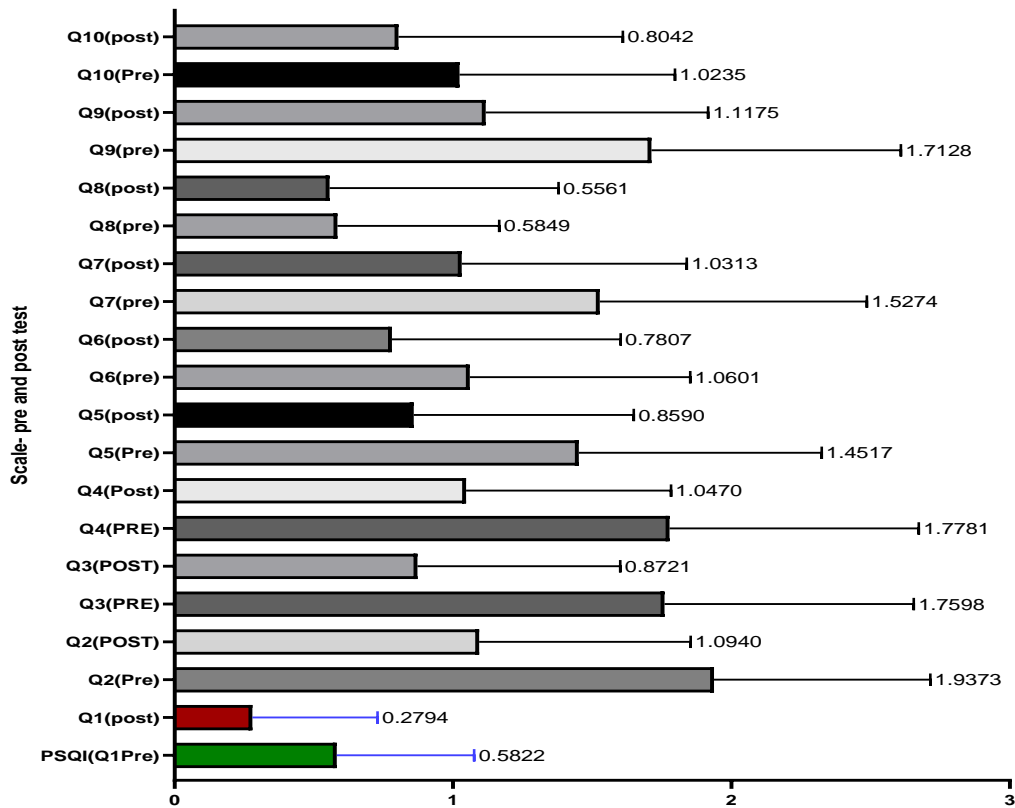


Figure-1: PSQI scale Comparison between before and after counseling

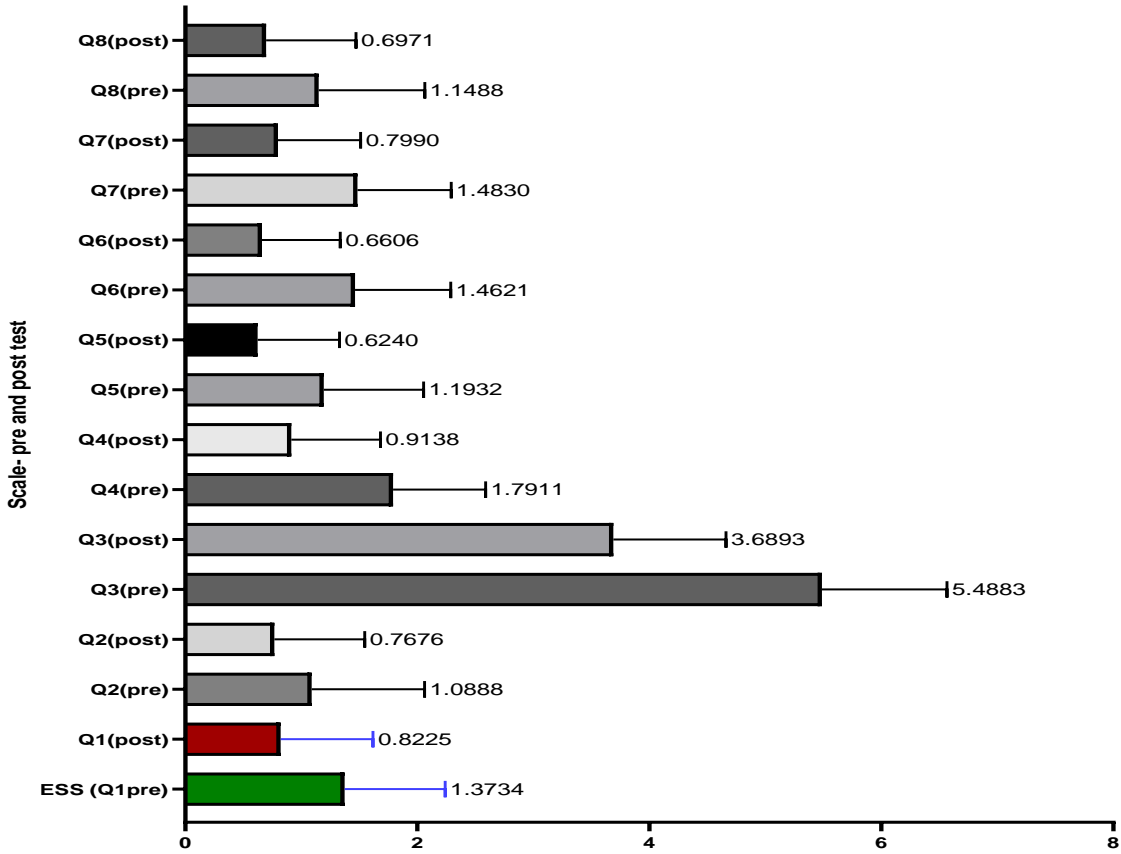


Figure-2: ESS scale Comparison between before and after counseling

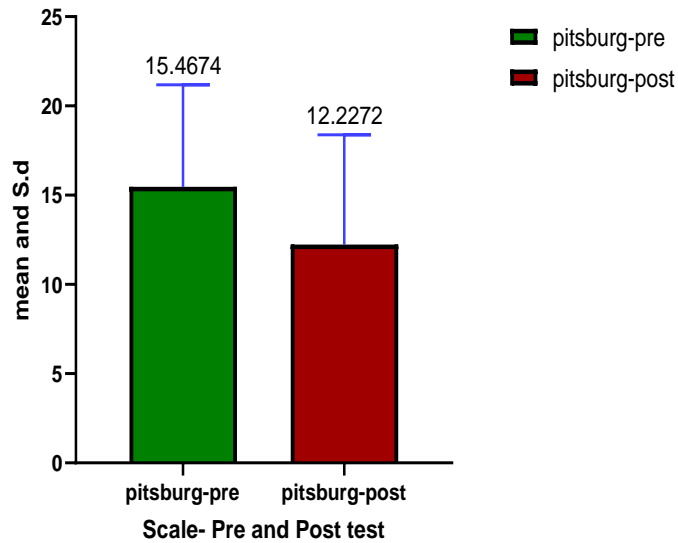


Figure-3: PSQI scale Comparison between before and after counselling (Overall)

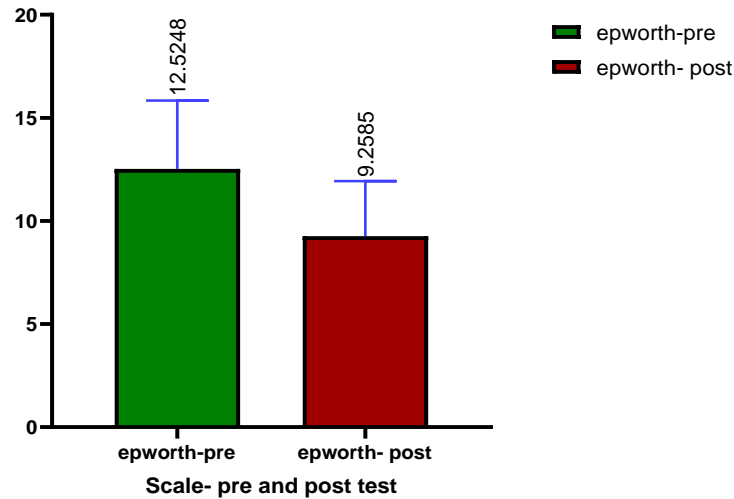


Figure-4: ESS scale Comparison between before and after counselling (Overall)

DISCUSSION:

Quality of sleep is an important constituent of quality of life. Poor sleep conjugates with depression, anxiety, impaired social functioning, chronic medical conditions, and mortality. Around 10% of people complain of one form of sleep disorders. This is particularly common in patients with diabetes mellitus, where poor quality of sleep significantly increases morbidity and mortality.

Poor sleep quality prevalence in patients with T2DM

Using Scale scores with cutoff point global PSQI ≥ 8 for sleep evaluation in our study, we found that 77.6% of T2DM patients suffer from poor sleep quality. However, other studies, which investigated this issue in diabetic patients, reported lower rates than ours. For example, Vigg et al's⁸ cross-sectional study, in which the cutoff point PSQI was > 5 , rated diabetic patients who complained of poor sleep quality at 71%. Tsai et al⁹ reported that 34.8% of Asian T2DM patients had poor sleep quality (global PSQI > 8). Depending on PSQI score > 8 , Cappuccio et al¹⁰ also found that 47.1% of T2DM patients were poor sleepers. Additionally, according to PSQI score ≥ 5 , Kara and Kilic,¹⁰ whose PSQI score was ≥ 5 , rated poor sleep quality in diabetic patients at 63.3%. Cho et al¹¹ reported the rate of 49% and Rajendran et al's¹² rate was 69%. Another study done in USA by Luyster and Dunbar-Jacob¹³ reported 55% of patients to be poor sleepers (PSQI score > 5). The total mean PSQI score of our study was higher than that in these studies. Differences in poor sleep quality may be because of differences in sample size and cultural differences. Additionally, most T2DM patients in our study had severe complications, which heighten poor sleep.

However, the rate in our study is lower than that of Mirghanis study,¹⁴ who found that 97.1% of Sudanese diabetic patients had poor sleep quality. This difference could be explained by the cutoff points used. Mirghani's cutoff point was PSQI ≥ 5 , while our cutoff point was PSQI ≥ 8 .

The effect of gender on poor sleep quality in patients with T2DM

After adjusting of other variables, we found that female patients had predilection for poor sleep quality more than male patients. Other studies reported similar gender associations as we established in our study. Cho et al¹¹ reported those female patients were 1.6 times more likely to have poor sleep quality which is lower than our result. However, the study by Rajendran et al¹² found no association between gender and poor sleep quality.

Effect of occupational status on poor sleep quality in patients with T2DM

Our study found that poor sleep quality was higher in employed diabetic patients, as compared to unemployed patients. Yet, no studies to investigate the association between sleep quality and occupational status among diabetic patients were found. Employment leads to psychological disturbance (work pressures) may consequently materialize into inefficient sleep amount and quality. This accounts for the high rate of poor sleep quality in the unemployed group in this research. This study showed that diabetic patients on insulin treatment were 2.17 times more likely to complain of poor sleep quality compared to patients receiving OHA only. This result is similar to Cappuccio et al's,¹⁰ which reported that insulin users complained of poor sleep quality more often than those on OHA use

only. Rajendran et al, ¹²did not find significant associations between sleep quality and the type of treatment of diabetes. Social and environmental factors, in addition to the sample size, may account for the explanation. Although we found significant associations between BMI and sleep quality, those associations did not materialize into significant rates after applying logistic regression. This, however, differs from some studies which found significant associations. In this study, significant associations between pre counselling and post counselling by using PSQI and ESS scales. Effectiveness of patient counselling by clinical pharmacist which improves the sleep quality. However, the study has got its own limitations as the above findings need to be confirmed with a larger sample size.

CONCLUSION:

In our study, poor sleep quality is prevalent. Females, employed, insulin users and uncontrolled diabetic patients have significant poor sleep quality. Poor sleep quality is associated with poor glycemic control. Significant associations between pre counselling and post counselling by using PSQI and ESS scales. Effectiveness of patient counselling by clinical pharmacist which improves the sleep quality. Thus patients reporting with sleep difficulties should be screened for diabetes. Type 2 diabetes patients with poor glycemic control should be assessed for sleep disorders and if present it should be corrected to achieve optimum control of blood sugar levels.

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