Section: Psychiatry

Original Research Article

SLEEP CHARACTERISTICS AND THEIR ASSOCIATION WITH GLYCAEMIC CONTROL IN TYPE 1 DIABETIC PATIENTS ATTENDING A TERTIARY CARE HOSPITAL

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ABSTRACT

Background: Sleep disturbances are increasingly recognised as an important and potentially modifiable factor influencing metabolic health in patients with type 1 diabetes mellitus (T1DM). This study evaluates sleep quality and daytime sleepiness in T1DM patients and assesses their association with glycaemic control and duration of diabetes. **Materials and Methods:** This hospital-based cross-sectional observational study included 150 adult patients with diabetes mellitus attending a tertiary care hospital. Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI) and daytime sleepiness using the Epworth Sleepiness Scale (ESS). Glycaemic control was evaluated using HbA1c values. Categorical variables were analysed using the Chi-square test, and correlations were assessed using Pearson's correlation coefficient. **Result:** The majority of participants were aged 21–30 years (29.3%) and 31–40 years (27.3%), with a female predominance (52%). Most patients had normal BMI (51.3%) and were married (70%). The most common duration of diabetes was 11–20 years (36.7%). On the ESS assessment, 88% had normal daytime sleepiness, while 12% had excessive daytime sleepiness. According to PSQI, 62.7% had good sleep quality and 37.3% had poor sleep quality. With increasing duration of diabetes, a gradual rise in mild, moderate, and severe excessive daytime sleepiness was observed, but this was not significant (p=0.515). Sleep quality did not differ significantly across duration categories (p=0.386). HbA1c showed a weak, non-significant negative correlation with ESS (r=–0.061, p=0.456) and PSQI (r=–0.125, p=0.129). **Conclusion:** Sleep disturbances were not significantly associated with glycaemic control or duration of diabetes in this study population. Routine screening for sleep disturbances may still be useful in comprehensive diabetic care.

INTRODUCTION

Diabetes mellitus is a chronic metabolic disorder with a quickly increasing global prevalence, especially in low- and middle-income countries. Diabetes affected nearly 537 million adults in 2021, and it is estimated to reach 783 million by 2045. In 2025, it was estimated that nearly 9.5 million people were suffering from type 1 diabetes mellitus (T1DM) worldwide. Glycaemic control, measured by glycated haemoglobin (HbA1c), is not kept under control in several people, leading to increasing complications and morbidity. Even though the incidence of diabetes is uncontrollably rising, the associated morbidities are reduced by improving medical care in many countries.1-3

Sleep is an important physiological process that influences multiple characteristics of health, including metabolic regulation, hormonal balance, and energy homeostasis. Poor sleep quality and disturbances in sleep duration have been linked to increased glucose variability. It was found that sleeping <6 hours a day leads to poor glycaemic control in T1DM patients. About 31-41% of T1DM patients suffer from poor sleep quality, compared to 39-60% of type 2 diabetes and 6.5-38% of non-

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diabetic patients.4,5 Patients with type 2 diabetes frequently experience sleep disturbances, which include poor subjective sleep quality, short or long sleep duration, and excessive daytime dysfunction. It has observed that poor sleep quality is a common problem among diabetic people.6 A study found that the chance of experiencing poor sleep quality is higher among women, smokers, and those facing unemployment. Such sleep disturbances may arise from various factors, including diabetes, nocturia, neuropathic pain, comorbid conditions, and altered circadian patterns.7

In studies examining subjective sleep quality and glycaemic outcomes, diabetic patients with higher Pittsburgh Sleep Quality Index (PSQI) scores had suboptimal glycaemic control and higher HbA1c compared to those with better sleep quality.5,8 But in T1DM, sleep disruption may result from frequent night-time glucose fluctuations, nocturnal hypoglycaemia, the need for blood glucose monitoring or insulin adjustments, and psychosocial factors related to disease management.9 Sleep quality and duration are commonly assessed using validated tools such as the PSQI, which evaluates multiple dimensions of sleep, including duration, latency, and disturbances, and the Epworth Sleepiness Scale (ESS), which quantifies daytime sleepiness.10 These instruments are widely used in clinical and research settings due to their reliability and ease of administration, enabling the systematic evaluation of sleep characteristics in diabetic populations.11

Longer duration of diabetes may be associated with increased risk of complications such as neuropathy and cardiovascular dysfunction, which can disrupt sleep patterns.12 But only limited studies have directly examined the relationship between the duration of diabetes and specific sleep measures. Given the high prevalence of sleep disturbances in diabetic patients and their impact on glycaemic control, an understanding of how sleep quality, daytime sleepiness, and duration of diabetes interact with glycaemic outcomes could help in planning management beyond standard pharmacotherapy. Hence, this study aims to evaluate sleep characteristics and their association with glycaemic control in T1DM patients.

Objectives

To assess sleep quality in diabetic patients using the PSQI and to evaluate daytime sleepiness using the ESS. To correlate various sleep characteristics with glycaemic control as measured by HbA1c levels and to analyse the association between sleep characteristics and the duration of diabetes mellitus.

MATERIALS AND METHODS

This hospital-based cross-sectional observational study was conducted in the Dr Ambedkar Institute of Diabetes (DAID) at Government Kilpauk Medical College (GKMC), Chennai, for 3 months after obtaining approval from the Institutional Review Board.

Inclusion criteria

Adult patients aged 18 years and above with a diagnosis of diabetes mellitus who were on treatment or under follow-up at the tertiary care hospital and who were willing to provide informed consent.

Exclusion criteria

Patients with known psychiatric illnesses, those with previously diagnosed sleep disorders such as obstructive sleep apnea, patients receiving medications known to significantly affect sleep, critically ill patients, and those who were unwilling to participate in the study.

Methods

After obtaining informed consent, 150 eligible patients were interviewed using a structured proforma to collect socio-demographic details such as age, sex, and marital status, along with clinical details including duration of diabetes and body mass index. Sleep quality was assessed using the PSQI, which is a self-rated questionnaire that assesses sleep quality and sleep disturbances over a one-month time interval. The PSQI consists of seven components, each scored from 0 to 3. The component scores are summed to obtain a global PSQI score ranging from 0 to 21, with higher scores indicating poorer sleep quality. A global PSQI score of more than 5 was considered suggestive of significant sleep difficulty and was classified as poor sleep quality.

Daytime sleepiness was assessed using the ESS, which is a self-administered questionnaire consisting of eight items. Participants were asked to rate their usual chances of dozing off or falling asleep in eight different situations on a four-point scale ranging from 0 to 3. The total ESS score, obtained by summing the eight item scores, ranges from 0 to 24, with higher scores indicating greater average sleep propensity in daily life or increased daytime sleepiness. Based on the ESS score, daytime sleepiness was categorised into normal daytime sleepiness, mild excessive daytime sleepiness, moderate excessive daytime sleepiness, and severe excessive daytime sleepiness. Glycaemic control was assessed using HbA1c values, which were obtained from recent laboratory reports or measured at the time of evaluation, and the relationship between glycaemic control and sleep parameters was analysed using PSQI and ESS scores.

Statistical analysis

Data were entered in Microsoft Excel and analysed using SPSS v.25. Categorical variables were expressed as frequency and percentage. The association were analysed using the Chi-square test. The relationship between parameters was assessed using Pearson's correlation coefficient. A p-value of <0.05 was considered statistically significant.

RESULTS

Most participants belonged to the age group of 21–30 years (29.3%) and 31–40 years (27.3%), with a

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female predominance (52%). The majority had normal Body Mass Index (BMI) (51.3%), followed by overweight (32.7%), and most were married (70%). The commonest duration of diabetes was 11–20 years (36.7%). On sleep assessment, 88% had normal daytime sleepiness on ESS, while only 12% had excessive sleepiness. According to PSQI, 62.7% had good sleep quality and 37.3% had poor sleep quality [Table 1].

Table 1: Distribution of Sociodemographic, Clinical, and Sleep Characteristics

Parameters	Category	Count (%)
Age Group (years)	<20	13 (8.7%)
	21–30	44 (29.3%)
	31–40	41 (27.3%)
	41–50	28 (18.7%)
	51–60	24 (16%)
Sex	Female	78 (52%)
	Male	72 (48%)
BMI	Underweight	14 (9.3%)
	Normal weight	77 (51.3%)
	Overweight	49 (32.7%)
	Obese	10 (6.7%)
Marital Status	Married	105 (70%)
	Unmarried	45 (30%)
Duration of Diabetes (years)	<5	25 (16.7%)
	6–10	37 (24.7%)
	11–20	55 (36.7%)
	>21	33 (22%)
ESS	Normal daytime sleepiness	132 (88%)
	Mild excessive sleepiness	12 (8%)
	Moderate excessive sleepiness	3 (2%)
	Severe excessive sleepiness	3 (2%)
PSQI	Good sleep quality	94 (62.7%)
	Poor sleep quality	56 (37.3%)

Patients with shorter duration of diabetes almost had normal ESS scores. With increasing duration of diabetes, a gradual rise in mild, moderate, and severe excessive daytime sleepiness was observed, with no significance (p = 0.515) [Table 2].

Table 2: Association Between Duration of Diabetes and Daytime Sleepiness

Duration of Diabetes (years)	ESS				P value
	Normal daytime sleepiness	Mild excessive sleepiness	Moderate excessive sleepiness	Severe excessive sleepiness	
<5	24 (96%)	1 (4%)	0	0	0.515
6–10	35 (94.6%)	2 (5.4%)	0	0	
11–20	46 (83.6%)	6 (10.9%)	2 (3.6%)	1 (1.8%)	
>21	27 (81.8%)	3 (9.1%)	1 (3%)	2 (6.1%)	

Most patients with a diabetes duration of 11–20 years had good sleep quality (70.9%). Patients who became diabetic recently had the worst sleep quality, but the differences were not significant (p = 0.386) [Table 3].

Table 3: Association Between Duration of Diabetes and Sleep Quality

Duration of Diabetes (years)	PSQI		P value
	Good sleep quality	Poor sleep quality	
<5	13 (52%)	12 (48%)	0.386
6–10	22 (59.5%)	15 (40.5%)	
11–20	39 (70.9%)	16 (29.1%)	
>21	20 (60.6%)	13 (39.4%)	

HbA1c showed a weak, non-significant negative correlation with both ESS (r = –0.061, p = 0.456) and PSQI (r = –0.125, p = 0.129) [Table 4 and Figure 1].

Table 4: Correlation of HbA1c with Daytime Sleepiness and Sleep Quality

		ESS	PSQI
HBA1C	Pearson Correlation	-0.061	-0.125
	P value	0.456	0.129

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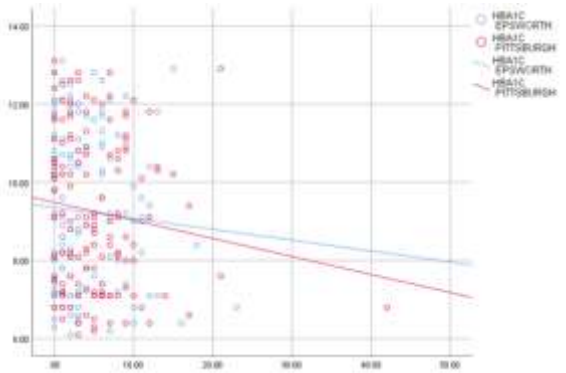

Figure 1: Correlation of HbA1c with Daytime Sleepiness and Sleep Quality

DISCUSSION

Sleep disturbances are commonly recognised as an important modifiable factor influencing glycaemic control in patients with diabetes mellitus. This study evaluated sleep quality and daytime sleepiness in T1DM patients attending a tertiary care hospital and their association with glycaemic control and duration of diabetes. The findings show that although most patients had normal daytime sleepiness and acceptable sleep quality, many showed poor sleep quality, and a gradual increase in sleep disturbances was observed with longer duration of diabetes.

Most participants belonged to the age group of 21–40 years, with a female predominance. The majority were married, had normal BMI, and a 11–20 years of duration of diabetes. Most had a normal ESS score and a good sleep quality. Pantanetti et al. reported that, among 41 adults with T1DM, the mean age was 51.9 ± 11.6 years, with a male predominance. The mean BMI was 25.0 ± 4.1 kg/m², and the mean duration of diabetes was 25.1 ± 14.6 years. A mean PSQI score of 6.0 ± 4.1, and 36.6% of participants were classified as poor sleepers (PSQI > 5), while 63.4% had good sleep quality.13 Reutrakul et al. reported that adult patients with T1D generally have poorer sleep quality compared to non-diabetic controls. Most of the patients were aged >50 years with normal to mildly elevated BMI. They found that self-reported good sleep quality was less common in T1D patients overall, and that poor sleep quality and shorter sleep duration were associated with worse glycaemic control.8 Unlike our study, some previous studies observed that diabetic patients have poor quality of sleep. This could be because, compared to other studies, the participants in our study are younger and might not have other complications. Due to a younger age, it can be considered that our patients did not have other complications, unlike other studies, which led to good quality sleep.

In our study, patients had abnormal ESS scores with increasing duration of diabetes, but the difference was not significant. Most patients with a diabetes duration of 11–20 years had good sleep quality, while patients who became diabetic recently had the worst sleep quality (p = 0.386). Similarly, Çömlek et al., in their study on adolescents with T1DM, reported that there was no significant relationship between sleep quality and duration of diabetes or HbA1c levels.14 Griggs et al. reported that there were no consistent differences across studies in the prevalence of self-reported hypersomnolence between individuals with T1D and controls. PSQI scores in some studies were negatively correlated with age and duration of diabetes. The authors emphasised that the influence of diabetes duration on sleep characteristics is inconsistent across studies, and it is probably confounded by multiple clinical and behavioural factors.15 Thus, we can consider quality of sleep among diabetic patients is not mainly affected by the duration of diabetes, but by the patient's age, and BMI status, along with duration.

In our study, HbA1c showed a weak, non-significant negative correlation with both ESS (r = –0.061, p = 0.456) and PSQI (r = –0.125, p = 0.129). Al-Anzi et al. observed inconsistent associations across studies between subjective sleep measures and HbA1c in individuals with T1DM. They suggest that sleep disturbances may influence short-term glycaemic variability and nocturnal hyperglycaemia rather than long-term average glycaemic control as reflected by HbA1c.16 Çömlek et al. reported that there was no significant relationship between sleep quality, duration of diabetes, and HbA1c levels in adolescents with T1DM.14 These findings indicate that glycaemic variability of the T1DM patients doesn't affect their sleep quality, but poor sleep can produce temporary hyperglycaemia. Hence, we can assume that poor ESS and PSQI scores are associated with other confounding factors like comorbidities, drinking and smoking history, along with HbA1c control and not HbA1c alone.

Our findings show that sleep disturbances are common among patients with T1DM, although their direct association with glycaemic control was weak and not statistically significant. Assessment of sleep quality and daytime sleepiness using validated tools such as the PSQI and ESS helps to identify patients with impaired sleep, particularly among those with longer disease duration. A strength of this study is its hospital-based design and systematic assessment using standardised and validated questionnaires, which allowed consistent evaluation of sleep parameters across the study population.

Limitations

Being a hospital-based cross-sectional study, causal relationships between sleep disturbances and glycaemic control cannot be established. The study population was drawn from a single tertiary care centre, which may limit the generalisability of the results. Sleep quality and daytime sleepiness were assessed using self-reported questionnaires, which are subject to recall bias and subjective interpretation. Objective sleep assessments, such as polysomnography or actigraphy, were not used. Possible confounding factors such as depression, anxiety, obstructive sleep apnoea, detailed medication profiles, and other comorbid conditions

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were not evaluated in detail, which may have influenced sleep patterns and glycaemic control. The relatively younger age and comparatively healthier profile of the study population may be the reason for the weaker associations observed.

CONCLUSION

A majority of patients with diabetes mellitus experience good sleep quality, although excessive daytime sleepiness was less common. Sleep quality and daytime sleepiness did not show a significant association with glycaemic control or the duration of diabetes. The sleep disturbances in diabetic patients may be influenced more by other factors such as age, BMI, and comorbid conditions, rather than glycaemic control alone. Routine screening for sleep disturbances using simple validated tools like PSQI and ESS may help in the early identification of sleep problems. Future studies should adopt multicentric, longitudinal designs with larger sample sizes and include objective sleep assessment methods to better clarify the causal relationship between sleep characteristics and glycaemic control.

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