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Sleep quality of patients with diabetes mellitus: association with anxiety trait and state

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Qualidade do sono de pacientes com diabetes mellitus: associação com ansiedade traço e estado

Calidad del sueño de pacientes con diabetes mellitus: asociación con ansiedad rasgo y estado

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ABSTRACT

Objective: To assess sleep quality and the association of trait and state anxiety in patients with diabetes mellitus.

Method: A cross-sectional, quantitative, and analytical study was conducted between January and April 2022, at the reference center for hypertension and diabetes in Rio Verde, Goiás, with 81 patients. The Pittsburgh Sleep Quality Index and State-Trait Anxiety Inventory were used for data collection. Analyses included the Student's t-test and multivariate logistic regression analysis.

Results: Of patients, 64.2% reported poor sleep quality. There were significant differences in trait anxiety levels between patients with good and poor sleep quality. Trait anxiety was associated with sleep quality, with an increase in the trait anxiety score increasing the chances of poor sleep quality.

Conclusion: A significant proportion of the sample had poor sleep quality, and trait anxiety was found to be associated with this condition.

Descriptors: Diabetes mellitus. Sleep quality. Anxiety.Nursing.

RESUMO

Objetivo: Analisar a qualidade do sono e a associação com a ansiedade traço e estado em pacientes com diabetes mellitus.

Método: Estudo transversal, quantitativo e analítico realizado entre janeiro e abril de 2022, no centro de referência em hipertensão e diabetes de Rio Verde – Goiás, com 81 pacientes. Utilizou-se o Índice de Qualidade do Sono de Pittsburgh e o Inventário de Ansiedade Traço-Estado para coleta de dados. Análises incluíram testes T de Student e regressão logística multivariada.

Resultados: Dos pacientes,64,2% relataram qualidade do sono ruim. Houve diferenças significativas nos níveis de ansiedade traço, entre pacientes com boa e ruim qualidade do sono. A ansiedade traço associou-se com a qualidade do sono, sendo que o aumento no escore de ansiedade traço aumentou as chances de qualidade do sono ruim.

Conclusão: Uma proporção significativa da amostra apresentou qualidade do sono ruim, e a ansiedade traço associou-se com essa condição.

Descritores: Diabetes mellitus. Qualidade do sono. Ansiedade. Enfermagem.

RESUMEN

Objetivo: Analizar la calidad del sueño y la asociación con ansiedad rasgo y estado en pacientes con diabetes mellitus.

Método: Estudio transversal, cuantitativo y analítico realizado entre enero y abril de 2022, en el centro de referencia en hipertensión y diabetes de Rio Verde – Goiás, con 81 pacientes. Para recopilar datos se utilizaron el Índice de Calidad del Sueño de Pittsburgh y el Inventario de Ansiedad Estado-Rasgo. Los análisis incluyeron pruebas t de Student y regresión logística multivariada.

Resultados: De los pacientes, el 64,2% refirió mala calidad del sueño. Hubo diferencias significativas en los niveles de ansiedad rasgo entre pacientes con buena y mala calidad del sueño. La ansiedad rasgo se asoció con la calidad del sueño, y un aumento en la puntuación de ansiedad rasgo aumenta las posibilidades de una mala calidad del sueño.

Conclusión: Una proporción significativa de la muestra tenía mala calidad del sueño y la ansiedad rasgo se asoció con esta condición.

Descriptores: Diabetes mellitus. Calidad del sueño. Ansiedad. Enfermería.

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INTRODUCTION

Diabetes mellitus (DM) is a syndrome characterized by persistent hyperglycemia, caused by metabolic disorders, which may occur due to the destruction of insulin-producing beta cells or resistance to insulin action[1]. Approximately 537 million people aged 20-79 years old have diabetes in the world, and Brazil is the sixth country with the highest number of people with the disease, with 15.7 million cases. Furthermore, it is estimated that around 5 million Brazilians live with the underdiagnosed disease[2].

Individuals with DM are susceptible to distress related to the diagnosis, difficulty adhering to medication treatment, inability to fight a sedentary lifestyle and unsuitability to new eating habits[3]. Factors that generate anxiety also manifest themselves through feelings of guilt caused by the abnormal blood glucose levels and prostration, combined with mood disorders[4]. DM associated with different complications can have important impacts on the individuals who suffer from the disease, their families and the health system. Factors such as fear, insecurity, anxiety, depression and poor sleep quality are complications that can be associated with a lack of control of blood sugar levels and can harm self-care in the long term[4,5].

Sleep quality plays a key role in overall health and well-being, and this is especially important for patients with DM[6]. It is noteworthy that poor sleep quality can have negative implications on the physical and mental health of patients with DM, as it can affect blood sugar levels control and increase the risk of cardiovascular and metabolic complications[7], which can harm quality of life of patients.

Previous studies have consistently identified a high prevalence of poor sleep quality specifically in patients with type 2 diabetes mellitus (T2DM)[8,9]. The results of a study carried out with Dutch adults with DM demonstrated that the prevalence of poor sleep quality was 31% for patients with type 1 diabetes mellitus (DM1) and 42% for patients with DM2[1]. Despite these results, it should be said that the scientific literature lacks studies that investigate sleep quality in patients with different types of diabetes mellitus, in addition to DM2. Furthermore, it is important to highlight that sleep quality can be associated with several factors, with factors that generate anxiety being particularly relevant in this context[4].

Anxiety is a common comorbidity in individuals with DM and its prevalence varies between 26% and 31%[10]. Scientific investigations have comprehensively demonstrated the effects of anxiety and anxiety disorders on sleep quality, but studies generally use global measures of anxiety or fail to distinguish the components of anxiety[4]. There still remains a gap in knowledge regarding the need to elucidate the distinction between anxiety as a stable personality trait, called trait anxiety, and transient and momentary situations that trigger anxiety, called state anxiety[11], and its specific impact on sleep quality.

Due to these existing gaps, it is necessary to understand how trait anxiety and state anxiety can affect sleep quality, as this could provide important insights for the integrated management of these conditions by health professionals who carry out longitudinal monitoring of patients with DM. Therefore, the present study aimed to analyze sleep quality and the association with trait and state anxiety in patients with DM.

METHOD

This is a cross-sectional, quantitative, and analytical study conducted at the Reference Center for Hypertension and Diabetes (CRHD), located in the city of Rio Verde, Goiás, Brazil. The CRHD is a secondary level center, created by the Rio Verde City Hall in 2007, with the purpose of offering specialized care to individuals diagnosed with hypertension and diabetes who present decompensation of the disease, despite receiving treatment in Basic Health Units. The study was carried out based on the recommendations of Strengthening the Reporting of Observational Studies in Epidemiology (STROBE).

The study sample consisted of 81 patients with DM. Convenience (non-probability) sampling method was used and, therefore, it was not necessary to calculate the sample size. The sample power was calculated taking into account the sample size (81 patients), the effect size (Cohen's d = 0.60), the significance level ($\alpha = 0.05$) and the desired power (0.80), resulting in an approximate value of 0.859. This means that there is an 86% probability of detecting an association between the variables of interest, considering the sample size and the statistical significance adopted.

Data were collected between the months of January and April 2022, through interviews carried out by a health professional previously trained in the application of the instruments used. Data collection was carried out in a private room at the reference center after patients participated in routine care, and the interviews lasted approximately 45 minutes.

The inclusion and exclusion criteria used in the present study were extracted from each patient's health record, according to the information recorded by the health

professional at the time of the diagnosis of DM. The following inclusion criteria were established: patients aged 18 years or over, diagnosed with diabetes mellitus according to the criteria recommended by the Brazilian Diabetes Society[12]. Patients with sleep disorders previously diagnosed before the diagnosis of DM were excluded, as well as those with anxiety and depressive disorders and who were using any psychotropic medication. Patients who were undergoing treatment for sleep disorders were also excluded. The justification for using the aforementioned exclusion criteria is to ensure that patients who were not previously diagnosed with depressive and anxiety disorders are specifically analyzed, as these conditions can impact sleep quality.

Three instruments were used to obtain the data. A questionnaire prepared by the authors, with 13 questions containing sociodemographic information (age, gender, marital status, occupation and education); clinical variables (type and duration of DM, capillary blood glucose); behavioral variables (use of tobacco, alcohol and physical activity). The patient's capillary blood glucose was obtained through self-report of the test carried out by the patient on the day of the interview.

The other instruments were the Pittsburgh Sleep Quality Index (PSQI) [13], to assess sleep quality, and the State-Trait Anxiety Inventory (STAI)[11] to assess anxiety.

The PSQI is a self-report questionnaire composed of 19 items that assess sleep quality and the degree of sleep difficulty in the last month. It is a 4-point Likert scale, ranging from 0 to 3 and contains seven components that are evaluated: sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disorders, medication use for sleeping and daytime dysfunction. The total PSQI score is determined by the sum of the components and ranges from 0 to 21 points, with higher scores suggesting worse sleep quality[13].

The specifications proposed by the authors who developed the instrument were used to categorize the quality of sleep. They established that a global score equal to or greater than 6 on the PSQI (PSQI ≥ 6) has a diagnostic sensitivity of 89.6% and specificity of 86.5% in distinguishing between individuals with good or poor sleep quality[14]. This cutoff point has been adopted in recent studies carried out in Brazil to define sleep quality[15,16]. The reliability of the PSQI was assessed using the Cronbach's alpha test (α) and the McDonalds omega coefficient (ω), and the results indicated a satisfactory internal consistency of the instrument (α = 0.669; ω = 0.728). These reliability analyzes are important because they ensure that the PSQI can be used as a valid and reliable instrument to assess sleep quality in research and clinical practice.

The State-Trait Anxiety Inventory (STAI) is a psychological assessment instrument that allows quantitative measurement of symptoms related to trait anxiety and state anxiety, which has been validated and adapted into Portuguese since 1990[11].

The STAI consists of 40 questions divided into two groups –STAI state and STAI trait. The STAI state subscale is made up of 20 statements and measures state anxiety, that is, the temporary condition of anxiety referred to in acute and specific situations. The STAI trait subscale also consists of 20 questions and assesses how the patient feels in a broader context. In this regard, the instrument assesses a more stable and usual pattern of anxiety throughout life. The instrument score is obtained using a Likert scale with answers ranging from 1 (almost never) to 4 (almost always). The final result for each of the subscales varies from 20 to 80 points, and the higher the score in each subscale, the greater the presence of trait and state anxiety symptoms. The results of the state and trait anxiety subscales were analyzed separately, and the internal consistency coefficients obtained were α = 0.723 and ω = 0.786 for the state subscale, and α = 0.748 and ω = 0.785 for the trait subscale. The results of these analyzes indicated that the STAI instrument presented satisfactory internal consistency for both subscales[11].

The results of this study were presented through descriptive analyses, where the absolute (n) and relative frequency (%) were used to characterize the sample. Chi-square tests or Fisher's exact tests were performed to investigate the existence of a significant association between sleep quality and sociodemographic, clinical and behavioral variables.

Data distribution was evaluated using the Shapiro-Wilk test. Since the data had a normal distribution, the results were presented using mean and standard deviation. Student's t test for independent samples was also used to investigate differences in trait and state anxiety levels between groups of diabetic patients, according to sleep quality classification. The effect size of the differences between the means was evaluated using Cohen's d measure and the effect size of the associations was evaluated using the Cramér's v, where negligible effects were considered (≥ -0.20 and < 0.20), small (≥ 0.21 and < 0.39), medium (≥ 0.40 and < 0.79) and high (≥ 0.80) [17]. To complement the analysis of anxiety levels in diabetic patients regarding sleep quality, the results of the STAI subscale averages were graphically presented using Raincloud graphs, with the aim of presenting the distribution

of anxiety levels among patients, according to the sleep quality classification.

Multivariate logistic regression analysis (enter method) was performed to verify the extent to which sleep quality could be predicted by trait and state anxiety levels. The assumptions of multivariate logistic regression were evaluated by variance inflation factor (VIF) and tolerance values equal to 1.17 and 0.852, respectively. The analyzes were performed using the JASP statistical program version 16.1 and values of $p < 0.05$ were considered significant.

The study was assessed and approved by the Research Ethics Committee of Universidade de Rio Verde, under CAAE: 29777520.6.0000.5077 and protocol number: 4.708.420.

RESULTS

The study sample consisted of 81 patients with a mean age of 58 years (±12.4), of which 60.5% were female, 50.6% did not have a partner, 59.3% did not have a paying job and 56.8% had incomplete/complete primary education. Regarding diabetes, 91.4% were patients with type 2 diabetes, 59.3% were diagnosed in the last 10 years and capillary blood glucose had an average value of 142 (±31.2). Furthermore, 60.5% reported a diagnosis of systemic arterial hypertension. Regarding health behaviors, 86.4% reported not using tobacco, 91.4% did not drink alcohol and 80.2% did not practice physical activity (Table 1).

Table 1 – Sociodemographic, clinical and behavioral characteristics of patients with diabetes mellitus. Rio Verde, Goiás, Brazil, 2022

Variables	Frequency	%
Average age (±SD)	58	±12.4
Gender		
Male	32	39.5
Female	49	60.5
Relationship		
With a partner	40	49.4
Without a partner	41	50.6
Occupation		
Works	33	40.7
Does not work	48	59.3
Education		
Uneducated	10	12,3
Incomplete/complete elementary education	46	56.8
Incomplete/complete higher education	25	30.9

Table 1 – Cont.

Variables	Frequency	%
Type of Diabetes Mellitus		
Type 1	7	8.6
Type 2	74	91.4
Time elapsed since diagnosis of DM		
Up to 10 years	48	59.3
11 or more	33	40.7
Type of treatment		
Oral hypoglycemic agent	46	56.8
Insulin	10	12.3
Oral hypoglycemic agent + insulin	25	30.9
Average capillary blood glucose (±SD)	142	±31.2
Use of tobacco		
Yes	11	13.6
No	70	86.4
Use of alcohol		
Yes	7	8.6
No	74	91.4
Physical activity		
Yes	16	19.8
No	65	80.2
Systemic arterial hypertension		
Yes	49	60.5
No	32	39.5

Source: Database, 2022.

Table 2 shows the results of sociodemographic, clinical and behavioral variables of patients with DM according to sleep quality. Of the 81 (100%) patients with DM, 35.8% (95% CI = 24.7 – 45.7) had good sleep quality, while 64.2% (95% CI = 54.3 – 75.3) had poor sleep quality according to the PSQI. There was no significant association between sleep quality and sociodemographic, clinical and behavioral variables.

Table 2 – Distribution of sociodemographic, clinical and behavioral characteristics in patients with diabetes mellitus according to sleep quality. Rio Verde, Goiás, Brazil, 2022

Variables	Sleep quality		p-value*	Effect size
	Good N (%) 29 (35.8)	Bad N (%) 52 (64.2)		
Average age (±SD)	57.9 (±10.7)	58.1 (±13.4)	0.95	0.01
Gender			0.79	0.02
Male	12 (37.5%)	20 (62.5%)		
Female	17 (34.7%)	32 (65.3%)		
Relationship			0.75	0.03
With a partner	15 (37.5%)	25 (62.5%)		
Without a partner	14 (34.1%)	27 (65.9%)		
Occupation			0.57	0.06
Works	13 (39.4%)	20 (60.6%)		
Does not work	16 (33.3%)	32 (66.7%)		
Education			0.45	0.13
Uneducated	5 (17.2%)	5 (9.6%)		
Incomplete/complete elementary education	17 (58.6%)	29 (55.8%)		
Incomplete/complete secondary education	7 (24.1%)	18 (34.6%)		
Type of Diabetes mellitus			1.00	0.04
Type 1	2 (28.6%)	5 (71.4%)		
Type 2	27 (36.5%)	47 (63.5%)		

Table 2 – Cont.

Variables	Sleep quality		p-value*	Effect size
	Good N (%) 29 (35.8)	Bad N (%) 52 (64.2)		
Time elapsed since diagnosis of DM			0.70	0.04
Up to 10 years	18 (37.5%)	30 (62.5%)		
11 or more	11 (33.3%)	22 (66.7%)		
Type of treatment			0.30	0.19
Oral hypoglycemic agent	20 (69.0%)	16 (50.0%)		
Insulin	2 (6.9%)	8 (15.4%)		
Oral hypoglycemic agent + insulin	7 (24.1%)	18 (34.6%)		
Average capillary blood glucose (±SD)	138 (±30,8)	144 (±31.5)	0.35	0.21
Use of tobacco			0.51	0.08
Yes	5 (45.5%)	6 (54.5%)		
No	24 (34.3%)	46 (65.7%)		
Use of alcohol			1.00	0.04
Yes	2 (28.6%)	5 (71.4%)		
No	27 (36.5%)	47 (63.5%)		
Physical activity			0.87	0.01
Yes	6 (37.5%)	10 (62.5%)		
No	23 (35.4%)	42 (64.6%)		
Systemic arterial hypertension			0.79	0.02
Yes	17 (34.7%)	32 (65.3%)		
No	12 (37.5%)	20 (62.5%)		

Source: Database, 2022.
Note: *Significance value from Student's t-test, Chi-square or Fisher's exact test.

Student's t-test analyzes were performed to compare the means of trait and state anxiety levels of diabetic patients according to the sleep quality classification. Regarding trait anxiety, the mean score for participants classified as having good sleep quality was 43.82 (± 7.23) and for patients with poor sleep quality it was 49.07 (±7.14) , resulting in a significant difference between the groups (t (79) = -3.158; p = 0.002) and the effect size of the difference between the means was medium (Cohen's d = 0.732) (Table 3).The results show that despite the variations in state anxiety scores (48 ±9.10 vs. 51.61 ±7.27) this difference was not significant. However, the effect size between the differences was also medium, but less substantial (Cohen's d = 0.453). The distribution of participants according to trait and state anxiety scores was represented in Figure 1.

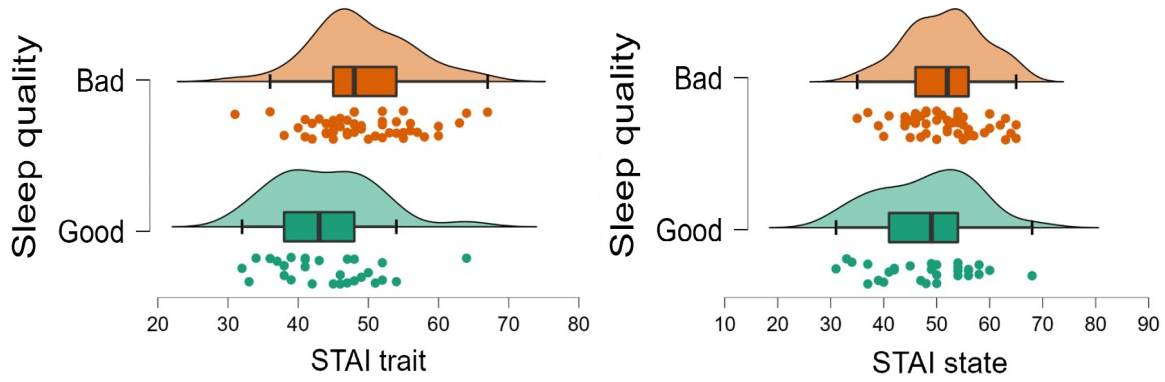
Multivariate logistic regression analyzes were used to investigate whether trait and state anxiety levels were predictors of sleep quality. It was noted that anxiety had a significant association with sleep quality (OR = 1.10; CI = 1.01 – 1.19; p = 0.018), suggesting that with each increase of one unit in the trait anxiety score, the chance of poor sleep quality increases by 1.10 times. On the other hand, state anxiety showed no association with sleep quality (p = 0.524) (Table 4). The model was statistically significant [$\chi 2(2) = 10.232$, p = 0.006; Nagelkerke R2 = 0.163].

Table 3 – Assessment of trait and state anxiety according to the sleep quality classification of patients with diabetes mellitus. Rio Verde, Goiás, Brazil, 2022

	Average Sample (SD)	Sleep quality		t*	df**	p-value†	Cohen's d
		Good Mean (SD)	Bad Mean (SD)				
STAI trait	47.2 (7.56)	43.82 (7.23)	49.07 (7.14)	-3.158	79	0.002	0.732
STAI state	50.3 (8.11)	48 (9.10)	51.61 (7.27)	-1.95	79	0.05	0.453

Source: Database, 2022.
Notes: *Student's t-test value.
**Student's t-test degrees of freedom.
†Student's t-test significance value.

Figure 1 – Distribution of trait and state anxiety scores according to sleep quality in patients with diabetes mellitus. Rio Verde, Goiás, Brazil, 2021



Source: Database, 2022.

Table 4 – Multivariate logistic regression analysis of state and trait anxiety as predictors of poor sleep quality in diabetic patients. Rio Verde, Goiás, Brazil, 2022

	Wald	df*	p-value**	ORa†	CI95% ORa	
					Lower limit	Upper limit
Trait anxiety	5.61	1	0.018	1.10	1.01	1.19
State anxiety	0.40	1	0.524	1.02	0.95	1.09
Constant	6.31	1	0.012	0.007		

Source: Database, 2022.
Notes: Reference = good sleep quality.
*Degrees of freedom of the logistic regression model.
**Significance value of the logistic regression model.
†Odds ratios of the independent variables in the multivariate logistic regression model.

DISCUSSION

The present study showed that trait anxiety was a significant predictor of sleep quality, which suggests that with each increase of one unit in the trait anxiety score, the chance of poor sleep quality increases by 1.10 times. t is worth noting that this is one of the first studies to evaluate the association between these two variables in patients with DM in the Brazilian context. The results of the study indicated that there was no significant difference in state anxiety when comparing groups of patients with good and poor sleep quality, and this variable was not a significant predictor of poor sleep quality in patients with DM. However, a significant association was observed between trait anxiety and poor sleep quality in the referred population.

Analysis of sleep quality revealed that of the 81 patients with DM, most had poor sleep quality. This finding is consistent with studies that used the PSQI and cutoff point to assess poor sleep quality. Studies conducted in Brazil have also reported high prevalence rates of poor sleep quality in different population groups, such as the general population[15], dental surgeons[16] and university students[16].

Given the context of research on sleep quality in patients with diabetes mellitus, it was possible to verify the existence of international studies that used the same methodology (PSQI ≥ 6) to evaluate sleep quality in this population. Of these, study with patients with type 1 diabetes reported that 59.8% had poor sleep quality[19], while other studies with patients with type 2 diabetes found prevalence rates of poor sleep quality ranging from 50.7% to 55.6%[8,20]. Comparing these results with those of the present study shows that the prevalence of poor sleep quality is even higher, which reinforces the problem related to sleep quality in patients with diabetes. In the Brazilian context, the lack of robust and reliable studies on the subject is evident, but a study carried out in Paraná with type 2 diabetic patients found a prevalence of 64.9% of poor sleep quality[21], while another study reported a prevalence of 53.3% of poor sleep quality[22], similar to that found in the present study.

The high prevalence of poor sleep quality in patients with DM can be attributed to several factors, including complications arising from the disease itself. Among these complications, diabetic neuropathy and nocturia were identified as important factors that impact sleep quality in diabetic patients[23]. Furthermore, it is recognized that sleep quality can play an important role in blood glucose control in people with DM, with recent systematic review and meta-analysis studies showing that short and long sleep durations were significantly associated with higher levels of glycated hemoglobin and fasting plasma glucose[7,24].

It should be stressed that recent studies have highlighted the bidirectionality between sleep disorders and anxiety, as anxiety can predict sleep disorders and vice versa[25]. In this regard, the literature has demonstrated that high levels of anxiety and poor sleep quality have a combined effect on blood glucose control and consequently reduce the quality of life of people with DM[4].

The lack of association observed between the state of anxiety and the quality of sleep of patients can be explained by the fact that one of the central characteristics of sleep quality is the sleep pattern and this is determined based on a relatively long period. State anxiety, on the other hand, is a

transitory characteristic, which may lead to a lower association with sleep quality assessed by the PSQI questionnaire. Similar to what was found in our study, a study carried out in Iran demonstrated that trait anxiety had a greater association with sleep quality than state anxiety[26].

An increase in trait anxiety score was associated with a greater likelihood of having poor sleep quality. This result is consistent with the findings of a previous study that had found a correlation between increased trait anxiety and decreased sleep quality through greater difficulty waking up after the sleep period and a worsening in behavioral difficulties while awake[27]. The results of the present study suggest that the chronicity of trait anxiety has a more detrimental effect on sleep and can be explained by a study that showed a significant relationship between trait anxiety and hyperstimulation, in which the autonomic components (brain activation) correspond to the level of trait anxiety and an increase in this construct during wakefulness indicated brain hyperactivation during sleep[28]. Thus, this study provides additional evidence that trait anxiety is a significant factor in determining sleep quality in individuals with DM.

This research contributes to the understanding of the relationship between trait and state anxiety and sleep quality in patients with DM. Therefore, it is important that health professionals, especially nursing teams, use strategies to track and evaluate anxiety and sleep quality during clinical monitoring of patients with DM. Furthermore, health services that provide longitudinal care for patients with DM should consider the inclusion of effective behavioral and pharmacological treatments to reduce anxiety levels and improve sleep quality. Among the low-density therapeutic options that can be implemented in routine healthcare for patients with DM, mindfulness-based practices have demonstrated evidence of reducing anxiety levels[29] and improving sleep quality[30]. Therefore, it is necessary to implement care practices focused on anxiety and sleep with the aim of contributing to the quality of life of people with DM.

This study has limitations that must be considered when interpreting the results. One of the main limitations concerns the sample size. However, when considering the desired power with the effect size and the level of significance, the probability of association between the variables was satisfactory. Furthermore, although validated and reliable instruments were used to assess sleep quality and anxiety, the measures were based on participants' self-reports and do not constitute clinical diagnoses of anxiety disorders or poor sleep quality. Finally, another important limitation of the present study concerns the prospect that patients with other pathological conditions that cause sleep problems and those who were not using psychotropic drugs may have been included in the research.

CONCLUSION

The research showed a high prevalence of poor sleep quality in patients with DM and pointed out an association between trait anxiety levels and worsening sleep quality indices. In view of these findings, early identification and adequate treatment of these symptoms are essential for the physical and mental health of diabetic patients.

Given the importance of anxiety levels and sleep quality for mental and physical health, especially in patients with DM, this study aims to deepen the understanding of these factors and their interactions. It is expected that the results of the present study can guide the development of effective personalized intervention and prevention strategies that, in addition to addressing physical issues related to DM, also comprehensively address factors related to mental health, which can impact the well-being -being of these patients. Therefore, it is essential that health professionals can specifically address sleep disorders and anxiety when planning the systematization of care for patients with DM through a multidisciplinary approach.

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