SLEEP QUALITY IN TYPE 2 DIABETICS

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Sleeping disorders in type 2 diabetic patients constitute risk factors for aggravating diabetes since they can affect the metabolic control through insulin resistance syndrome. This was an observational, cross-sectional study. The majority (52%) of subjects had scores indicating poor sleep quality. The Pittsburgh Sleep Quality Index (PSQI) scores showed patients with a time after diagnosis over 10 years and hypertension had the poorest sleep quality. For those with hemoglobin A1c > 7% taking sleeping medicines and those who had normal body mass index (BMI), the sleep quality was even poorer. The findings of the present study reinforce the relevance of this topic since there are no specific tools for sleep evaluation of type 2 diabetics making it difficult to make any assertions on the sleep quality of these patients.

DESCRIPTORS: sleep disorders; diabetes mellitus, type 2; quality of life

CALIDAD DEL SUEÑO EN DIABÉTICOS TIPO 2

Los disturbios del sueño en diabéticos del tipo 2, constituyen factores de riesgo para el agravamiento de la diabetes, pues pueden interferir en el control metabólico a través del síndrome de la resistencia a la insulina. El estudio fue del tipo observacional-transversal. La calidad del sueño fue investigada en 50 diabéticos del tipo 2, a quienes se aplicó el Índice de Calidad del Sueño de Pittsburgh (PSQI). La mayoría (52%) presentó puntuaciones del PSQI, que indican calidad del sueño mala. Aquellos con tiempo de diagnóstico superior a 10 años y con hipertensión poseían peor calidad del sueño. Para aquellos con valores de Hemoglobina A1c > 7%, que usaban medicamentos para dormir y los que presentaron IMC normal, la calidad del sueño se mostró peor. Lo encontrado en esta investigación refuerza la relevancia de la temática, ya que no existen instrumentos específicos para evaluar el sueño del diabético del tipo 2, dificultando afirmaciones sobre la calidad del sueño del diabético.

DESCRIPTORES: transtorno del sueño; diabetis mellitus tipo 2; calidad de vida

QUALIDADE DO SONO EM DIABÉTICOS DO TIPO 2

Distúrbios do sono em diabéticos do tipo 2 constituem fatores de risco para o agravamento do diabetes, pois podem interferir no controle metabólico através da síndrome da resistência à insulina. O estudo foi do tipo observacional-transversal. A qualidade do sono foi investigada em 50 diabéticos do tipo 2, sendo aplicado o Índice de Qualidade do Sono de Pittsburgh (PSQI). A maioria (52%) apresentou escores do PSQI que indicam qualidade do sono ruim. Aqueles com tempo de diagnóstico superior a 10 anos e com hipertensão possuíam pior qualidade do sono. Para os outros com valores de hemoglobina A1c > 7%, que usam medicação para dormir, e aqueles que apresentaram IMC normal a qualidade do sono mostrou-se pior. Os achados desta investigação reforçam a relevância da temática, pois não existem instrumentos específicos para a avaliação do sono do diabético do tipo 2, dificultando afirmações acerca da qualidade do sono do diabético.

DESCRITORES: transtornos do sono; diabetes mellitus tipo 2; qualidade de vida

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INTRODUCTION

Diabetes mellitus is a chronic condition of public health concern due to its high morbidity and mortality and significant loss of quality of life.

In Brazil it is estimated that there will be around 11.3 million diabetic patients by 2030, over 100% increase compared to the current 5 million diabetic patients[1].

Studies point the aging of diabetic patients, increased risk factors that are directly associated to modern life habits and improved diagnostic criteria[2] as causes for such growth. Prolonged unhealthy eating habits, smoking, physical inactivity, obesity, and alcohol abuse[2] are among the most investigated risk factors for diabetes mellitus.

Diabetes risk factors such as obesity, organ fat, advanced age now have been associated to sleep-related respiratory disorders[3]. New factors that may predispose to the development of diabetes as well as the association between impaired glucose metabolism and reduced sleep hours have been recently investigated.

During sleep, individuals experience a range of changes in their cognitive and systemic functions, such as reduction of cardiac output and peripheral vascular resistance and consequently reduction of blood pressure due to reduced sympathetic activity, hypo- and hyperventilation, hypothermia and hormonal secretion[4].

Melatonin is a hormone produced during sleep secreted by the pineal gland. It acts in sleep regulation and has an antioxidant action as well. Leptin, also secreted during sleep, is a hormone that acts as a satiety moderator balancing out the need for food intake and energy consumption[4].

During sleep deprivation, hypersecretion of leptin leads to increased food intake, especially carbohydrates, which can predispose to or aggravate obesity. Notably, obesity predisposes to chronic degenerative diseases such as diabetes mellitus[5].

In addition, sleep deprivation is known to inhibit insulin production by increasing cortisol levels. In the long run it may induce to a pre-diabetes state or even to full-blown diabetes[6].

While sleeping, normal individuals keep a balance between insulin secretion and glucose uptake, without showing high or low blood glucose levels. But in diabetic patients such balance is impaired due to low blood glucose levels[6].

Sleep deprivation has been shown to cause increased glucose levels due to reduced glucose metabolism and high cortisol levels. Besides aggravating diabetes by increasing glucose levels, it can pose a higher risk for the development of diabetes[7].

The inability of diabetic patients to maintain a normal sleep pattern can involve more than feeling tired the next day since the metabolic control, production of glucocorticoids and blood glucose control are affected leading to the development of insulin resistance.

Studies have described intrinsic (sleep apnea, insomnia, periodic limb movements) and extrinsic sleep disorders (circadian rhythm, sleep hygiene and psychoactive drug use) in diabetic patients. The most common disorder seen is sleep apnea[8-9].

Individuals with sleep apnea have shown high levels of leptin associated with resistance to its action. This state is aggravated by obesity, predisposing to the development of other diseases such as diabetes[5].

Leptin not only regulates appetite but also acts on chemoreceptors that can detect changes in oxygen and carbon dioxide levels. The pathogenesis of ventilatory dysfunctions in diabetic patients is also associated to changes in the chemoreceptors involved in the central respiratory function.

Sleep deprivation in diabetic patients has also been associated to eye problems. Retinopathy may be initiated or aggravated by hypoxia that occurs during sleep hours in the dark. Retinal blood flow in normal individuals is adequate during sleep. But diabetic patients with retinopathy when exposed to reduced lightness in a dark room during sleep do not have adequate oxygen supply to the retina.

It should be noted that sleep fragmentation due to nocturia and even frequent urination at night may be a reflex of poor blood glucose control[10].

In addition to high blood glucose that affect the sleep pattern of type 2 diabetic patients, low nocturnal blood glucose is often seen in 29% to 56% of insulin-dependent type 1 or type 2 diabetic patients and may go unnoticed or accompanied by manifestations that affect sleep quality.

Psychophysiological insomnia, defined as a difficulty in failing asleep or staying asleep, is another intrinsic sleep disorder commonly reported in diabetic patients.

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Restless leg syndrome, another intrinsic sleep disorder, is characterized by uncomfortable sensation that occurs mostly during sleep. The development of this syndrome is associated to advanced age, uremia, polyneuropathy, rheumatoid arthritis, anemia, and metabolic disturbances including diabetes mellitus[11].

Extrinsic sleep disorders are particularly associated to environment-related factors such as noise, activities such as music listening, reading, TV watching, manual work, among others, as well as excessive consumption of food and drinks before sleep time causing delay in sleep initiation.

Intrinsic and extrinsic sleep disorders affect to some extent the quality of life and to greater extent the sleep quality of diabetic patients.

Given that sleep-related extrinsic and intrinsic disorders in diabetic patients have been little explored in the nursing area, further investigations of reliable, specific instruments that can provide objective information on sleep quality are needed. These instruments can provide input to develop effective strategies for qualified nursing interventions and therapeutic approaches for sleep promotion in diabetic patients as part of their comprehensive care.

OBJECTIVES

To assess sleep quality in a group of diabetic patients at a university research and extension center of a city of the interior of the State of São Paulo, Brazil.

MATERIALS AND METHODS

Observational, cross-sectional study conducted between May 20 and June 20, 2005 at a university research and extension center in a city of the interior of the State of São Paulo. The study sample comprised 54 diabetic patients enrolled in the Standard Diabetic Patient Care Program at the center. Of them, four patients were excluded due to impaired cognition assessed by the Mini-Mental State Examination (MMSE). The final study sample included 50 diabetic patients.

The Pittsburgh Sleep Quality Index (PSQI) was used in the assessment of sleep quality. PSQI is an instrument that assesses subjective sleep quality and related disorders. The original validated[12]

instrument has 89.6% sensitivity and 86.5% specificity. The validated Brazilian Portuguese version shows the same high sensitivity (80%) but slightly lower specificity (68.8%)[13].

PSQI comprises seven domains: subjective sleep quality; sleep latency; sleep duration; habitual sleep efficiency; sleep disturbances; use of sleeping medication; and daytime drowsiness and dysfunction. It includes 10 questions, of which questions 1 to 4 are open and 5 to 10 are semi-open.

This instrument comes with instructions for the scoring of each domain. PSQI scoring scale ranges from zero to 21 and scores greater than 5 indicate poor sleep quality. Each domain has a set weight between zero and three and global score is given by the sum of the scores in the seven domains. A semi-structured guide was used for collecting information on sociodemographic (gender, age, marital status, years of study, occupation and family income) and clinical variables (duration of diagnosis, diagnosis of high blood pressure, nocturia, medications, level of hemoglobin A1c, weight and height).

Data was collected during interviews with the investigator at the study center on Tuesday and Wednesdays, from 1 pm to 5 pm. These interviews took place in a previously prepared, peaceful and comfortable room. Subjects were asked to sign a free informed consent form before the interview. A database was created in Windows Excel to organize data and then moved to the Statistical Package for the Social Science (SPSS, version 13.0 for Windows) for data analysis. Absolute values, percentages and absolute frequency and median distribution were described according to the normality of data.

RESULTS

Most subjects were females (76%), married (52%), retired or homemakers (88%), had a median four years of study and income of three monthly minimum wages (52%). Their age ranged between 44 and 79 years, with median 62 years old. Of all, 38% had been diagnosed with diabetes for more than 10 years, 70% with high blood pressure, 36% had hemoglobin A1c greater than 7%, 72% had nocturia, 85% had body mass index (BMI) corresponding to obesity and 22% took sleeping medications.

Table 1 shows global PSQI scores of the subjects studied.

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Table 1 – Pittsburgh Sleep Quality Index (PSQI) scores of type 2 diabetic patients. São Paulo, Brazil, 2005

PSQI Global Score	N	%
PSQI >5	26	52%
PSQI <5	24	48%
Total	50	100%

Table 1 shows 26 (52%) of all subjects had PSQI scores lower than 5, indicating that most could be categorized as having adequate sleep quality, and 24 (48%) had poor sleep quality. It should be stressed that data from the different PSQI domains cannot be interpreted separately and that only the PSQI global score allows to assessing sleep quality in type 2 diabetic patients.

For 30% of subjects sleep quality was impaired. In regard to sleep latency, 62% took less than 15 minutes to fall asleep; 16% took 16 to 30 minutes; 12% took 31 to 60 minutes; and 10% took more than 60 minutes. As for sleep duration, 38% reported sleeping more than seven hours a night, 22% reported six to seven hours; 18% five to six hours, and 22% less than five hours. Six percent had sleep efficiency greater than 85%; 22% between 75 and 84%; 28% between 65 and 74%; and 44% lower than 65%. The most common sleep disorders were: nocturia, coughing or intense snoring, difficulty to breath, feeling hot, cold and pain. Most subjects did not take any sleep medications. And the majority did not refer any problems of daytime drowsiness and disturbances.

The analysis of PSQI scores and duration of diagnosis showed sleep quality was more affected in those subjects who had been diagnosed with diabetes for more than 10 years. It is known that diabetes complications become more frequent after the first 10 years of disease (Table 2).

Table 2 – Distribution of subjects according to the Pittsburgh Sleep Quality Index (PSQI) and duration of diagnosis. São Paulo, Brazil, 2005

PSQI Global Score	Duration of diagnosis <10 years		Duration of diagnosis >10 years	
	N	%	N	%
PSQI >5	12	42.9%	12	54.5 %
PSQI <5	16	57.1%	10	45.5%
Total	38	100%	22	100%

When PSQI scores and levels of hemoglobin A1c were correlated, 33% of subjects with hemoglobin A1c greater than 7% had impaired sleep quality, i.e., poor sleep quality (Table 3).

Table 3 – Distribution of subjects according to the Pittsburgh Sleep Quality Index (PSQI) and levels of glycosylated hemoglobin (A1c). São Paulo, Brazil 2005

PSQI Global Score	Hemoglobin A1c >7%		Hemoglobin A1c ≤7%	
	N	%	N	%
PSQI >5	6	33.3%	18	56.2%
PSQI <5	12	66.7%	14	43.8%
Total	18	100%	32	100%

The analysis of BMI and PSQI scores showed 47.6% of obese diabetic patients had poor sleep quality. The same was found for those who had been diagnosed for more than 10 years and had high blood pressure.

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.

Sleep latency, i.e., difficulty in falling asleep and staying asleep, is associated to stress and anxiety in the daily life. In particular in type 2 diabetic patients, these problems can affect their metabolic control since hormones involved in vital processes of body function are produced during the sleep cycle[4].

An adult needs seven hours of sleep per night, and the number of hours of sleep tends to decrease with age. The number of hours necessary for resting varies individually and some people may be rested after a reduced number of hours of sleep[14]. Given that, in the present study, 60% of diabetic subjects were elderly, the study findings may be reflecting their need of sleep during aging and the very change of intrinsic sleep processes at this phase of life.

The fact that 44% of subjects had less than 65% habitual sleep efficiency is concerning because sleeping is a prime physiological need for a healthy life and for physically restoring the body.

In addition to hormonal changes associated to a irregular sleep pattern, individuals can experience

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irritability, reduced ability for planning and performing tasks, mood swings and difficulty in concentration in the short run and premature aging, the development of cardiovascular and gastrointestinal conditions, obesity and diabetes mellitus[6] in the long run.

Given that 66% of the subjects studied had sleep problems such as waking in the middle of the night or very early in the morning, it can be assumed these patients' habitual sleep efficiency may be impaired. However, further studies are required to better establish this association.

Nocturia is a major clinical sign of poor metabolic control. Diabetic patients are at risk of dehydration due to osmotic diuresis. Additionally, episodes of nocturia can lead to frequent awakenings which affect sleep quality, latency, duration and habitual efficiency[15].

Symptoms such as coughing, intense snoring, and difficulty to breath are associated to sleep apnea. During an episode of sleep apnea, the passage of air through the trachea is obstructed producing several sounds characteristic of snoring. It is generally not perceived by the snorer but rather by someone who sleeps in the same room[16].

During an episode of apnea patients have hypoxia and as a result they can develop glucose intolerance with metabolic impairment[17]. Therefore, further studies are recommended to thoroughly describe sleep disorders for the diagnosis of sleep apnea in those diabetic patients who have sleep-related coughing, intense snoring, and difficulty to breath.

Drugs for the treatment of sleep disorders may cause sleep pattern dysfunction as they can depress or reduce brain cortex response to stimuli and produce a state of alertness, anxiety and depression. Most sleep inducers depress REM sleep so those taking these medications have an altered sleep cycle[15].

One should also bear in mind that the treatment of sleep disorders is not always followed up by a medical provider as for the class of drug taken, dose and time of administration. On the other hand, when drugs are prescribed by a doctor, treatment compliance is often poor. Both situations can affect sleep quality and lead to an adverse effect.

Drug therapy for improving the sleep pattern of diabetic patients may do more harm than good. Elderly patients with diabetes usually take multiple drugs for diabetes management, dyslipidemia, high blood pressure, among others, and the combined effect of multidrug therapy may negatively affect their sleep pattern. Thus, drugs have to be judiciously prescribed to diabetic patients and followed up by the medical provider[18-20].

Excessive daytime drowsiness is the most common complaint associated to sleep disorders. Daytime drowsiness may be mistaken with laziness, lack of interest or even alcohol intoxication[15].

But in diabetic patients it may associated to signs and symptoms of metabolic decompensation due to nocturia; pain; tingling in the lower limbs, sweating, palpitation, among others.

There is still no consensus but episodes of dozing and even frequent awakenings at night seem currently to be part of a pattern typical of the sleep-wake cycle. An experimental study showed sleep deprivation can predispose to glucose intolerance. Sleep disorders are believed to result from the deleterious effect of diabetes on the central mechanism of respiratory control; thus diabetes may be the cause or effect of sleep disorders[3]. However, we were not able to confirm that hemoglobin A1c greater than 7% affected sleep quality since most subjects (66.7%) with this condition were categorized as having adequate sleep quality.

CONCLUSION

Global PSQI score showed 48% of type 2 diabetic patients had poor sleep quality. PSQI is a tool that provides data about sleep quality in these patients and improves data collection for supporting evidence-based nursing interventions. The findings of the present study stress the importance of this subject since there are no specific instruments for sleep assessment in diabetic patients. They also allow nurses to broaden their knowledge on factors affecting sleep that can be applied in effective nursing interventions for improving sleep patterns of diabetic patients.

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