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Quality of sleep in people with Type 2 diabetes

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Abstract

The aim of the study is to determine sleep quality and related factors in people with type 2 diabetes. This descriptive and cross-sectional study was conducted with 283 people with type 2 diabetes. Data were collected The Pittsburgh Sleep Quality Index (PSQI), The Epworth Sleepiness Scale (ESS), and the World Health Organization-5 Well-Being Index (WHO-5). Data was analyzed using the SPSS 15.0 software. The mean age of the people with diabetes was 60.0±10.7. Among the participants, 60.4% were female. The mean PSQI, ESS and WHO-5 scores of the participants were 6.6±3.4, 5.1±4.2 and 11.9±5.9, respectively. Among the participants, 55.8% had sleep problems. Males, those with higher education levels, employed individuals, those with moderate economic status, those who exercised, those without sleep apnea problems, those without additional health problems, and those who did not have hypertension experienced sleep problems at a lesser degree ($p<0.05$). The waist circumference and Body Mass Index (BMI) of the participants who experienced sleep problems were higher, while their mean height was lower ($p<0.05$). The mean WHO-5 score of the participants who experienced sleep problems was lower, while their mean ESS score was higher ($p<0.05$). More than half of the people with diabetes reported to have sleep problems. Participants who experienced sleep problems had increased waist circumference, lower height and higher BMI. Participants who experienced sleep problems also had higher levels of daytime sleepiness and lower quality of life. According to these findings, it is recommended to routinely assess sleep quality in people with diabetes. It is also recommended to reduce BMI and waist circumference, exercise, treat other health problems such as hypertension and OSAS for better sleep quality in individuals with diabetes.

Keywords: Diabetes, sleep quality, daytime sleepiness, quality of life

Introduction

Sleep is one of the basic life activities that directly affects quality of life and covers approximately one third of human life [1,2]. Sleep problems have been reported to have a prevalence of 23% to 56% in the general population [3]. Many individual, environmental, mental, and physiological factors including age, sex, diseases, physical activity, emotional status, lifestyle, employment conditions, alcohol and stimulants, and medication

negatively affect sleep quality and duration [1]. Sleep problems cause disruptions in daily activities, especially in family life, personal activities, and professional activities [3]. The prevalence of sleep problems in chronic diseases varies between 2.8% and 17.0%. Sleep problems have been reported to be at higher rates among patients with diabetes, asthma, chronic lung disease and stroke, and also increase in prevalence as the number of chronic diseases increase [4]. Determination of sleep problems in patients with chronic diseases and simultaneously treating them would contribute to have better treatment outcomes.

Today, the prevalence and economic burden of diabetes increase worldwide [5,6]. Of the people with diabetes 33.6% to 82.5% have poor sleep quality [7-15]. Although sleep disturbances are associated with diabetes outcomes, there is considerable heterogeneity between studies [15]. Poor sleep quality in people

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with diabetes causes daytime sleepiness, daytime fatigue, emotional distress, depressive mood, reduced diabetes self-management, and decreased quality of life [7-9,12-14,16-19]. Sleep problems, which are common in diabetes, may negatively affect diabetes control [20]. On the other hand, poor diabetes control may negatively affect sleep quality. Since diabetic complications are prevented and diabetes control is provided when sleep problems are resolved [11,15], clinicians are recommended to assess sleep problems and make interventions to solve them as a part of patient care and management [9,17,20]. According to nursing theoreticians, sleep is a basic human need and “disruptions in sleep patterns” is one of the diagnoses defined by the International North American Nursing Diagnosis Association (I-NANDA). To determine the nursing interventions to solve sleep problems, it is necessary to have knowledge about sleep problems and related factors [2].

The current study aimed to assess sleep quality and determine related factors with sleep in patients with diabetes. Additionally, the current study aimed to determine the relationship between sleep quality, daytime sleepiness, and well-being.

Materials and Methods

This descriptive and cross-sectional study was conducted with type 2 diabetic outpatients. Diabetes Mellitus patients who applied to Tekirdag Namik Kemal University Endocrinology Outpatient Clinic between July and October 2017 were invited to the study consecutively according to the time of admission to the outpatient clinic. The study was conducted with 283 volunteers from type 2 diabetic patients who met the inclusion criteria. Patients were informed about the study and informed consent was obtained. The forms were filled in the outpatient room by interviewing the patients face to face. The patient's BP, waist circumference, height and body weight were measured. Diabetic foot examination was performed. The patient registration system was used for laboratory results. The interview with each patient was completed in 20-25 minutes.

Inclusion criteria in the study:

Being 18 years or older

Having been diagnosed with type 2 DM at least 6 months ago

Not being pregnant

No diagnosed psychiatric illness

No sleep disorder diagnosed

Have no malignancy

Do not drink alcohol regularly (especially before sleep)

Not to be a communication problem.

Ethical Issues

Before beginning the study, permission from the local ethical

committee was obtained (2017165106105). All patients were made aware of the proposed study procedures and freely gave written informed consent.

Data Collection Form

A data collection form was used for data collection. The data collection form included questions about the sociodemographic and disease-related characteristics of the patients, the Pittsburgh Sleep Quality Index (PSQI) to evaluate sleep quality, The Epworth Sleepiness Scale (ESS) to evaluate daytime sleepiness, and the World Health Organization-5 Well-Being Index (WHO-5) to evaluate quality of life.

The Pittsburgh Sleep Quality Index (PSQI): This is a scale developed by Buysse et al. to measure the quality and patterns of sleep. In the scale, sleep patterns and habits within the last month are questioned. The PSQI has nineteen individual items which are used to generate seven sub-dimensions scores. Sub dimensions consist of subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of sleeping medication, and daytime dysfunction. The score that can be attained from the scale changes between 0-21 points. Higher scores indicate poor sleep quality and a higher level of sleep problems. A total score above 5 indicates clinically poor sleep quality [21,22]. The validity and reliability of the Turkish version of the scale were tested by Agargün et al. and the Cronbach alpha coefficient of the scale was reported as 0.80 [23]. In this study, the Cronbach alpha value of the scale was calculated as 0.829.

The Epworth Sleepiness Scale (ESS): This scale is widely used to evaluate daytime sleepiness among adults. The scale evaluates sleepiness during 8 situations encountered in daily life recently. The total score that can be attained from the scale varies between 0 and 24, and higher scores indicate increased daytime sleepiness [24]. A total score of 10 or more reflects above normal daytime sleepiness (inadequate sleep and the need to improve sleep hygiene) and indicates a need for further assessment. The Cronbach alpha value of the scale has been reported to be 0.87 in people with sleep apnea and 0.86 in healthy individuals [25]. In this study, the Cronbach alpha coefficient of the scale was calculated to be 0.814.

The World Health Organization-5 Well-Being Index (WHO-5): This is a brief and practical scale developed by the World Health Organization to evaluate well-being [26]. The scale consists of 5 items containing positive terms regarding the feelings of the participant in the last 2 weeks. Each item in the scale is scored on a 6-point Likert type scale with scores between 0 and 5. 0 points from an item indicate no positive feelings within the last 2 weeks, while 5 points indicate continuous positive feelings. A raw score of 0 represents the worst possible quality of life, while a raw score of 25 represents the best possible quality of life. Raw scores are converted into a scoring between 0 and 100. Scores below 50 indicate negative mood and warrant additional examination [26,27]. In the current study, the raw scores were used without any conversion process. The Turkish adaptation of the WHO-5 Well-Being Index was made by Eser [26]. In this study, the Cronbach alpha value of the scale was found to be 0.852.

Table 1. Sociodemographic and disease related characteristics of the patients

Variables		n	%
Age (year, mean±SD)		60.0±10.7 (19-88)	
Gender	Female	171	60.4
	Male	112	39.6
Marital status	Married	240	84.8
	Single	43	15.2
Educational status	0-4 year	61	21.3
	5-8 year	188	66.1
	9 year and above	34	12.6
Employment status	Unemployed	230	82.2
	Employed	53	17.8
Economical situation	Good	14	4.9
	Moderate	230	81.3
	Bad	39	13.8
Physical exercise	Yes	90	31.8
	No	193	68.2
Type of exercise	Walking	88	
	ROM	2	
Duration of diabetes (year, mean±SD)		11.6±8.0 (0.5-40)	
Type of treatment	Diet	17	6.0
	OAD	114	40.3
	Insulin	50	17.2
	OAD+insulin	102	36
Additional disease	Yes	203	72
	No	79	28
CAD	Yes	83	29.3
	No	200	70.7
Retinopathy	Yes	42	14.8
	No	241	85.2
Neuropathy	Yes	50	17.7
	No	233	82.3
Nephropathy	Yes	20	7.1
	No	263	92.9
CVD	Yes	8	2.8
	No	275	97.2
Diabetic foot	Yes	11	3.9
	No	272	96.1
HT	Yes	192	67.8
	No	91	32.2
Sleep problem	Yes	158	55.8
	No	125	44.2

FBS (mg/dl) (Mean±SD)	159.5±67.9 (27-42)
PPBS (mg/dl) (Mean±SD)	193.1±69.4 (40-500)
HbA1C (%) (Mean±SD)	7.8±1.8 (4.60-16)
Height (cm) (Mean±SD)	162.8±7.9 (143-185)
Weight (kg) (Mean±SD)	81.6±14.2 (39-128)
BMI (kg/cm²) (Mean±SD)	30.8±5.6 (17.3-48.3)
Waist circumference (cm) (Mean±SD)	104.2±13.1 (64-180)
Cholesterol (mg/dl) (Mean±SD)	198.0±52.8 (85-388)
LDL (mg/dl) (Mean±SD)	124.7±42.8 (22-257)
HDL (mg/dl) (Mean±SD)	49.5±17.9 (5-165)
Triglycerides (mg/dl) (mean±SD)	156.0±86.1 (39-589)
SBP (mmHg) (Mean±SD)	124.3±16.0 (90-200)
DBP (mmHg) (Mean±SD)	74.5±9.6 (42-100)

ROM: Range of Motion, CAD: Coronary Artery Disease, CVD: Cerebrovascular Disease, HT: Hypertension, FBS:Fasting Blood Sugar, PPBS:Postprandial Blood Sugar, HbA1c: Hemoglobin A1c test, BMI: Body Mass Index, LDL:Low Density Lipoprotein, HDL: High Density Lipoprotein, SBP: Systolic Blood Pressure, DBP:Diastolic Blood Pressure

Statistical Analysis

Data were assessed by using the SPSS 15.0 program (SPSS Inc., Chicago, IL, USA) [28]. Data were summarized using frequencies, percentages, means, and standard deviations as appropriate. The independent t-test, ANOVA test, and Pearson's correlation were used to evaluate statistical significance. A level of significance of $p<0.05$ was established before data collection.

Results

The mean age of the 283 people with diabetes was 60.0 ± 10.7 . Among the participants, 60.4% were female, 84.8% were married, 66.1% had an education between 5 and 8 years, and 82.2% were unemployed. The mean disease duration of the individuals was 11.6 years, 40.3% used oral antidiabetic drugs (OAD), 72% had an additional disease other than diabetes, and 55.8% had sleep problems. The mean Fasting Blood Sugar (FBS), Postprandial Blood Sugar (PPBS), Hemoglobin A1c test (HbA1c), height, weight, BMI, waist circumference, cholesterol level, and blood pressure of the cases were provided in Table 1.

The mean PSQI, ESS, and WHO-5 scores of the individuals were 6.6 ± 3.4 , 5.1 ± 4.2 and 11.9 ± 5.9 , respectively (Table 2).

Males, those with higher education levels, employed individuals, those with moderate economic status, those who exercised, those without sleep apnea problems, those without additional health problems, and those who did not have hypertension had better sleep quality compared to the other groups. Sleep quality decreased as the number of diseases accompanying with diabetes increased. The waist circumference and BMI of those who experienced sleep problems were higher, while their mean height was lower. The mean WHO-5 Well-Being Index score of the participants who experienced sleep problems was significantly lower, while their

mean Epworth Daytime Sleepiness Scale score was higher (Table 3).

Experiencing sleep problems did not significantly differ according to age, marital status, disease duration, treatment type, and diabetes complications including CAD, retinopathy, neuropathy, nephropathy, CVD, and diabetic foot. Additionally, there was no difference between participants who did and did not experience sleep problems with regard to FBS, PPBS, HbA1c, cholesterol, HDL, LDL, triglyceride, weight, SBP, and DBP (Table 3).

Table 2. Sleep Quality Index, The Epworth Sleepiness Scale and the World Health Organization-5 Well-Being Index Scores

Variables	Scores
PSQI (Mean±SD)	6.6 ± 3.4 (1-16)
Subjective sleep quality (Mean±SD)	1.3 ± 0.7 (0-3)
Sleep latency (Mean±SD)	1.2 ± 0.9 (0-3)
Sleep duration (Mean±SD)	1.0 ± 0.9 (0-6)
Habitual sleep efficiency (Mean±SD)	0.6 ± 0.9 (0-3)
Sleep disturbance (Mean±SD)	1.3 ± 0.6 (0-3)
Use of sleeping medication (Mean±SD)	0.3 ± 0.8 (0-3)
Day time dysfunction (Mean±SD)	0.9 ± 0.9 (0-3)
ESS (Mean±SD)	5.1 ± 4.2 (0-20)
WHO-5 (Mean±SD)	11.9 ± 5.9 (0-25)

Table 3. Sleep quality according to patient characteristics

Variables		PSQI (Mean±SD)	Statistical Analysis
Age		r=0.054; p=0.362	
Gender	Female	7.0±3.4	t=2.069
	Male	6.1±3.2	p=0.039
Marital status	Married	6.7±3.3	t=0.191
	Single	6.5±4.0	p=0.848
Educational status	0-4 year	7.8±3.5	F=8.248 p=0.000
	5-8 year	6.6±3.4	
	9 year and above	4.9±2.8	
Employment status	Unemployed	6.9±3.5	t=2.959
	Employed	5.4±2.8	p=0.003
Economical situation	Good	8.5±3.7	F=5.251 p=0.006
	Moderate	6.3±3.4	
	Bad	7.8±3.3	
Duration of diabetes		r=-0.066; p=0.268	
Type of treatment	Diet	7.1±3.8	F=0.894 p=0.445
	OAD	6.4±3.5	
	Insulin	7.2±3.6	
	OAD+insulin	6.5±3.1	
Physical exercise	Yes	5.2±3.1	t=4.906
	No	7.3±3.4	p=0.000
Sleep apnea	Yes	9.9±3.9	t=6.588
	No	6.1±3.1	p=0.000
Additional disease	Yes	7.1±3.5	t=3.694
	No	5.5±2.8	p=0.000
Number of additional diseases		r=0.358; p=0.000	
CAD	Yes	7.2±3.7	t=1.677
	No	6.4±3.3	p=0.095
Retinopathy	Yes	6.9±2.9	t=0.661
	No	6.6±3.5	p=0.509
Neuropathy	Yes	7.0±3.3	t=0.752
	No	6.5±3.4	p=0.453
Nephropathy	Yes	7.3±3.9	t=0.842
	No	6.6±3.4	p=0.401
CVD	Yes	8.5±4.7	t=1.578
	No	6.6±3.4	p=0.116
Diabetic foot	Yes	7.5±4.5	t=0.907
	No	6.6±3.4	p=0.365
HT	Yes	6.9±3.4	t=2.084
	No	6.0±3.4	p=0.038

FBS (mg/dl) (Mean±SD)	r=0.108	p=0.082
PPBS (mg/dl) (Mean±SD)	r=0.066	p=0.321
HbA1C (%) (Mean±SD)	r=0.113	p=0.099
Cholesterol (mg/dl) (Mean±SD)	r=0.042	p=0.544
LDL (mg/dl) (Mean±SD)	r=0.003	p=0.967
HDL (mg/dl) (Mean±SD)	r=0.026	p=0.708
Triglycerides (mg/dl) (mean±SD)	r=0.059	p=0.399
Waist circumference (cm) (Mean±SD)	r=0.251	p=0.002
Height (cm) (Mean±SD)	r=-0.153	p=0.012
Weight (kg) (Mean±SD)	r=0.110	p=0.071
BMI (kg/cm²) (Mean±SD)	r=0.191	p=0.002
SBP (mmHg) (Mean±SD)	r=0.119	p=0.071
DBP (mmHg) (Mean±SD)	r=-0.061	p=0.358
WHO-5 Score	r=-0.495	p=0.000
ESS Score	r=0.474	p=0.000

Discussion

Decreased or increased sleep duration and poor sleep quality can increase the risk of Type 2 diabetes and diabetes-related complications [29-31].

In this study, the mean PSQI score of the people with diabetes was 6.6. The sleep quality of people with diabetes is poor because the mean score is over 5 [23]. While the domains where sleep quality was highest respectively used sleeping medication, habitual sleep efficiency, and daytime dysfunction, the domains where sleep quality was lowest included respectively sleep disturbance, sleep latency, and sleep duration. In this study, 55.8% of people with diabetes had poor sleep quality. The mean PSQI scores and sleep quality of patients were evaluated in various studies conducted with people with type 2 diabetes. In these studies, poor sleep quality was found in 34% to 82.5% of diabetic patients, and the mean PSQI score ranged from 6.6 to 8.3 [8,9,11-13,15,32]. Besides sleep interruptions due to nocturia, high HbA1c level can cause sleep problems associated with neurodegeneration of brain regions involved in sleep/wake regulation [33]. Routine screening of patients for sleep problems, referring patients to a professional when necessary, and recommending sleep hygiene strategies to patients as a part of diabetes management can help solve sleep problems.

Sleep problems may occur secondary to diabetes, as well as making it difficult to achieve treatment goals, negatively affecting the patient's quality of life [34]. In this study, the quality of life of the participants who experienced sleep problems was found to be lower compared to those who did not. The quality of life of people with type 2 diabetes who have poor sleep quality has been reported to be also low in other studies [8,13,14,35]. Frequent waking due to nocturia and increased daytime sleepiness affect the quality of life more than other sleep problems [34]. To improve the quality of life of people with type 2 diabetes, reducing sleep problems should be an important treatment goal.

Poor sleep quality and insufficient sleep time in diabetes can cause increased daytime sleepiness. In the objective sleep assessment performed with actigraph, it was found that sleep interruptions were more in diabetic patients [36]. In this study, the daytime sleepiness levels of the participants who experienced sleep problems were found to be higher. Similarly, previous studies have reported a relationship between poor sleep quality and sleepiness during daytime activities, with higher daytime sleepiness levels among participants with poor sleep quality [7,9].

According to our findings, the experience of sleep problems did not differ according to age. While studies are supporting our findings and reporting no difference in sleep quality according to age [7,12,37], there are also studies reporting the mean age of people with poor sleep quality to be higher compared to those with good sleep quality [10,32]. According to our findings, females experienced more sleep problems compared to males. The prevalence of sleep problems according to sex has been evaluated in many studies with different results. Similar to our study, studies are reporting that females experience more sleep problems [8,9,11,38], and studies reporting that sleep quality does not differ according to sex [37]. When the presence of sleep problems according to education levels and employment status was examined, it was found that sleep problems decreased with increasing education levels and employment. Patients with higher education levels may have noticed sleep problems in the early period and/or seeking professional help to solve such problems. Since employed patients do not sleep during the day, become tired, and have to sleep earlier to be able to work the next day, sleep problems may have been less prevalent in this group.

In this study, disease duration did not significantly differ among participants who did and did not experience sleep problems. A study reports no relationship between sleep quality and disease duration [12]. But there are also studies reporting that poor sleep quality is related to longer disease duration [10,11,32]. Another problem addressed in our study is sleep apnea, and it has been

shown to be common in diabetic individuals and to affect sleep quality. A recent study suggested that OSAS treatment will decrease HbA1c level as well as improve sleep quality (39). The importance of exercise, which is known to reduce the amount of HbA1c, on sleep quality has been demonstrated in this study. In the current study, participants who did not exercise experienced more sleep problems compared to participants who exercised. In a study conducted with people with Type 2 diabetes, the sleep quality of patients who exercised was reported to be better compared to patients who did not, whereas there was no such relationship among patients with type 1 diabetes [9]. Exercise has been reported to cause nocturnal hypoglycemia in patients with type 1 diabetes [40]. In the current study, patients who had an additional disease experienced more sleep problems compared to patients who did not have an additional disease. Similarly, previous studies reported that low sleep quality was associated with a higher number of comorbidities and complications [9,12,15]. Symptoms of additional diseases and the side effects of treatments used may negatively affect sleep.

According to our study, participants who experienced sleep problems had thicker waists, lower heights, and higher BMI at a statistically significant level, while there was no difference between participants who did and did not experience sleep problems with regard to FBS, PPBS, HbA1c, total cholesterol, HDL, LDL, triglyceride, weight, SBP, and DBP values. It has been reported in some publications that patients with poor sleep quality have higher BMI values [9,11]. However, there are also studies reporting no relationship between BMI and sleep quality [7]. Similarly, while there are studies reporting no relationship between HbA1C and sleep quality [7,9,39], there are also studies reporting the sleep quality of participants with higher HbA1C and FBS to be poorer [11,33,41,42]. The relationship between HbA1c and sleep quality may vary depending on patients' adherence to treatment [39].

In conclusion, sleep quality of people with diabetes was found to be poor. Participants who experienced sleep problems had lower mean WHO-5 well-being index scores and higher mean Epworth Daytime Sleepiness Scale scores. Males, participants with higher education levels, employed individuals, those with moderate economic status, those who exercised, those without sleep apnea problems, those without additional health problems, and those who did not have hypertension experienced fewer sleep problems. The waist circumference and BMI of participants who experienced sleep problems were higher, while their mean height was lower. According to these results, interventions aimed at increasing the sleep quality of people with diabetes, decreasing their daytime sleepiness, and increasing their quality of life by increasing their activity levels, preventing additional diseases, and keeping waist circumference and BMI in normal values are recommended. Additionally, routinely screening patients with regard to sleep problems, referring patients to a professional when necessary, and recommending sleep hygiene strategies to patients as a part of diabetes management can help solve sleep problems.

Conflict of interests

The authors declare that they have no competing interests.

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Ethical approval

Ethics approval was obtained before the study (No:2017165106105).

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