ORIGINAL ARTICLE

Evaluation of depression and quality of life in patients with obstructive sleep apnea syndrome

S Yosunkaya, R Kutlu[1], FG Cihan[1]

Departments of Chest Diseases and [1]Family Medicine, Meram Medical Faculty, Necmettin Erbakan University, Konya, Turkey

Abstract

Background: Sleep fragmentation, repetitive hypoxemia during sleep, excessive sleepiness during the day, lack of concentration, memory loss, depression, decreased libido, and impotence are the characteristics of obstructive sleep apnea syndrome (OSAS) that may impair quality of life (QOL). This study aimed to investigate the QOL and factors that may affect QOL in people with different OSAS severity and without sleep apnea.

Methods: This was an analytical cross-sectional study. Polysomnography was performed on 200 people. Those detected as having nonapnea and mild-moderate-severe OSAS were administered the Epworth sleepiness scale, Beck Depression Inventory, and the World Health Organization Quality of Life-BREF (WHOQOL-BREF) scale.

Results: According to the apnea-hypopnea index, 36 people (18.0%) were in the nonapnea-hypopnea group, 28 (14.0%) in the mild OSAS group, 63 (31.5%) in the moderate OSAS group, and 73 people (36.5%) were in the severe OSAS group. Depression was present in 31 people (15.5%) who participated in the study. The nonapnea-hypopnea group comprised 12.9% of those with depression, mild OSAS group comprised 16.1%, moderate OSAS group comprised 22.6%, and severe OSAS group had 48.4% of the depressed subjects. Beck depression scores showed a significant positive correlation with the Epworth scale ($t < 90\%$ SaO_2) ($r = 0.285$, $P < 0.001$ and $r = 0.283$, $P < 0.001$, respectively). The mean scores of WHOQOL-BREF subgroups' physical health ($P < 0.001$), psychological health ($P < 0.001$), social relations ($P < 0.001$), and the environmental area ($P < 0.001$) in those with depression were statistically significantly lower than those without depression. QOL was significantly associated with the presence of OSAS ($P = 0.008$).

Conclusion: Decreased deep sleep duration, increased arousal index, and a high ratio of sleep duration with oxygen saturation below 90% to the duration of the entire sleep period increase daytime sleepiness and depressive symptoms in those with OSAS; thus, disrupting general health and QOL.

Key words: Depression, obstructive sleep apnea, quality of life

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Introduction

Obstructive sleep apnea syndrome (OSAS) is characterized by repeated episodes of upper airway obstruction during sleep, with disturbances in arterial blood gases and increasing inspiratory effort until the upper airway obstruction discontinues due to arousal.[1] The incidence of OSAS in the general population is 2–4%. It is characterized by sleep fragmentation due to excessive negative intrathoracic pressure and respiratory events, and often a decrease in blood oxygen saturation.[2] The prevalence of OSAS in Turkey was found to be 0.9–1.9% in a study conducted by

Address for correspondence:
Dr. S Yosunkaya,
Department of Chest Diseases, Meram Medical Faculty, Necmettin Erbakan University, Akyokus, Meram, Konya 42090, Turkey.
E-mail: syosunkaya@gmail.com

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Köktürk *et al.*[3] The physiopathology of OSAS involves numerous factors, among which the abnormal pharyngeal collapsibility during sleep is the most important. Serotonin delivery to the upper airway dilatator motor neurons has been shown to be reduced according to the vigilance state.[4] This leads to reductions in dilator muscle activity specifically during sleep, which may contribute to sleep apnea. Snoring, apnea experienced at night, and excessive daytime sleepiness (EDS) are the most common symptoms of OSAS. EDS is defined as sleepiness (the urge of sleep) that occurs in a situation when an individual is normally expected to be awake and alert. It is a serious disorder characterized by sleep fragmentation caused by repeated arousals and disruption of normal sleep architecture secondary to partial or complete closure of the upper airway during sleep. It has been also reported that neuropsychologic deficits, including decreased concentration, memory loss, irritability, moodiness, depression, psychosis, decreased libido, and impotence, are often found in addition to EDS in patients with severe OSAS.[1,4] Polysomnography (PSG) is the gold standard in diagnosis, and the severity of the syndrome is determined by the apnea-hypopnea index (AHI). The primary cause of mortality and morbidity in OSAS is the complication of other systems, especially the cardiovascular system. In addition, industrial and traffic accidents related to EDS are other major causes.[5]

Quality of life (QOL) is defined as the total subjective perception based on an assessment of the individual's own life, and emotion and cognition processes; therefore, it is an expression of an individual's well-being. In the medical field, QOL is the combination of the physical, emotional, and social well-being of the patient in relation to the condition and treatment of the disease.[6] QOL is also viewed as an evaluation of perceptions and the "satisfaction" derived from them against the prevailing functional status of the patient. It is a multidimensional concept that requires reviews and evaluations related to the individual's physical or disease symptoms, which in turn are related to treatment and psychological and social aspects.[7] Sleep fragmentation and repetitive hypoxemia, excessive sleepiness during the day, lack of concentration, memory loss, depression, psychosis, decreased libido, and impotence associated with OSAS are characteristics that may impair the QOL.[5] The high comorbidity of OSAS and depression also suggests that both disorders may share a common neurobiological risk factor. On the neurotransmitter level, the serotoninergic system has a central role as a neurobiological substrate underlying impairments in the regulations of mood, sleep-wakefulness cycle, and upper airway muscle tone control during sleep. Depression is associated with a functional decrease of serotoninergic neurotransmission, and is mostly responsible for the alterations in sleep.[8] Serotonin reuptake inhibitors are widely prescribed antidepressants that are suggested to improve the AHI in OSAS.

In this study, depression and QOL were evaluated in patients who were admitted to a sleep laboratory with suspected OSAS, and their relationship with PSG data was investigated.

Materials and Methods

Study design and population

This was an analytical cross-sectional study. It was performed on 200 people with suspected OSAS who were admitted to the Department of Chest Diseases, Meram Faculty of Medicine, Sleep Laboratory, Necmettin Erbakan University, Konya, between 10 June 2012 and 30 June 2013. Approval of the Meram Faculty of Medicine Ethics Committee was received before the commencement of the study. The patients were informed about the purpose of the study in the implementation phase and provided their oral and written informed consent to participate in the study.

Exclusion criteria

Subjects with periodic extremity movements, those with another sleep disorder, history of mental illness and hypertension, and those who did not agree to participate in the study were excluded. In addition, patients with chronic obstructive pulmonary disease who were using bronchodilators were excluded.

Data collection

Questionnaires consisting of four sections developed in accordance with the relevant literature were used as a data collection tool. Sociodemographic characteristics of the patients were analyzed in the first section, depression status was measured in the second, QOL was measured in the third, and Epworth sleepiness scale (ESS) was applied in the fourth section. Depression status was assessed with the Beck Depression Inventory (BDI), whereas the QOL was assessed by the World Health Organization QOL-BREF (WHOQOL-BREF) scale. An all-night PSG examination was performed on all participants at the sleep laboratory and their AHI was calculated. Anthropometric measurements were made. Systolic blood pressure (SBP) and diastolic BP (DBP) were measured according to standard conditions using a sphygmomanometer; three measurements were performed at intervals of 2–5 min and the mean of the three values was calculated.

Polysomnography

Overnight PSG was performed on all participants using the SOMNO screen™ plus PSG + Tele (BT) and Camera COMPACT R&K and the following variables were included: Electroencephalogram (4 channels: C3/A2-, C4/A1-, O1/A2, and O2/A1), electrooculogram (2 channels: Right, left), electromyogram of submental muscles (3 channels), electromyogram of the anterior tibialis muscle

of both legs (2 channels), electrocardiogram, and airflow (assessed with an oronasal cannula and a thermistor). Chest and abdominal efforts (2 channels) were measured using thoracic and abdominal strain gauges, and arterial oxyhemoglobin saturation (SaO_2: 1 channel) was measured by pulse oximetry using a finger probe. Sleep staging and respiratory event scoring were performed manually by a single doctor according to the guidelines of the American Academy of Sleep Medicine.[9]

Apneas were defined as the complete cessation of airflow for ≥10 s, and hypopneas were defined as >30% reduction in nasal-oral airflow with an associated ≥3% decrease in oxygen saturation or arousal.[9]

During PSG, the following variables were recorded: Sleep efficiency, calculated as the total sleep time multiplied by time spent in bed; minimum oxygen saturation, the lowest oxygen saturation recorded during sleep; mean oxygen saturation (mean SaO_2), the average oxygen saturation recorded during sleep; and time <90% (t < 90% SaO_2), defined as the total sleep time multiplied by the amount of sleep time spent at <90% of the saturation level.

Apnea-hypopnea index

AHI was expressed as the number of apnea and hypopnea episodes per sleep hour. Patients with AHI < 5 were included in the control group. Patients with AHI > 5 were considered as OSAS patients. An AHI of ≥5 to <15 indicated mild OSAS, ≥15 to <30 moderate OSAS, and ≥30 severe OSAS.[9]

Epworth sleepiness scale

The ESS is a scale intended to subjectively measure daytime sleepiness using a very short questionnaire. The Turkish validation of this test has been previously conducted.[10] The questionnaire requires the subject to rate his or her probability of falling asleep on a scale of increasing probability from 0 to 3 for eight different situations. The scores for the eight questions are added together to obtain a single value. A value in the range of 0–9 is considered normal whereas a value in the range of 10–24 indicates EDS.

The short form of the World Health Organization Quality of Life-BREF (TR)

QOL was assessed using the Turkish version of the WHOQOL-BREF questionnaire, which was assessed for validity and reliability by Eser *et al.*[11] The WHOQOL-BREF is a self-report scale that consists of 26 items. The 27th question on the Turkish version includes the social pressure area.

The participants were asked to consider what they have experienced in the last 15 days when answering the questions. The general health and QOL of the individuals, including their physical (body), social, psychological, and environmental state of well-being were assessed on this form. The answers given to the questions in this Likert-type scale are scored in 1, 2, 3, 4, 5 or 5, 4, 3, 2, 1 format according to the degree of importance. The scale assesses the patient's level of satisfaction with life, the status of being affected by disease, and positive or negative change in their QOL.[11] Perceived health is a term used to describe a person's health status that shows how the individual feels about himself/herself and how they meet the qualifications. There is no total score of the scale. The scores for the perceived QOL question and the perceived health question range between 1 and 5 points, and the points for the other four areas range between 0–100 and 0–20. The QOL also increases when the points increase.[11]

Beck depression inventory

Depression level was evaluated by the BDI Turkish version, which was assessed for validity and reliability by Ulusoy *et al.*[12] BDI is a self-administered 21-item questionnaire measuring symptoms of depression. The total BDI value was considered as "no depression" if it was 9 or less, "mild" if it was 10–16, "moderate" if it was 17–23, and as "severe depression" if it was 24 or above. In similar studies using the BDI, although different values were regarded as the BDI cutoff value, in general, 17 was considered the cutoff.[13,14] This value was used as the cutoff in our study.

Anthropometric measurements

We measured the weight, length, neck circumference (NC), and waist circumference (WC) of all patients. NC was measured at the level of the superior border of the cricothyroid membrane using a tape measure. WC was measured in the standing position at the level of the umbilicus (halfway between the lower border of the ribs and the iliac crest, in a horizontal plane) to the nearest 0.1 cm with a flexible anthropometrical tape. Height was measured to the nearest 0.5 cm, without shoes, and with the back square against the wall tape. Weight was measured with a balance to the nearest 100 g, without shoes, and in light undergarments.

Statistical analyses

SPSS (SPSS Inc., Chicago, IL, USA) for Windows 16.0 program was used for statistical analyses of the results obtained in this study. Descriptive statistics of continuous variables in terms of mean and standard deviation and of categorical data in terms of frequency and percentage are summarized. Independent samples t-test was used to compare quantitative data, whereas the Chi-square test was used for categorical comparison of the data. The results were evaluated within the 95% confidence interval and the significance was evaluated at the level of $P < 0.05$. Correlation between parameters was performed using Pearson's correlation analysis.

Ethical considerations

The study protocol was approved by the Ethics Committee of Meram Medical Faculty of Selcuk University and written informed consent was obtained from all participants before the study.

Results

Of the 200 study participants, 87.5% were male ($n = 175$) and 12.5% were female ($n = 25$), 92.0% were married ($n = 184$), and 35% were smokers. The mean age of all patients was determined as 46.5 ± 9.9 years (range, 20-83). Mean NC as 41.2 ± 3.8 cm (28.7–53.0).

Table 1: Logistic regression analysis of some parameters

	B	*P*	Exp (B)	95.0% CI for EXP (B)	
				Lower	Upper
Age (year)	−0.031	0.345	0.969	0.908	1.034
BMI (kg/m^2)	−0.072	0.442	0.931	0.776	1.117
ESS	0.250	0.015	1.284	1.050	1.571
Beck scores	−0.080	0.148	0.923	0.828	1.029
Duration of NREM3 (%)	−0.128	0.024	0.880	0.787	0.983
Duration of REM (%)	−0.108	0.028	0.898	0.816	0.988
Arousal index	0.349	0.000	1.417	1.195	1.681
Minimum SaO_2 (%)	−0.495	0.000	0.610	0.466	0.798
Mean SaO_2 (%)	0.496	0.101	1.642	0.908	2.970
t<90% SaO_2 (%)	0.082	0.034	1.086	1.006	1.171
Constant	−1.476	0.954			

BMI=Body mass index; ESS=Epworth sleepiness scale; NREM3%=Non-REM 3 sleep time; REM=Rapid eye movement sleep time; Minimum SaO_2 (%)=The lowest oxygen saturation recorded during sleep; Mean SaO_2=The average oxygen saturation recorded during sleep; *t*<90% SaO_2=The amount of total sleep time spent at <90% saturation; CI=Confidence interval

Table 2: The relationship between the World Health Organization Quality of Life-BREF general health and quality of life, life satisfaction, and depression

	With depression (BDI ≥17) *n* (%)	Without depression (BDI <17) *n* (%)	χ^2	*P*
General health and quality of life				
Very bad	1 (50.0)	1 (50.0)	15.408	0.004
Slightly bad	3 (15.8)	16 (84.2)		
Neither good nor bad	25 (21.4)	92 (78.6)		
Pretty good	2 (4.4)	43 (95.6)		
Very good	-	17 (100.0)		
General health and life satisfaction				
Not satisfied	6 (40.0)	9 (60.0)	14.426	0.006
Slightly satisfied	8 (24.2)	25 (75.8)		
Neither satisfied nor unsatisfied	10 (12.3)	71 (87.7)		
Quite satisfied	7 (13.7)	44 (86.3)		
Very satisfied	-	20 (100.0)		

BDI=Beck depression inventory

The mean BDI was determined as 9.7 ± 7.4 (0–42) and mean body mass index (BMI) as 31.2 ± 6.2 kg/m^2 (15.5–67.1). Depression was present in 31 people (15.5%) when the BDI cutoff value was taken as 17. According to the AHI, 36 people (18.0%) were in the nonapnea-hypopnea group, 28 (14.0%) were in the mild OSAS group, 63 (31.5%) were in the moderate OSAS group, and 73 (36.5%) were in the severe OSAS group. In the nonapnea-hypopnea group, 30% were unemployed and in the OSAS group, 27% were unemployed. The nonapnea-hypopnea group comprised 12.9% of those with depression, mild OSAS group comprised 16.1%, moderate OSAS group comprised 22.6%, and the severe OSAS group had 48.4% of the depressed subjects. No statistically significant association was found between depression and OSAS severity ($P = 0.148$).

There was no significant difference in terms of pack-years, the incidence of comorbid disease, and rapid

Table 3: The relationship between the World Health Organization Quality of Life-BREF domains and depression

Domains	Mean±SD		*P*
	With depression (BDI ≥17)	Without depression (BDI <17)	
WHOQOL-BREF			
Physical health	55.3±16.7	67.0±14.2	0.001
Psychological health	51.8±16.9	69.1±13.5	0.001
Social relationships	44.4±22.5	67.7±17.5	0.001
Environment	59.7±17.3	71.0±13.7	0.001

WHOQOL-BREF=World Health Organization Quality of Life-BREF; SD=Standard deviation; BDI=Beck depression inventory

Table 4: The relationship between the World Health Organization Quality of Life-BREF general health and quality of life, life satisfaction, and obstructive sleep apnea syndrome

	With OSAS (AHI ≥5) *n* (%)	Without OSAS (AHI <5) *n* (%)	χ^2	*P*
General health and quality of life				
Very bad	1 (50.0)	1 (50.0)	13.904	0.008
Slightly bad	15 (78.9)	4 (21.1)		
Neither good nor bad	100 (85.5)	17 (14.5)		
Pretty good	40 (88.9)	5 (11.1)		
Very good	9 (52.9)	8 (47.1)		
General health and life satisfaction				
Not satisfied	11 (73.3)	4 (26.7)	9.109	0.058
Slightly satisfied	30 (90.9)	3 (9.1)		
Neither satisfied nor unsatisfied	65 (80.2)	16 (19.8)		
Quite satisfied	46 (90.2)	5 (9.8)		
Very satisfied	13 (65)	7 (35)		

OSAS=Obstructive sleep apnea syndrome; AHI=Apnea-hypopnea index

eye movements (REMs) sleep time between OSAS groups ($P > 0.05$). Duration of non-REMs (NREM) sleep, arousal index, Epworth sleepiness scores, minimum SaO_2, mean SaO_2, and $t < 90\%$ SaO_2 was significantly different between groups ($P < 0.05$). When the four groups were separately examined in terms of age distribution, the mean age and BMI in those with severe OSAS was statistically significantly higher than in the nonapnea-hypopnea group ($P = 0.027$ and $P = 0.018$, respectively). The logistic regression analysis of some parameters was presented in Table 1.

Table 5: The relationship between the World Health Organization Quality of Life-BREF domains, beck scores, and obstructive sleep apnea syndrome

Domains	Mean±SD		*P*
	With OSAS (AHI ≥5)	Without OSAS (AHI <5)	
WHOQOL-BREF			
Physical health	65.7±14.7	62.9±17.0	0.057
Psychological health	66.4±14.8	66.7±18.2	0.041
Social relationships	63.8±20.8	65.5±17.3	0.341
Environment	69.4±14.0	68.7±18.8	0.003
Beck score	10.13±7.44	7.97±6.95	0.117

WHOQOL-BREF=World Health Organization Quality of Life-BREF; OSAS=Obstructive sleep apnea syndrome; AHI=Apnea-hypopnea index; SD=Standard deviation

There was no statistical difference between the groups in terms of fasting blood glucose, lipid profile, hemoglobin, and hematocrit values ($P > 0.05$). However, SBP and DBPs were high, especially in the severe OSAS group compared to the nonapnea-hypopnea group, and this difference was statistically significant ($P = 0.015$ and $P = 0.044$, respectively).

WHOQOL-BREF general health and QOL ($P = 0.004$) and general health and satisfaction with life status ($P = 0.006$) in individuals without depression were significantly better than those with depression [Table 2]. The mean scores of WHOQOL-BREF subgroups' physical health ($P < 0.001$), psychological health ($P < 0.001$), social relations ($P < 0.001$), and the environmental area ($P < 0.001$) in those with depression were significantly lower than those without depression [Table 2]. The relationship between WHOQOL-BREF domains and depression was shown in Table 3.

Table 6: Correlations between polysomnography parameters and the World Health Organization Quality of Life-BREF Quality of Life

Parameters	1	2	3	4	5	6	7	8	9
Physical health									
r	1								
P									
Psychological health									
r	0.634**	1							
P	0.001								
Social relationships									
r	0.528**	0.642**	1						
P	0.001	0.001							
Environmental area									
r	0.502**	0.660**	0.624**	1					
P	0.001	0.001	0.001						
Total AHI									
r	−0.087	−0.078	−0.032	−0.090	1				
P	0.223	0.274	0.657	0.205					
Arousal index									
r	−0.055	−0.061	0.046	−0.040	0.668**	1			
P	0.441	0.392	0.522	0.574	0.001				
Epworth scale									
r	−0.190**	−0.287**	−0.290**	−0.225**	0.364**	0.286**	1		
P	0.007	0.001	0.001	0.001	0.001	0.001			
t<90% saturation									
r	−0.189**	−0.215**	−0.160*	−0.109	0.540**	0.375**	0.310**	1	
P	0.007	0.002	0.023	0.124	0.001	0.001	0.001		
Mean SaO_2									
r	0.060	0.148*	0.078	0.057	−0.500**	−0.350**	−0.347**	−0.776**	1
P	0.396	0.037	0.272	0.426	0.001	0.001	0.001	0.001	

*Correlation was significant at the 0.05 level (two-tailed); **Correlation was significant at the 0.01 level (two-tailed). AHI=Apnea-hypopnea index; *t*<90% SaO_2=The amount of total sleep time spent at <90% saturation; Mean SaO_2=The average oxygen saturation recorded during sleep

General health and QOL were significantly associated with the presence or absence of OSAS ($P = 0.008$); however, general health and satisfaction of life was not different between those with and without OSAS ($P = 0.058$) [Table 4].

The relationship among WHOQOL-BREF domains, Beck scores, and OSAS was shown in Table 5. The environmental area points in those with OSAS ($P = 0.003$) were higher than those without apnea-hypopnea. There was no statistical difference between the groups in terms of Beck depression scores ($P = 0.117$) [Table 5]. In addition, no significant correlation was detected between AHI, which shows the OSAS severity, physical health, social relationships, and the environment. However, a significant negative correlation was detected between the ESS and physical health, psychological health, social relationships, and environmental area ($r = -0.190$, $P = 0.007$; $r = -0.287$, $P < 0.001$; $r = -0.290$, $P < 0.001$, and $r = -0.225$, $P < 0.001$, respectively). A significant negative correlation was present between $t < 90\%$ SaO_2 and physical health and psychological health areas ($r = -0.189$, $P = 0.007$ and $r = -0.215$, $P = 0.002$, respectively) [Table 6].

The mean ESS score was determined as 8.8 ± 4.9 (0–24). According to the ESS, excessive sleepiness state was observed at a maximal frequency of 48.9% in the severe OSAS group; this difference was statistically significant compared to the other groups ($P < 0.001$). A significant positive correlation was present between the values of AHI, which determines the degree of OSAS and BMI, age, $t < 90\%$ SaO_2, and Epworth and arousal index. There was a significant negative correlation between overnight average SaO_2 and AHI. There was a weak positive correlation between AHI and BDI scores ($r = 0.180$, $P = 0.011$). The Beck depression score also had significant positive correlation with ESS and $t < 90\%$ SaO_2 ($r = 0.285$, $P < 0.001$ and $r = 0.283$, $P < 0.001$, respectively) [Table 6]. There was no significant relationship among depression and age, occupation, pack-years, marital status and BMI, duration of REM sleep, duration of NREM-3 sleep, overnight average O_2 saturation, and minimum O_2 saturation ($P > 0.05$).

Discussion

Sleep fragmentation, repetitive hypoxemia, excessive sleepiness state during the day, and depression related to OSAS are commonly observed problems in OSAS; these are thought to impair the QOL of the patients with sleep apnea. Consistent with previous results, this study demonstrated that general health and life satisfaction in those with OSAS is worse than in those without.[15] This effect was particularly prominent in the areas of physical and psychological health and environment. In England, disorders have been identified in all areas from measurements made by short form-36 (SF-36) in 108 patients with OSAS (AHI > 10).[16] Smith and Shneerson have identified disorders in vitality and social functioning areas using measurements also made by SF-36 in 223 patients with OSAS.[17] In the measurements made by using health-related QOL, which is shown to be better associated with sleep disorders, it has been shown that excessive sleepiness, cognitive dysfunction, and psychological disorder are leading disorders in those with OSAS.[15] In our study, although there is no significant relationship between WHOQOL-BREF areas and total AHI, which shows the severity of OSAS, it was found that there is a strong relationship with physical health, psychological health, social relationships, and environmental areas, and the ESS. Similarly, the ratio of the overnight duration of oxygen saturation below 90% to the total night sleep was found to be significantly associated with the areas of physical and psychological health. In our study, it has been shown that the duration of NREM-3, namely deep sleep, in those with severe OSAS was significantly short, and the arousal index was significantly high. In addition, it has been shown that there is a strong correlation between the arousal index and Epworth scores. These two factors are related to sleep, i.e. lack of sufficient sleep at night in the deep sleep period and frequent interruptions in sleep increase the ESS values by causing EDS.[18] Using SF-36, Bennett *et al.* also found a weak correlation between AHI and QOL; however, the EDS detected with the ESS and Multiple Sleep Latency Test is related to the energy and vitality scores of SF-36.[18] It has also been shown in other recently performed studies that EDS is mainly associated with QOL.[19,20]

In addition, it has been suggested that the presence or absence of anxiety and depression in people with OSAS can affect the QOL. For example, Akashiba *et al.*[21] found that six of the eight domains of the SF-36 QOL questionnaire and total score of SF-36 were significantly lower in patients with OSAS. Five of these eight areas were shown to be associated with depression in patients with OSAS. It has been shown in another study that the relationship between OSAS and depression decreased in the presence of health-related comorbid conditions, especially hypertension and obesity.[22] Although a statistically weak relationship is also found between depression scores and OSAS severity in our study, WHOQOL-BREF general health and QOL and general health and state of satisfaction with life in individuals with depression were found to be significantly worse than those without depression. In other words, depression was found to be an important factor negatively affecting the QOL in patients with OSAS. All of the WHOQOL-BREF areas in those with depression were significantly worse than in those without.

The incidence of depression in those with OSAS was 16.4% in our study. This rate was reported as 11% in another study conducted in Turkey, in which 90 OSAS patients were examined.[23] In addition, depressive

symptoms were identified in half of the patients in a study conducted in Japan using the SF-36 test on 60 patients with OSAS.[21] In a review on the subject, it can be noted that the rate of depression in OSAS varies within a wide range, such as 7–63%.[24] The reason for this is attributed to the characteristics of the patients, differences in depression assessment methods, and selection of the study. We could not find a difference in Beck depression scores between groups with and without OSAS. We determined that the actual factors affecting the Beck depression score are the ESS and $t < 90\%$ SaO_2 values; therefore, although there is a strong correlation between the degree of AHI and these values, there are patients without excessive sleepiness despite a high AHI or with excessive sleepiness and low AHI values. Therefore, depressive symptoms are more common in those with OSAS experiencing EDS and below 90% saturation during a large part of the night. The study by Klonoff *et al*. shows that the frequency of depression in those with sleep apnea is not more than in any other chronic disease.[25] It cannot be concluded that OSAS causes clinically significant depression; however, it is thought to be associated with depression at the sub-clinical level. The study by Gall *et al*. supports this idea and is consistent with our study.[26] In fact, the complaint of insomnia is present in those with depression and mood disorders rather than in those with excessive sleepiness; however, 15% of patients with depression show excessive sleepiness.[5] Our study shows that OSAS and depressive complaints are associated with EDS.

The limitations of the present study must be considered. The known data have been obtained from a relatively small patient sample. Hence, the sample was not entirely representative of the Turkish population.

Conclusion

According to our study, there is no significant difference in Beck depression scores between groups with and without OSAS, but the Beck depression scores were positively correlated with ESS and $t < 90\%$ SaO_2. Two factors are related to OSAS; lack of sufficient sleep at night in the deep sleep period and frequent interruptions in sleep by arousals increase the ESS values. In addition, a significant negative correlation was detected among the ESS and physical health, psychological health, social relationships, and environmental area. A significant negative correlation was present among $t < 90\%$ SaO_2 and physical health, and psychological health areas. OSAS-related EDS leads to the increase of depressive symptoms and therefore, causes disorders, in general, health and QOL in those with OSAS.

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Conflicts of interest
There are no conflicts of interest.

References

1. Iber C, Ancoli-Israel S, Chesson A, Quan S. The AASM Manual for the Scoring of Sleep and Associated Events: Rules, Terminology and Technical Specifications. Westchester, Illinois: American Academy of Sleep Medicine; 2007.
2. Young T, Peppard PE, Gottlieb DJ. Epidemiology of obstructive sleep apnea: A population health perspective. Am J Respir Crit Care Med 2002;165:1217-39.
3. Köktürk O, Tatlıcıoğlu T, Kemaloğlu Y. The prevalence of obstructive sleep apnea syndrome in patients with habitual snoring. Tuberc Thorax 1997;45:7-11.
4. Veasey S. Serotonin agonists and antagonists in obstructive sleep apnea. Am J Respir Med 2003;2:21-9.
5. Berry RB. Fundamentals of Sleep Medicine. USA: Philadelphia Elsevier Saunders; 2011.
6. Development of the World Health Organization WHOQOL-BREF quality of life assessment. The WHOQOL Group. Psychol Med 1998;28(3):551-8.
7. Cella DF. Quality of life: Concepts and definition. J Pain Symptom Manage 1994;9:186-92.
8. Schröder CM, O'Hara R. Depression and obstructive sleep apnea (OSA). Ann Gen Psychiatry 2005;4:13.
9. Berry R, Brooks R, Gamaldo C, Harding S, Marcus C, Vaughn B. The AASM Manual for the Scoring of Sleep and Associated Events: Rules, Terminology and Technical Specifications, Version 2.0. Darien, Illinois: American Academy of Sleep Medicine; 2012. p. 47.
10. Izci B, Ardic S, Firat H, Sahin A, Altinors M, Karacan I. Reliability and validity studies of the Turkish version of the Epworth sleepiness scale. Sleep Breath 2008;12:161-8.
11. Eser S, Saatli G, Eser E, Baydur H, Fidaner C. World Health Organization quality of life module for elderly WHOQOL-OLD: Validity and reliability of Turkish version; results in Turkey fieldwork. Turk J Psychiatry 2010;21:37-48.
12. Ulusoy M, Sahin NH, Erkmen H. Turkish version of the Beck Anxiety Inventory: Psychometric properties. J Cogn Psychother 1998;12:163-72.
13. Beck AT, Epstein N, Brown G, Steer RA. An inventory for measuring clinical anxiety: Psychometric properties. J Consult Clin Psychol 1988;56:893-7.
14. Hisli N. The validity and reliability of the Beck Depression Inventory for college students. Psychology Journal 1989;7:3-13.
15. Atkeson A, Basner R. Sleep and quality of life in sleep apnea. In: Verster J, Pandi-Perumal SR, Streiner D, editors. Sleep and Quality of Life in Clinical Medicine. Totowa, NJ: Humana Press; 2008. p. 79-91.
16. Jenkinson C, Coulter A, Wright L. Short form 36 (SF36) health survey questionnaire: Normative data for adults of working age. BMJ 1993;306:1437-40.
17. Smith IE, Shneerson JM. Is the SF 36 sensitive to sleep disruption? A study in subjects with sleep apnoea. J Sleep Res 1995;4:183-8.
18. Bennett LS, Barbour C, Langford B, Stradling JR, Davies RJ. Health status in obstructive sleep apnea: Relationship with sleep fragmentation and daytime sleepiness, and effects of continuous positive airway pressure treatment. Am J Respir Crit Care Med 1999;159:1884-90.
19. Baldwin CM, Griffith KA, Nieto FJ, O'Connor GT, Walsleben JA, Redline S. The association of sleep-disordered breathing and sleep symptoms with quality of life in the sleep heart health study. Sleep 2001;24:96-105.
20. Mitler MM, Gujavarty KS, Browman CP. Maintenance of wakefulness test: A polysomnographic technique for evaluation treatment efficacy in patients with excessive somnolence. Electroencephalogr Clin Neurophysiol 1982;53:658-61.
21. Akashiba T, Kawahara S, Akahoshi T, Omori C, Saito O, Majima T, *et al*. Relationship between quality of life and mood or depression in patients with severe obstructive sleep apnea syndrome. Chest 2002;122:861-5.
22. Bardwell WA, Berry CC, Ancoli-Israel S, Dimsdale JE. Psychological correlates of sleep apnea. J Psychosom Res 1999;47:583-96.
23. Soyuer F, İsmailoğulları S, Aksu M, Elmalı F. Relationship between physical activity and depression in patients with obstructive sleep apnea syndrome. Turk J Neurol 2011;17:32-7.
24. Saunamäki T, Jehkonen M. Depression and anxiety in obstructive sleep apnea syndrome: A review. Acta Neurol Scand 2007;116:277-88.
25. Klonoff H, Fleetham J, Taylor DR, Clark C. Treatment outcome of obstructive sleep apnea. Physiological and neuropsychological concomitants. J Nerv Ment Dis 1987;175:208-12.
26. Gall R, Isaac L, Kryger M. Quality of life in mild obstructive sleep apnea. Sleep 1993;16:S59-61.