

## The eating attitudes in patients with obstructive sleep apnea syndrome

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### ABSTRACT

**Aim:** Obstructive sleep apnea syndrome (OSAS) patients show multiple physiological deficits and several neuropsychological comorbidities. The aim of this study was to investigate the eating attitudes in OSAS patients.

**Material and methods:** Polysomnography records of 157 were performed. Eating Attitudes Test (EAT), Beck Depression Inventory (BDI), and the Beck Anxiety Inventory (BAI) were applied to all participants.

**Results:** The mean age of the 157 individuals included in the study was  $47.2 \pm 11.4$  (18–76) years and 36% ( $n = 56$ ) of the individuals were female and 64% ( $n = 101$ ) were male. When the patients were ranked according to the severity of OSAS, 38.2% ( $n = 60$ ) were severe, 20.4% ( $n = 32$ ) were moderate, 24.2% ( $n = 38$ ) were mild, and 17.2% ( $n = 27$ ) were OSAS negative. There was a significant difference in terms of the age-and-BMI-adjusted EAT score according to OSAS severity ( $p = .042$ ). There was a significant difference in the age-and-BMI-adjusted value of the EAT according to the presence of OSAS ( $p = .011$ ). After controlling age and BMI, no significant correlation was found between the EAT and the BDI ( $r = 0.012$ ,  $p = .890$ ) in patients with OSAS while there was a significant positive correlation EAT and the BAI ( $r = 0.177$ ,  $p = .046$ ).

**Conclusions:** Considering the association of OSAS with psychiatric disorders, the presence of eating disorders (EDs) becomes an important and special topic. Treatment of patients with OSAS should not only aim to improve the patient's sleep apnea, but also to improve the patient's quality of life by evaluating the patient's psychological and physical functions.

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### Introduction

Obstructive sleep apnea syndrome (OSAS) is characterized by repetitive, complete, or partial collapse of the pharyngeal airway during sleep [1]. Upper respiratory tract collapse episodes during sleep are typically seen in OSA and these episodes lead to repeated oxyhemoglobin desaturations [2,3]. OSAS is a prevalent disorder, affecting approximately 4–9% of middle-aged adults [1]. OSAS patients show multiple physiological deficits and several neuropsychological comorbidities, including cognitive deficits and anxiety symptoms, the latter affecting 12–17% of adult OSAS patients [4–8]. Daytime symptoms in OSAS patients may cause anxiety and depression in the individual. Inadequate sleep and cognitive disorders cause anxiety. Although anxiety is common in OSAS patients, there is a weak correlation between its severity and apnea–hypopnea index (AHI) [9]. Anxiety symptoms such as depression in OSAS patients have also been associated with more brain structural changes [10]. Investigations have

shown that depressive symptoms improve with treatment of OSA and that untreated OSAS may contribute to treatment resistance in some cases of mood disorders [11].

Eating disorders (EDs) are eating behavior disorders that cause medical, social, and psychological problems and affect quality of life negatively. Although a specific cause and pathogenesis for ED are not known, it is accepted that risk factors include social, familial, developmental, psychological, behavioral, and biological factors and life events [12,13].

Sleep disorders are often comorbid with psychiatric diseases including ED such as anorexia nervosa, bulimia nervosa, binge ED, and night eating syndrome [14]. Our study was based on the hypothesis that the frequency of disordered eating behavior in patients with OSAS could be different than in patients without OSAS. Considering the association of OSAS with many psychiatric disorders, this study aims to investigate the eating attitudes in patients with OSAS.

## Material and methods

### Study group

In this prospective study, polysomnography records of 157 individuals who admitted to the Sleep Laboratory of the Duzce University, School of Medicine between March 2018 and May 2018 were analyzed. Medical records of 130 subjects (83%) were diagnosed as OSAS. 38 mild OSAS (group 1), 32 moderate OSAS (group 2), 60 severe OSA (group 3), and 27 OSAS negative individuals (group 4) were included in the study. Body mass indexes (BMI) of individuals were calculated by measuring their height and weight.

All participants assessed by Eating Attitudes Test (EAT), Beck anxiety inventory (BAI), and Beck depression inventory (BDI). Participants were divided into following groups:  $EAT < 30$  and  $EAT \geq 30$  according to the scores of EAT,  $BDI < 17$  and  $BDI \geq 17$  according to scores of BDI and  $BAI < 16$  and  $BAI \geq 16$  according to scores of BAI.

### Exclusion criteria

Subjects with psychiatric illness, chronic inflammatory diseases, diabetes mellitus, malignancy, chronic renal diseases, chronic liver diseases, cardiovascular diseases, and cerebrovascular diseases, were excluded.

### Polysomnography and sleep assessment

Full overnight polysomnography (Philips Respironics Model: Alice-6 PSG, Germany) procedure was performed to patients who had referred to sleep laboratories with a preliminary diagnosis of OSAS. The system was composed of dual-channel electroencephalography (EEG), 2-channel electrooculography (EOG), submental electromyography (EMG), tibial EMG, oral, and nasal airflow (by the thermistor and nasal cannula), thoracic and abdominal movements, body position, snoring, ECG and pulse oximetry recordings were obtained (>6 h). All recordings were manually scored by a certified sleep physician. Apnea was defined as complete cessation of oral and nasal airflow for at least 10 s. Hypopnea was defined as a reduction >30% in airflow for at least 10 s accompanied by >3% desaturation and arousal. The average number of episodes of apnea and hypopnea per hour of sleep were measured according to the AHI. Patients with an  $AHI < 5$  were considered OSAS-negative, while those with  $AHI 5-15$  were regarded as having mild,  $AHI 15-30$  to have moderate, and  $AHI > 30$  to have severe OSAS [15].

### Eating Attitudes Test

It is a self-report scale used in individuals older than 11 years to measure possible disturbances in eating behaviors in both patients with EDs and in individuals without EDs [16]. EAT is a scale that can determine impaired eating behavior and attitude in clinical level. The test consisted of 40 items and the cut-off score of the six-point Likert scale was 30. This test was developed to evaluate eating behaviors and attitudes in patients with anorexia nervosa. However, it is used in the determination of EDs in normal individuals. The level of total score is directly related to the level of psychopathology. The Turkish validity and reliability of the test were performed [17].

### Beck Depression Inventory

It measures physical, emotional, cognitive, and motivational symptoms of depression. The aim of the scale is not to diagnose depression, but to determine the level and the change in the severity of depression symptoms. BDI is a scale that includes 21 self-assessment sentences and each symptom category has four options. Each item is scored from 0 to 3 and total score varies within the range of 0–63 [18]. A validity and reliability study was performed in our country. The cut-off point of the Turkish form was determined as 17 [19].

### Beck Anxiety Inventory

This scale measures the commonness of the symptoms of anxiety experienced by an individual. BAI, a self-report scale, comprises 21 items; each item is scored from 0 to 3, and the total score varies within the range of 0–63. A high score implies the severity of the anxiety experienced by the individual [18]. In Turkey, validity and reliability study for BAI has been conducted by Ulusoy et al. The cut-off point of the Turkish form was determined as 16 [20].

### Statistical analysis

Data were analyzed using the Statistical Package for the Social Sciences (Windows version 20.0; SPSS Inc., Chicago, IL) and special syntax. Suitable descriptive statistics (mean, standard deviation/standard error, median, interquartile range-IQR, minimum, and maximum) of all variables were calculated. The normality assumption control of continuous variables was examined by Shapiro–Wilk and Kolmogorov–Smirnov tests. The assumption of homogeneity of group variances

was tested by Levene test. The One way ANOVA (*post hoc* Fisher LSD test) was used for the comparison among the groups for variables that meet the assumptions and Kruskal–Wallis analysis (*post hoc* Dunn test) and Mann–Whitney U test were used for the comparison between the groups of variables that meet the assumptions. In addition, Spearman correlation analysis was used to determine the covariates that affect or are thought to affect the outcome variable(s) to examine the relationships between the variables. The Generalized Linear Modeling approach (Linear, Gamma with log link, *post hoc*: Fisher LSD test) was used to compare the groups by eliminating the effects of the covariates according to whether the assumptions were met or not. The relationships between quantitative variables were determined by nonparametric partial correlation analysis after controlling covariates. The relationships between categorical variables were examined by Pearson Chi-Square test.  $p$  value  $< .05$  was considered statistically significant.

## Results

The mean age of the 157 individuals included in the study was  $47.2 \pm 11.4$  (18–76) years and 36% ( $n = 56$ ) of the individuals were female and 64% ( $n = 101$ ) were male. The mean BMI of the participants was  $31.7 \pm 6.3$  (19–52)  $\text{kg}/\text{m}^2$  and 83% ( $n = 130$ ) of them were OSAS positive. When the patients were sorted according to the severity of OSAS, 38.2% ( $n = 60$ ) were severe,

20.4% ( $n = 32$ ) were moderate, 24.2% ( $n = 38$ ) were mild and 17.2% ( $n = 27$ ) were OSAS negative. The proportions of gender were similar according to OSAS grade ( $p = .173$ ). Both age and BMI distributions according to OSAS grade were not homogeneous ( $p < .001$  for each). Mean age ( $38.9 \pm 12.4$ ) of non-OSAS subjects was significantly lower than those of mild ( $48.1 \pm 10.2$ ), moderate ( $48.2 \pm 10.2$ ), and severe ( $49.9 \pm 10.7$ ) OSAS patients ( $p = .001$ ,  $p = .001$ ,  $p < .001$ , respectively). BMI median value (27 (IQR: 5.1)) of non-OSAS subjects was significantly lower than those of mild (30.7 (IQR: 7.1)), moderate (30 (IQR: 6.6)), and severe (32 (IQR: 7.5)) OSAS patients ( $p = .006$ ,  $p = .049$ ,  $p < .001$ , respectively). In the study, covariates such as age and BMI were found to directly or indirectly affect polysomnographic characteristics. In order to eliminate the effects of these covariates, i.e. to obtain more unbiased and more accurate group comparison results, an adjustment was performed using appropriate statistical tools. There was a significant difference in terms of the age-and-BMI-adjusted mean values of AHI, total sleep time 90 (TST90), mean  $\text{O}_2$  saturation, oxygen desaturation index (ODI), min  $\text{O}_2$  saturation, min  $\text{O}_2$  time, and arousal index values except for TST ( $p < .05$  for each). The descriptive statistics of the age-and BMI-adjusted polysomnographic data are shown in Table 1.

There was no significant difference in terms of the age-and-BMI-adjusted mean values of BDI and BAI among OSAS severity ( $p > .05$  for each). There was a

**Table 1.** The comparison of clinical, polysomnographic features and Eating Attitudes Test (EAT), Beck Depression Inventory (BDI), and the Beck Anxiety Inventory (BAI) of patients with and without obstructive sleep apnea.

Clinical and polysomnographical feature	OSAS negative ( $n = 27$ )	Mild OSAS ( $n = 38$ )	Moderate OSAS ( $n = 32$ )	Severe OSAS ( $n = 60$ )	$p$
AHI (event /h of sleep) <sup>ab</sup>	$2.7 \pm 0.3$ [2.2–3.4]	$9.9 \pm 0.5$ [9.0–10.8]	$20.6 \pm 0.7$ [19.3–21.9]	$52.5 \pm 2.3$ [48.1–57.3]	$<.001$
TST (min) <sup>ab</sup>	$365.6 \pm 12.9$ [340.3–390.9]	$362.8 \pm 9.3$ [344.6–381.1]	$362.2 \pm 11.5$ [339.7–384.7]	$378.8 \pm 7.7$ [363.8–393.8]	.499
TST90 (min) <sup>ab</sup>	$1.8 \pm 0.6$ [0.9–3.4]	$30.6 \pm 7.5$ [18.9–49.6]	$24.1 \pm 5.9$ [14.9–39.0]	$100.1 \pm 14.9$ [74.8–133.9]	$<.001$
Mean $\text{O}_2$ saturation (%) <sup>ab</sup>	$94.1 \pm 0.3$ [93.5–94.7]	$93.0 \pm 0.2$ [92.6–93.5]	$93.3 \pm 0.3$ [92.7–93.8]	$91.5 \pm 0.4$ [90.7–92.3]	$<.001$
ODI (event /h of sleep) <sup>ab</sup>	$3.5 \pm 0.5$ [2.6–4.6]	$13.2 \pm 2.1$ [9.7–18.1]	$21.5 \pm 1.3$ [19.1–24.1]	$51.3 \pm 3.2$ [45.4–57.9]	$<.001$
Min $\text{O}_2$ saturation (%) <sup>ab</sup>	$87.6 \pm 0.6$ [86.3–88.8]	$84.5 \pm 0.6$ [83.3–85.8]	$81.3 \pm 0.7$ [79.9–82.7]	$73.4 \pm 1.2$ [71.2–75.7]	$<.001$
Min $\text{O}_2$ time (min) <sup>ab</sup>	$14.5 \pm 3.4$ [9.2–23.0]	$9.3 \pm 1.6$ [6.6–13.0]	$7.1 \pm 1.2$ [5.1–10.0]	$6.5 \pm 1.1$ [4.7–8.9]	.032
Arousal index (event /h of sleep) <sup>ab</sup>	$6.5 \pm 1.3$ [4.4–9.7]	$11 \pm 1.7$ [8.1–14.8]	$20.3 \pm 4.1$ [13.7–30.1]	$19.4 \pm 2.8$ [14.6–25.8]	$<.001$
EAT <sup>ab</sup>	$19.0 \pm 2.2$ [15.2–23.8]	$24.6 \pm 1.6$ [21.8–27.9]	$26.8 \pm 2.1$ [22.9–31.3]	$26.9 \pm 1.6$ [24.0–30.2]	.042
BDI <sup>ab</sup>	$14.7 \pm 1.8$ [11.5–18.8]	$15.6 \pm 1.8$ [12.4–19.5]	$14.1 \pm 1.4$ [11.6–17.1]	$13.9 \pm 0.9$ [12.3–15.9]	.869
BAI <sup>ab</sup>	$16.6 \pm 1.8$ [13.4–20.7]	$18.2 \pm 2.2$ [14.3–23.2]	$18.7 \pm 1.8$ [15.5–22.5]	$18.6 \pm 1.5$ [15.8–21.9]	.866

OSAS: obstructive sleep apnea syndrome; AHI: apnea–hypopnea index; TST: total sleep time; ODI: oxygen desaturation index; EAT: Eating Attitudes Test; BDI: Beck Depression Inventory; BAI: Beck Anxiety Inventory; BMI: body mass index.

<sup>a</sup>the age-and-BMI-adjusted mean  $\pm$  standard error (for age  $\cong 47.2$ , BMI  $\cong 31.7$ ), <sup>b</sup>95% Wald confidence interval [lower–upper].

significant difference in terms of the age-BMI-adjusted mean EAT score according to OSAS severity ( $p = .042$ ). The age-BMI-adjusted mean EAT score of the normal individuals was significantly lower than the values measured in individuals with mild, moderate, and severe OSAS ( $p = .039$ ,  $p = .011$ ,  $p = .006$ , respectively) (Table 1).

There was a significant difference in the age-and-BMI-adjusted mean values of the EAT according to the presence of OSAS ( $p = .023$ ). The age-and-BMI-adjusted mean value of the EAT was significantly higher in the OSAS positive group than in the OSAS negative group, however, there was no significant difference in terms of the age-and-BMI-adjusted BDI and BAI mean values between OSAS positive and OSAS negative groups ( $p > .05$  for each). There was a significant relationship between the presence of ED and OSAS ( $p < .001$ ). It was determined that 46.2% ( $n = 60$ ) of OSAS patients had impaired eating behavior by taking 30 or more points from EAT and this proportion was 7.4% ( $n = 2$ ) in OSAS negative group ( $p < .05$ ). There was no significant difference between the proportions of BDI status ( $< 17$ ,  $\geq 17$ ) according to the presence of OSAS ( $p = .218$ ). There was no significant difference between the proportions of BAI status ( $< 16$ ,  $\geq 16$ ) according to the presence of OSAS ( $p = .987$ ) (Table 2).

Nonparametric partial correlation coefficients between scales measured in both OSAS positive and OSAS negative patients after controlling for age-and-BMI are shown in Table 3. After controlling for age-and-BMI, no significant correlation was found between the EAT and the BDI ( $r = 0.012$ ,  $p = .890$ ) in patients with OSAS while there was a significant positive correlation EAT and the BAI ( $r = 0.177$ ,  $p = .046$ ). In addition, there was a significant positive partial correlation between beck depression and beck anxiety scales ( $r = 0.563$ ,  $p < .001$ ).

No significant correlation was found between the EAT and the BAI, BDI in OSAS negative patients after controlling for age-and-BMI ( $p > .05$ ). There was a significant positive correlation between BDI and BAI alone ( $r = 0.718$ ,  $p < .001$ ) after controlling for age-and-BMI. There was a significant positive partial correlation between EAT and the BAI ( $r = 0.184$ ,  $p = .022$ ), the BDI ( $r = 0.035$ ,  $p = .663$ ) in all individuals. In addition, there was a significant positive partial correlation between BDI and BAI ( $r = 0.590$ ,  $p < .001$ ).

## Discussion

In our study, it was found that OSAS patients had significantly higher EAT scores compared to OSAS negative control group and according to EAT cut-off score,

**Table 2.** Comparison between OSAS negative and OSAS positive groups in terms of eating attitudes and depression levels according to cut-off point.

	OSAS negative ( $n = 27$ )	OSAS positive ( $n = 130$ )	$p$ Value
EAT <sup>a,b</sup>	19.1 ± 2.2 [15.3–23.9]	26.2 ± 1.0 [24.3–28.3]	.011
BDI <sup>a,b</sup>	14.7 ± 1.8 [11.5–18.7]	14.8 ± 0.8 [13.1–16.0]	.932
BAI <sup>a,b</sup>	16.7 ± 1.8 [13.4–20.7]	18.5 ± 1.1 [16.5–20.7]	.415
EAT < 30	25 (92.6%)	70 (53.8%)	<.001
EAT ≥ 30	2 (7.4%)	60 (46.2%)	
BDI < 17	20 (74.1%)	80 (61.5%)	.218
BDI ≥ 17	7 (25.9%)	50 (38.5%)	
BAI < 16	12 (44.4%)	58 (44.6%)	.987
BAI ≥ 16	15 (55.6%)	72 (55.4%)	

OSAS: obstructive sleep apnea syndrome; EAT: eating attitudes test; BDI: beck depression inventory; BAI: beck anxiety inventory; Std: standard.  
<sup>a</sup>the age-and-BMI-adjusted mean ± standard error (for age  $\cong 47.2$ , BMI  $\cong 31.7$ ), <sup>b</sup>95% Wald confidence interval [lower–upper].

**Table 3.** Nonparametric partial correlation coefficients between scales measured in both OSAS positive and OSAS negative groups after controlling for age-and-body mass index.

OSAS		Beck Depression Inventory	Beck Anxiety Inventory
Negative ( $n = 27$ )	Eating Attitudes Test		
	$r$	0.147	0.158
	$p$	0.483	0.449
	Beck Depression Inventory		
Positive ( $n = 130$ )	$r$	1.000	0.718
	$p$	–	<.001
	Eating Attitudes Test		
	$r$	0.012	0.177
	$p$	0.890	0.046
	Beck Depression Inventory		
	$r$	1.000	0.563
	$p$	–	<.001

OSAS: obstructive sleep apnea syndrome.

it was found that ED was more frequent in OSAS patients than OSAS negative patients. And also there was a significant positive correlation EAT and the BAI in patients with OSAS after controlling for age-and-BMI. In the literature, a few studies have investigated the relationship between ED and sleep disorders. Most research that investigated the relationship between ED and sleep has focused on night eating syndrome [21]. And also in a few studies have shown a relationship between sleep apnea, restless legs syndrome and insomnia [22–24].

Since OSAS is a chronic disease, it may affect the quality of life of patients and cause psychiatric disorders. There have been reports that depressive symptoms can be associated with this sleep disorder. Although some have found no correlation, most studies have concluded that there is an association between OSAS and depressive symptoms [13]. In this

study, there was no significant difference in terms of the-age-and-BMI adjusted mean values of BDI and BAI between the OSAS positive and OSAS negative groups. Also, there was no significant difference in terms of the-age-and-BMI adjusted mean values of beck depression and beck anxiety scale according to OSAS severity. In a prospective study of sleep-disordered breathing among healthy elderly controls major depressives, sleep apnea was found in 17.6% of depressives, and 4.3% of controls [25]. A recent observational study using a Korean nationwide representative sample of 2004 through 2006 data on 985 individuals suggests that OSA is associated with an increased incidence of affective disorder, such as depression and anxiety [26].

It is suggested that major depressive disorder patients with residual depressive symptoms despite pharmacotherapy who also have symptoms of suspected OSAS, should be evaluated for sleep apnea by polysomnography and treated with an appropriate treatment such as continuous positive airway pressure (CPAP). CPAP treatment may result in a significant improvement in residual depressive symptoms due to the improvement of daytime sleepiness in these patients [27]. The presence of depressive symptoms among OSAS patients is of concern due to its relationship to diminished quality of life, decreased CPAP compliance [28].

Another significant result of this study is the difference in terms of the-age-and-BMI adjusted mean values of EAT score according to OSAS severity. The-age-and-BMI adjusted mean EAT score of the OSAS negative patients was significantly lower than the values measured in patients with mild, moderate, and severe OSAS.

In this study, after controlling the age-and-BMI, no significant correlation was found between the EAT and the BDI in patients with OSAS while there was a significant positive correlation EAT and the BAI. In a study from Chennai, it was that the ones who had abnormal eating attitudes had scored higher levels of depression and higher levels of both states as well as trait anxiety than those with normal eating attitudes [29].

In conclusion, the age-and-BMI adjusted mean EAT score was found to be significantly higher in patients with OSAS compared to OSAS negative cases, in accordance with our eating behavior disorder hypothesis. The limited number of patients and the fact that the scales used were not diagnostic were limitations of our study. Despite these limitations, we think that our study contributes to the literature in terms of

revealing the relationship between impaired eating behavior and OSAS.

Considering the association of OSAS with psychiatric disorders, the presence of EDs becomes an important and special topic. Treatment of patients with OSAS should not only aim to improve the patient's sleep apnea, but also to improve the patient's quality of life by evaluating the patient's psychological and physical functions.

### Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Ethics committee approval was received for this study from the ethics committee of Duzce University (2019-60).

### Informed consent

Informed consent was obtained from all individual participants included in the study.

### Disclosure statement

The authors declare that they have no conflict of interest.

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