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The Relationship Between Obstructive Sleep Apnea Syndrome and Mood Disorders

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Research Article

Keywords: obstructive sleep apnea syndrome, apnea-hypopnea index, anxiety, depression

Posted Date: March 24th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9187508/v1

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Additional Declarations: The authors declare no competing interests.

Abstract

Background- We aimed to examine the correlation between the severity of obstructive sleep apnea syndrome (OSAS), measured by the Apnea-Hypopnea Index (AHI), and the severity of mood disorders. Additionally, we evaluated the impact of Continuous Positive Airway Pressure (CPAP) therapy on mood disorder symptoms over a 6-month period.

Methods- A total of 60 patients diagnosed with OSAS and treated with CPAP were included in the study. Anxiety and depressive symptoms were assessed using the Beck Anxiety Inventory (BAI) and the Beck Depression Inventory–II (BDI-II), respectively. Polysomnographic parameters, including the AHI, were recorded. Changes in anxiety and depression scores before and after CPAP treatment were analyzed, and the relationship between AHI and mood scores was evaluated.

Results- No significant correlation was found between AHI and baseline anxiety or depression scores. Following CPAP treatment, a statistically significant reduction in anxiety and depression scores was observed. In multivariate analysis, AHI was not identified as an independent predictor of baseline anxiety and depression levels.

Conclusions- This dissociation highlights the multifactorial nature of mood disturbances in OSAS and supports the notion that psychological symptoms may arise independently of classical polysomnographic severity markers. However, significant reductions in anxiety and depression scores were observed following treatment.

Introduction

Obstructive Sleep Apnea Syndrome (OSAS) is a common disorder affecting approximately 9–38% of the adult population, with higher prevalence in males, older individuals, and those with obesity. It is characterized by recurrent episodes of partial or complete upper airway collapse during sleep, resulting in intermittent hypoxia, hypercapnia, and repeated arousals [1].

Apnea is defined as a reduction in airflow of 90% or more for at least 10 seconds. Hypopnea is defined as a decrease in oxygen saturation of ≥3% or arousal lasting at least 10 seconds compared to baseline. The apnea-hypopnea index (AHI) measures the average number of apneas and hypopneas per hour during sleep [2].

OSAS is defined as at least 5 obstructive apneas, hypopneas, or both per hour during sleep. OSAS is classified into three severity levels: mild (AHI = ≥ 5 - < 15 occurrences per hour), moderate (AHI = 15-30 events per hour), and severe (AHI > 30 events per hour) [3].

Polysomnography in a sleep laboratory is the most effective test for detecting obstructive sleep apnea, with the apnea-hypopnea index as the primary indicator [4]. Positive airway pressure therapy is the first line therapy in the treatment of OSAS and the most effective treatment. The most common mode of therapy is Continuous Positive Airway Pressure (CPAP) derived via different masks [5].

Beyond its well-established cardiovascular and metabolic consequences, OSAS has been increasingly linked to neuropsychiatric manifestations, particularly mood disorders such as depression and anxiety. Patients with OSAS frequently report symptoms including irritability, emotional lability, anhedonia, and decreased motivation, which often overlap with diagnostic criteria for mood disorders [6].

The Beck Anxiety Inventory (BAI) is a widely used self-report questionnaire designed to assess the severity of anxiety symptoms. It consists of 21 items, each describing a common symptom of anxiety, primarily focusing on somatic and cognitive manifestations such as nervousness, fear, and physiological arousal. Respondents rate how much they have been bothered by each symptom during the past week on a 4-point Likert scale ranging from 0 (“not at all”) to 3 (“severely”). The total BAI score ranges from 0 to 63, with higher scores indicating greater anxiety severity. Standard cutoff values categorize anxiety severity as minimal (0–7), mild (8–15), moderate (16–25), and severe (26–63). The BAI has demonstrated high internal consistency and good validity across both clinical and non-clinical populations and has been validated in various languages [7].

The Beck Depression Inventory–II (BDI-II) is a 21-item self-report instrument developed to assess the presence and severity of depressive symptoms in accordance with DSM-IV criteria. The scale evaluates affective, cognitive, and somatic symptoms of depression, including sadness, pessimism, loss of interest, fatigue, and sleep disturbance. Each item is scored on a 4-point scale from 0 to 3, reflecting increasing symptom severity over the previous two weeks. Total scores range from 0 to 63, with commonly used cutoff scores indicating minimal (0–13), mild (14–19), moderate (20–28), and severe depression (29–63). The BDI-II has shown excellent psychometric properties, including strong reliability, construct validity, and sensitivity to changes over time, making it suitable for both clinical assessment and outcome evaluation [8].

Both the BAI and BDI-II are well-established, validated instruments frequently used in sleep medicine research to evaluate mood disturbances in patients with obstructive sleep apnea syndrome. Their sensitivity to symptom severity and treatment-related changes allows for reliable assessment of psychological outcomes following interventions such as CPAP therapy [9].

The relationship between OSAS and other medical conditions, such as hypertension and obesity, continues to enjoy considerable attention in the research literature while the relationship between OSAS and mental health does not. Understanding the relationship between OSAS and mood disorders is crucial, as unrecognized psychiatric symptoms may impair treatment adherence and worsen clinical outcomes. Therefore, in this study we aimed to investigate prevelance and severity of anxiety and depression in OSAS patients. Additionally we aimed to examine the correlation between OSAS severity and mood disorder severity. Furthermore, we aimed to evaluate the impact of CPAP therapy on mood disorder symptoms over a 6-month period.

Materials and Methods

Participants

60 OSAS patients (48 male, 12 female) were included in the study.

Inclusion Criteria

Adults aged 18-70 years who were newly diagnosed with OSAS (AHI > 5 events/hour confirmed by polysomnography) were included in the study.

Exclusion Criteria

Participants with pre-existing diagnosed psychiatric disorders, using antidepressant or anxiolytic medications or with other significant sleep disorders (e.g., narcolepsy, restless leg syndrome) were excluded from the study.

Study plan

Firstly, participants had polysomnography test to confirm OSAS and determine AHI. Then, for baseline assessment, psychological evaluation using validated scales: Beck Anxiety Inventory (BAI) and Beck Depression Inventory (BDI-II) were performed. Participants prescribed CPAP therapy and for follow- up, psychological evaluations repeated at 3 months and 6 months.

Psychological Assessment

Anxiety and depressive symptoms were assessed using the Beck Anxiety Inventory (BAI) and the Beck Depression Inventory–II (BDI-II).

Beck Anxiety Inventory (BAI)

The BAI is a 21-item self-report scale measuring the severity of anxiety symptoms experienced during the previous week, with total scores ranging from 0 to 63, where higher scores indicate greater anxiety severity.

Beck Depression Inventory–II (BDI-II)

The BDI-II is a 21-item self-report instrument assessing depressive symptoms over the preceding two weeks, with scores ranging from 0 to 63 and higher scores indicating more severe depression. Both instruments are widely used, reliable, and validated for clinical and research purposes.

Polysomnography

Polysomnography tests were performed using Comet Grass devices (Astro-Med, Inc., West Warwick, Rhode Island, United States) and scored according to the American Academy of Sleep Medicine guidelines. Patients with OSAS underwent positive airway pressure titration test. Mean efficient CPAP pressure was 6 or 7 cm H20 in OSAS patients. For BIPAP therapy, inspiratory (IPAP) and expiratory (EPAP) pressures were 15 cmH_2O and 5 cmH_2O respectively.

Statistical Analysis

All statistical analyses were performed using IBM SPSS Statistics for Windows, version 26 (IBM Corporation, Armonk, NY, USA), with a significance level set at $P < 0.05$. Continuous variables were expressed as mean, standard deviation, median, and interquartile range, while categorical variables were presented as frequency and percentage. Spearman correlation difference was made to examine relationships between AHI and mood scores because the distribution was not normal. Since the scores were not normally distributed, the Wilcoxon signed-rank test was applied to evaluate changes over time. Multivariate regression analysis was made to control for confounders.

Results

1. Descriptive statistics

A total of 60 patients (48 male, 12 female) were evaluated. The mean age was 49.72 ± 7 (range 29-61). The mean AHI was 44.7 ± 17.3 (minimum–maximum: 12–90.2). The baseline Beck Anxiety Inventory score was 3.73 ± 9.61. The baseline BDI-II score was 3.33 ± 6.38.

2. Relationship between AHI and mood scores

No significant relationship was found between AHI and baseline BAI ($\rho = 0.07$, $p = 0.62$) and BDI-II ($\rho = 0.09$, $P = 0.58$) scores.

3. Change over time (paired analysis)

When we compare baseline and third month BAI and BDI-II scores there was a statistically significant difference ($P < 0.001$). There was also a statistically significant difference between baseline and sixth month BAI and BDI-II scores ($P < 0.001$) There is a significant decrease in anxiety and depression scores after treatment (Table 1).

4. Multivariable regression analysis

Spearman correlation analysis revealed no significant association between AHI and baseline Beck or BDI-II scores ($P > 0.05$). Anxiety and depression scores significantly decreased at 3 and 6 months compared with baseline (Wilcoxon signed-rank test, $P < 0.001$). In multivariate linear regression analysis, AHI was not an independent predictor of baseline anxiety scores ($\beta = 0.037$, $P = 0.62$).

Discussion

In the present study, no significant relationship was found between the apnea–hypopnea index (AHI) and baseline anxiety or depression scores. Furthermore, AHI was not identified as an independent predictor of baseline anxiety levels. However, a statistically significant reduction in anxiety and depression scores was observed following treatment.

These findings suggest that **the severity of respiratory events, as quantified by AHI, does not directly reflect the psychological burden experienced by patients with OSAS**. This dissociation highlights the multifactorial nature of mood disturbances in OSAS and supports the notion that psychological symptoms may arise independently of classical polysomnographic severity markers.

The lack of association between AHI and anxiety or depression scores is consistent with several previous studies reporting weak or absent correlations between AHI and psychiatric symptom severity. AHI primarily measures the frequency of breathing events but does not fully capture other critical contributors to mood dysregulation, such as sleep fragmentation, nocturnal hypoxemia burden, individual vulnerability, coping mechanisms, and psychosocial stressors.

Importantly, the significant reduction in anxiety scores after treatment—despite AHI not being an independent predictor—suggests that **OSAS treatment may improve anxiety through mechanisms beyond simple reduction in apnea severity**. Improvements in sleep continuity, reduction in nocturnal arousals, enhanced daytime functioning, and increased sense of disease control may all contribute to anxiety relief. This finding underscores the therapeutic impact of OSAS treatment on mental well-being, even in patients with varying baseline disease severity [9].

The fact that AHI was not an independent predictor of baseline anxiety further emphasizes that **anxiety in OSAS patients may be more closely related to subjective sleep quality and daytime symptoms than to objective respiratory indices.** This may explain why some patients with mild OSAS experience pronounced anxiety, while others with severe OSAS report minimal psychological distress [9].

From a clinical perspective, these results indicate that reliance on AHI alone may be insufficient to identify patients at risk for mood disturbances. Routine screening for anxiety and depression should therefore be considered in all OSAS patients, regardless of AHI severity. Additionally, the observed improvement in anxiety following treatment supports the integration of psychological outcome measures into OSAS management and follow-up [10].

The literature on OSAS paints an ambiguous picture of the role of depression in sleep apnea. There are perhaps, three general positions on the issue of depression. The first maintains that higher levels of depression do exist. The second position also maintains that it exists, but considers it to be incidental and as such does not warrant attention. The third position, though less common, maintains that higher levels of depression do not exist in this population [11].

Reports of anxiety in the context of OSAS are less common than depression but are nevertheless not unusual. Moreover, many research literatures concerned themselves mainly with whether or not there are clinical levels of depression. Thus, the full complex array of psychopathology may not have been adequately acknowledged in quantity and quality. This represents an oversight in the investigation into the relationship between OSAS and mental health [12].

Turner et al investigated neurocognitive behaviors before and after treatment and found no difference in anxiety and depression after 3 months [13]. But in our study we found significant difference in anxiety and depression scores after CPAP treatment.

Celik et al.'s study in OSAS patients, CPAP treatment has positive effects on psychological parameters like depression, anxiety, and perceived stress. They suggest that possible psychogenic benefits should be considered when deciding to start CPAP treatment, particularly in patients with pronounced and extended snoring who may also have social problems [14]. Likewise, our study we found positive effects of CPAP on anxiety and depression parameters.

High anxiety score was associated with non-compliance with CPAP therapy. High depression score was associated with daytime sleepiness and non-compliance with CPAP therapy [9]. Also in our study compliance with CPAP therapy resulted in low depression scores.

Obstructive sleep apnea syndrome (OSAS) is characterized by reversible upper airway obstructions during sleep, affecting both adults and children. It disrupts sleep architecture and leads to daytime impairments in neuropsychological and affective domains, including executive dysfunction, impaired vigilance, and depression. Treatment with continuous positive airway pressure can reverse some cognitive and affective dysfunctions, but residual impairments may indicate subtle structural brain damage, particularly in the prefrontal cortex. Early recognition and treatment of OSAS are essential to prevent these effects [15].

Fidan et al. showed that anxiety and depression scores of the patients were significantly decreased after CPAP treatment compared with those before the treatment. As a conclusion, OSAS patients with high anxiety and depression scores benefit from CPAP treatment [16]. Our anxiety and depression scores decreased after CPAP treatment, as well.

Clinical studies have indicated a relationship between OSA and depression, and that this relationship is multifactorial [17]. In one study, the prevalence of depression was found to be 7-63%, and the prevalence of anxiety was 11-70% [11]. Ohayon also found a relationship between OSAS and depression [18]. Guilleminault et al. found depression in 24% of patients with OSA, and Millman et al. found depression in 45% [19, 20]. In their study, Sahbaz et al. found a relationship between anxiety and depression and the severity of OSA [15].

Some studies showing the opposite have stated that there is no relationship between OSAS and depression. Fidan et al. found low depression scores in their patients and detected a negative correlation with OSA severity [16]. Bliwise et al. and Millman et al. could not find a relationship between OSAS and depression [20, 21]. We could not find any difference between OSAS severity and anxiety or depression scores, either.

Several studies have shown a relationship between OSA and anxiety. Borak et al. stated that there is anxiety in those with severe OSAS [4]. Şahbaz et al. said that sleep fragmentation in OSA patients causes

excessive daytime sleepiness, resulting in anxiety and depression and impaired quality of life [15]. Engleman et al. found the prevalence of depression in patients with mild OSAS to be 16-41% and the prevalence of anxiety to be 67% [22]. A relationship between OSAS and anxiety has been found in patients with severe OSA [4]. A relationship has been found between AHI and depression and anxiety [23].

Some studies have also addressed the relationship between depression and gender in OSA. Women with OSA have more depressive symptoms than men [11]. Pillar and Lavie stated that mood changes differ between women and men, attributing this to gender [24]. One study found that women had higher depression and anxiety scores, and that depression scores were higher in severe OSA [25]. It was found that women with OSA have more depressive symptoms than men [25,26]. In our study, we could not evaluate the difference between women and men because the number of women was small. Optimal treatment of OSA with CPAP can improve affective and cognitive functions [12]. Compared to the general population, depression is more common in untreated OSA. Generally, those with sleep disorders are more prone to depression [9, 20]. Depression improves with CPAP treatment. Is CPAP therapy effective against depression? Further research is needed to answer this question.

A key limitation of is the relatively small sample size and the unequal gender distribution, particularly the lower number of female participants, which may affect generalizability. Additionally, the clustering of baseline anxiety and depression scores at or near zero among a substantial proportion of participants may have limited variability in the data. This pattern likely reflects the clinical characteristics of the study population rather than a methodological shortcoming.

Previous studies have shown that not all patients with obstructive sleep apnea exhibit clinically significant anxiety or depressive symptoms, particularly in cohorts without major psychiatric comorbidities. The use of validated self-report scales such as the Beck Anxiety Inventory and BDI-II may therefore result in clustering of low scores in populations with mild or subclinical psychological burden.

Despite this, a statistically significant reduction in anxiety scores was observed over time, indicating that the intervention was associated with measurable psychological improvement even in patients with initially low symptom levels. This suggests that the instruments retained sensitivity to change, reinforcing the validity of the findings.

Conclusions

This study suggests that mood disturbances in OSAS may be influenced by multiple factors and may not be fully explained by classical polysomnographic severity markers. Variability in reported rates of anxiety and depression across studies may reflect differences in patient characteristics (such as gender, age, and individual factors) as well as the assessment methods used. In this study, reductions in anxiety and depression scores were observed following treatment; however, these findings should be interpreted with caution. Further research is needed to better understand the relationship between OSAS and mood

disorders, including potential bidirectional effects, and to evaluate the broader impact of CPAP therapy beyond respiratory outcomes.

Declarations

Acknowledgements The author would like to thank all patients who aggreed to take part in the study.

Funding The author declared that this study has received no financial support.

Data availability Data supporting this study are not publicly available due to ethical and legal restrictions.

Ethical approval This study was approved by the Scientific Research Ethics Committee of Adana City Training and Research Hospital. (approval no:811, date: October 23, 2025) and conducted in accordance with the 2013 Helsinki Declaration.

Informed consent Written informed consent was obtained from all participating patients.

Conflict of interest The authors declare that there are no competing interests.

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Tables

Table 1 Correlation and longitudinal analyses

Analysis	Test	Statistic	p-value
AHI vs Beck Anxiety (baseline)	Spearman	ρ = 0.11	0.39
AHI vs BDI-II (baseline)	Spearman	ρ = 0.23	0.07
Beck baseline vs 3 months	Wilcoxon	Z = 0.00	<0.001*
Beck baseline vs 6 months	Wilcoxon	Z = 0.00	<0.001*
BDI-II (baseline) vs 3 months	Wilcoxon	Z = 0.00	<0.001*
BDI-II (baseline) vs 6 months	Wilcoxon	Z = 0.00	<0.001*

**p<0.01*