

# The Association Between Obstructive Sleep Apnea and Depression in Older Adults

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## Abstract

**Background:** Depression is the most frequent psychiatric disorder among the elderly. Obstructive sleep apnea (OSA) is a chronic and prevalent disease that has an ambiguous role in triggering depression. Several researches with contradictory findings have been performed about the association between OSA and depression.

**Objectives:** This study aimed to investigate the association between OSA and depression among elderly.

**Patients and Methods:** A total of 350 home residing elderly took part in this case-control study. The participants were selected using clustering method. All cases were divided into two groups of depressed and non-depressed using the geriatric depression scale (GDS). Then they were matched in age, gender, education and body mass index (BMI). Berlin questionnaire (BQ) was used to diagnose OSA. Data analysis was performed using Mann-Whitney U test, t-test, Chi-square and Fisher's exact tests and odds ratio.

**Results:** Totally, 60.6 % of depressed group and 18.9 % of non-depressed group were in high risk for OSA. A significant association was found between OSA and depression ( $P < 0.001$ , OR = 6.61, CI 95 % = 4.1 - 10.7). In addition, a significant association was found between gender and OSA ( $P = 0.008$ ).

**Conclusions:** OSA was associated with depression among the elderly patients. Given the high prevalence of OSA in older adults, implementation of screening methods is necessary to identify people at high risk of OSA.

**Keywords:** Obstructive Sleep Apnea, Depression, Elderly

## 1. Background

Advances in science and technology have led to increase in life expectancy and the elderly population (1). Obstructive sleep apnea (OSA) is a serious health issue among the elderly. It is defined as a halt of breathing more than 10 seconds due to stop of air flow in the upper airway, which may be caused by obstruction, frequent arousal of sympathetic activity and hypoxia during sleep (2, 3). Futile efforts to breath during OSA exacerbate the chest negative pressure and awaken the patient (4). In addition, failing to treat OSA leads to cerebrovascular diseases and car accidents (5). More than 50% of the elderly are living with OSA (6). The important issue is the possible association between OSA and mental disorders such as depression (7, 8). Nowadays, depression is considered as the fourth leading cause of mortality worldwide and soon it would be the second (9). Previous reports have shown that the prevalence

of depressive symptoms is higher among people with OSA than those without it (10). Studies reported different prevalence of OSA-caused depression ranging from 6% to 54% (7, 8). However, some of the studies could not find an association between depression and OSA (10-12). Depression and OSA are two common entities with health complications. Then, it is important for care providers, especially nurses to take them and their possible association into account.

## 2. Objectives

The present study aimed to investigate the association between OSA and depression among the elderly living in Saqqez, Iran.

### 3. Patients and Methods

This case-control study was conducted from November 2014 to April 2015. Sample size was estimated based on Gassino et al. who reported that 71 % of depressed and 56 % of non-depressed people had OSA (13). Then, considering  $\beta = 0.20$ ,  $\alpha = 0.05$ ,  $P_1 = 0.71$  and  $P_2 = 0.56$ , 162 subjects estimated to be recruited in each group. However, we recruited 175 subjects in each group to achieve more reliable results. Sampling was continued until completion of sample size. Using geriatric depression scale (GDS) and abbreviated mental test (AMT) and face to face interviews, we selected 175 depressed people as the case group and 175 non-depressed people matched in age, gender, education and BMI as the control group. Depression was diagnosed when the total GDS score was 5 or more. Firstly, among all 11 healthcare centers in the area, 4 centers were randomly selected. Then, a total of 500 people over 60-years-old, who visited healthcare centers in Saqqez for routine education, were assessed to select the needed samples fit for the study groups.

Inclusion criteria were age  $\geq 60$ , living with family, referral to the healthcare centers, willing to participate in the study, lack of cognitive disorders (achieving score  $\geq 7$  in AMT, lack of hearing and visual impairments (because of their effect on depression), using no sleep medications and depression diagnosis according to GDS for the case group and excluding it for the control group.

All patients filled a demographic form, the berlin questionnaire (BQ) (14) to evaluate OSA and GDS (15) to assess depression. Because of inaccessibility, time consuming and high costs of polysomnography, BQ was used to identify OSA. BQ includes 10 questions, which are classified into 3 domains of snoring, drowsiness and blood pressure. Based on BQ, patients were divided into 2 groups; high risk and low risk for OSA. The domains 1 and 2 were considered positive if the total score was 2 or more. The third domain was considered positive in the case of high blood pressure (blood pressure  $\geq 140/90$ ) or BMI  $\geq 30$  kg/m<sup>2</sup>. The patient was considered to be at high risk of OSA if he or she had 2 or more positive zones. The scores of the Farsi version of 15 items GDS were also classified into 2 groups: 0 - 4 = non-depressed and  $\geq 5$  = depressed. Because absence of cognitive disorders is necessary to use GDS, AMT questionnaire with 10 questions was used to exclude those with cognitive disorders.

In this study, a number of experts confirmed the content validity of the instrument. The content validity index of BQ and GDS was calculated (CVI = 0.81 and 0.86 respectively). Moreover, the content validity ratio (CVR) of the individual items ranged between 0.70 and 0.95 for BQ and between 0.75 and 0.93 for GDS. The reliability of the BQ and

GDS was also assessed through interclass correlation coefficient (ICC = 0.82, 0.85) and Cronbach's alpha coefficient ( $\alpha = 0.75$ ,  $\alpha = 0.78$ ).

#### 3.1. Ethical Considerations

This study was conducted as a part of thesis with ethical code SBMU2.REC.1394.46, approved by Shahid Beheshti university of medical sciences. A written informed consent was obtained from participants before participation. They were assured about the data confidentiality and the questionnaires were anonymous.

#### 3.2. Data Analysis

Data distribution was not normal based on Kolmogorov-Smirnov test. Chi-square and Fisher's exact tests were used to compare the two groups. Mann-Whitney U and Chi square tests were used to identify the association between age and BMI with OSA. Chi-square test was used to examine the association between OSA and depression. Moreover, the odds ratio (OR) of OSA in the two sexes and also in depressed and non-depressed people was calculated. Data was analyzed using SPSS ver.13 (SPSS Inc., Chicago, IL, USA) and P value  $< 0.05$  was considered as statically significant.

### 4. Results

The mean age of case and control groups were  $69.42 \pm 7.95$  and  $68.08 \pm 7.48$  years, respectively ( $P = 0.174$ ). Regarding demographic variables, no significant differences were observed between the two groups except for smoking and occupation (Table 1).

Chi square test showed a significant difference regarding the risk of OSA between males and females ( $P = 0.008$ , OR = 1.80) (Table 2). However, no association was found between age and OSA ( $P = 0.454$ ). Moreover, chi square test showed a significant difference regarding the risk of OSA between depressed and non-depressed older adults ( $P < 0.001$ , OR = 6.61) (Table 2).

### 5. Discussion

The current study showed a significant association between depressive symptoms and the risk of OSA so that depressed participants were 6.61 times more than non-depressed ones at high risk of OSA. Consistently, Macey et al. showed that depression symptoms, daytime sleepiness and poor sleep quality are associated with high risks of OSA (7). Moreover, Douglas et al. reported that depression was directly related to the severity of daily drowsiness caused by OSA (16). Sharafkhaneh et al. showed high prevalence

**Table 1.** Demographic and Anthropometric Variables of the Elderly in the Study Groups<sup>a</sup>

Variables	Depressed	Non Depressed	P Value
<b>Gender</b>			0.915 <sup>b</sup>
Male	95 (49.7)	96 (50.3)	
Female	80 (50.3)	79 (49.7)	
<b>Marriage</b>			0.712 <sup>b</sup>
Married	128 (73.1)	132 (75.4)	
Divorced/widow	45 (26.9)	45 (24.6)	
<b>Education</b>			0.904 <sup>b</sup>
Literate	46 (26.3)	48 (27.9)	
Illiterate	129 (73.7)	127 (72.6)	
<b>Body mass index</b>			0.884 <sup>c</sup>
Low weight	3 (1.7)	2 (1.1)	
Normal	100 (57.1)	95 (54.3)	
Over weight	52 (29.7)	58 (33.1)	
Obesity	20 (11.4)	20 (11.4)	
<b>Smoking</b>			0.023 <sup>b</sup>
Yes	33 (25.5)	18 (25.5)	
No	142 (149.5)	157 (149.5)	
<b>Occupation</b>			0.025 <sup>b</sup>
Employed	28 (36.5)	45 (25.7)	
Unemployed	147 (63.5)	130 (74.3)	

<sup>a</sup>Data are expressed as No. (%).<sup>b</sup>Chi square.<sup>c</sup>Fishers exact test.**Table 2.** Frequency of Obstructive Sleep Apnea Based on Gender, Depression and Risk of OSA<sup>a</sup>

Obstructive Sleep Apnea	High Risk of OSA	Low Risk of OSA
<b>Gender</b>		
Male	88 (46.1)	103 (53.9)
Female	51 (32.1)	108 (67.9)
P value= 0.008, OR= 1.80, CI 95%= 1.4 - 2.2		
<b>Depression</b>		
Depressed	106 (60.6)	69 (39.4)
Non-depressed	33 (18.9)	142 (81.1)
P value <0.001, OR= 6.61, CI 95%= 3.96-11.07		

Abbreviation: OSA, obstructive sleep apnea.

<sup>a</sup>Data are expressed as No. (%).

of depressive disorders in OSA patients (17). Although the association between depression and OSA is still controversial, these studies confirm our findings regarding the association between depression and OSA in older adults. A re-

cent study suggested that the association between depression and OSA can be mediated by other factors such as patients' quality of life (11).

No certain mechanism is able to explain the associa-

tion between depression and OSA. However, people with OSA have a fragmented and ineffective sleep and hypoxia, as a neurobiological risk factor. Depression is also resulted from decline in blood serotonin and functioning of its receptors that both affect sleep (2) and airway dilator muscles activity. Although the role of serotonin in depression is widely proved, its role in the occurrence of apnea is still controversial (6). The controversy about the association between OSA and depression in different studies (10-13) might be attributed to differences in sample sizes, study population, gender distribution, age, race, matched factors, instruments and overlapping between OSA and depression. In the present study, the two groups were matched for age, gender, education and BMI to minimize the bias of confounding factors. However, some of the known or non-quantifiable factors could not be removed. For example, large tonsils and adenoids and craniofacial abnormalities are risk factors for OSA and we could not exclude patients with these problems. The differences in the result of the current study might also be attributed to screening and selection of OSA patients, because patients' selection in this study was based on screening tools, while in earlier studies PSG was the golden standard method.

In the present study, the risk of OSA was higher in men than women, which is consistent with the results of some of the earlier studies (10, 18). The exact reason for variation between men and women has not been established yet. Previously OSA was known as a men's disease and male gender is an important factor in some of the OSA screening scales (19).

OSA and depression are both disorders that often occur together and are associated with serious health consequences. Healthcare professionals including physicians and nurses must be aware of this association and should seriously assess all depressed older adults for the risk of OSA.

Our study had some limitations. Given that this study was conducted in one of the remote areas of Iran, time, budget and access to the gold standard instruments for diagnosing OSA were some of the limitations. Another limitation was that depression diagnosis was based on questionnaire, rather than clinical interview or examination by a psychiatrist. Further studies using more reliable diagnostic instrument are recommended to find a causal link between depression and OSA.

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## Footnote

**Authors' Contributions:** Mohammad Farajzadeh wrote the proposal and collected the data; Meimanat Hosseini designed the methodology; Jamileh Mohtashami analyzed data; Samira Chaibakhsh and Mansoureh Zagheri Tafreshi analyzed data and wrote the manuscript; Reza Ghanei Gheshlagh edited the manuscript.

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