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Original Article

Analysis of demographic and anthropometric measurements of individuals with sleep apnea syndrome according to gender

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Abstract

Aim: In order to better understand and diagnose Obstructive Sleep Apnea Syndrome (OSAS), which develops as a result of changes in the respiratory pattern during sleep, some morphometric measurements should be made. Our aim in the study is to compare the morphometric measurements, which are the gold standard in the diagnosis of OSAS patients, in terms of gender.
Materials and Methods: 79 patients (53 male-26 female) aged 30-65 years with OSAS diagnosis were included in the study. After recording the patients' demographic information (age, gender, height, weight), neck circumference, waist circumference, hip circumference and waist/hip ratio data were recorded.
Results: When comparing patients with OSAS by gender in the study, there were no significant differences in weight, but there were significant disparities in age, height, and body mass index (BMI) results ($p<0.05$). An analysis of the anthropometric data revealed a statistically significant difference ($p<0.05$) between the waist and hip circumference values. Women were found to have a larger hip circumference than men in both measures. The waist/hip ratio and neck circumference did not differ ($p>0.05$). According to the correlation study, there was a moderately strong positive link between hip circumference and weight and BMI, and a strong positive correlation between waist circumference, hip circumference, and BMI.
Conclusion: Morphometric measurements of OSAS patients are essential in the identification and diagnosis of the disease. We believe that treatment protocols should be different for female and male OSAS patients due to these morphometric differences.

Keywords: Obstructive sleep apnea syndrome, neck circumference, hip circumference, waist circumference, waist/hip ratio

INTRODUCTION

In medical anthropology, which is a science that investigates the effects of biological and socio-cultural characteristics in human behavior on disease and health, the composition, proportions and type of the human body are revealed and their effects on chronic diseases are investigated. In addition to being used in the follow-up and treatment of diseases, they are also important in terms of predicting chronic diseases (1).

Characterized by the disruption of the respiratory pattern as a result of partial or complete closure of the airways during sleep, OSAS is estimated to have a prevalence rate of 5-14% in the general population, while a recent study has shown that this rate varies between 24-50% (2,3). Although OSAS can be seen at any age and gender, it is most commonly seen between the ages of 40-60, and 80-90 % of middle-aged individuals remain undiagnosed (3,4) 3-7% in men and 2-5% in women, and even 2-3 times more in men than in women in some sources (2,4,5).

The most important risk factor for OSAS is body weight exceeding the normal limit (1,2,4,6). OSAS is observed in 60-90% of overweight individuals (4). It has long been accepted that fat distribution in the upper body is associated with an increased risk of cardiovascular disease, and neck skin fold or neck

circumference has been used as an index for such an adverse risk profile. It has been reported that free fatty acid release from subcutaneous adipose tissue in the upper body is greater than that from the (7).

Although polysomnography (PSG) examination is frequently used in the diagnosis of OSAS, it is an expensive, time-consuming and teamwork-requiring procedure, so anthropometric data that can be associated with OSAS have been investigated (6). Since OSAS is mostly associated with obesity, instead of limited and expensive PSG examination , it is thought that using obesity (6). The primary instruments for evaluating health, particularly with regard to obesity, are anthropometric measurements. The most widely used measurements are waist circumference, neck circumference, waist-to-height ratio, and body mass index (BMI). Anthropometric measurements have a strong clinical correlation, are easily available, affordable, and easy to utilize. They have a high association with sleep apnea and have been shown to be effective in evaluating health in general (8). Because it can predict the occurrence of sleep apnea, neck circumference is a factor that is frequently taken into account in sleep medicine (9). Generally speaking, visceral fat accumulation is directly linked to larger anthropometric measurements, and this raises the risk of insulin resistance, type 2 diabetes, metabolic syndrome, and cardiovascular diseases. When determining the severity of OSAS, anthropometric measurements are crucial (10).

In this study, it was aimed to evaluate patients with OSAS according to gender by performing anthropometric measurements.

MATERIALS AND METHODS

The study included 79 patients aged 30-65 years diagnosed with OSAS. Of these patients, 52 were male (65.8%) and the mean age was 51.00±7.82 years, while 27 were female (34.2%) and the mean age was 56.38±8.45 years. The sample size was calculated using G- Power 3.1.7 software with effect size=0.72, 80% confidence interval, α=0.05 and 1-β=0.80 (11) apnea -hypopnea index (AHI, events/hour) ≥15 in polysomnography) in the Chest Clinic of Ersin Aslan Training and Research Hospital were included in the study. The study was conducted in accordance with the Declaration of Helsinki.

Inclusion and Exclusion Criteria for the Study

This study comprised people over the age of 18 who were open to communication, could follow directions, had no cognitive issues, and did not have chronic chest disease or discomfort. This study excluded participants with a history of smoking and alcohol use, cognitive impairments, chronic illnesses (apart from OSAS), regular medication users, and people who were not communicative.

Data Collection Process

After the volunteers were informed about the study, they signed consent forms. The sociodemographic information of each patient was recorded in the patient information form.

Anthropometric Measurements

Age, Height, Weight and Body Mass Index Measurements

With an accuracy of 0.1 cm, the patients' heights were measured in centimeters while they were standing barefoot, and their ages were recorded in years. The Tanita Corporation (Tokyo, Japan, Tanita BC Segmental Body Analysis System) was used to measure their weights in kilograms while they were standing barefoot and metal-free. By dividing weight by height squared (kg/m^2), BMI was determined (12).

Working Design

The study involved the voluntary and random selection of people with an OSAS diagnosis. The neck circumference was measured in the middle of the neck, halfway between the middle cervical vertebra and the middle anterior neck, and if perceptible, immediately below the laryngeal prominence to 0.5 cm, following the registration of the patient's demographic data (age, gender, height, and weight). The subject's waist circumference was measured between the 12th costa and the crista while they were standing and just wearing their underpants. positioned between the iliac crests for measurement. The ratio of waist to hips shows core fatness. Using a 7 mm broad tape measure, measurements of the waist and hip circumference were obtained from anatomical positions. Although the tape measure totally surrounded that bodily portion, it did notcompress the subcutaneous fat tissue (13).

Ethical Approval

The study ethic approval, Gaziantep Islam Science and Technology University Interventional Non Clinical Researches Ethic From the Board dated 03.11.2023 and numbered 2023/279 approval with has been taken.

Statistical Analysis

Study data descriptive statistics, numerical Variables for average And standard deflection using presented. Measurements distribution of normality Kolmogrov -Smirnov (men for) and Shapiro Wilk (for women for) test using evaluated (n≤30). Genders between Relationships to evaluate for, normally distributed in the data compare for independent sample t- test non-normal distribution in the data is the Mann Whitney U test was used. Also, numeric Variables between Relationships Pearson correlation analysis using analysis All statistical Analyses were performed using SPSS 22.0 (IBM Corp., Armonk, NY). was realized And meaningfulness level as $p<0.05$ determined.

RESULTS

When comparing patients with OSAS by gender in the study, there were no significant variations in weight, but there were significant differences in age, height, and BMI findings ($p<0.05$) (Table 1). Men were found to have OSAS pathology at a younger age than women, despite the fact that their height and BMI were much lower.

The waist and hip circumference measurements showed a statistically significant difference ($p<0.05$) when anthropometric data were evaluated (Table 1). Women were found to have a larger hip circumference than men in both measures. The waist/hip ratio and neck circumference did not differ ($p>0.05$).

Table 1. Distribution of demographic and anthropometric measurements of obstructive sleep apnea patients by gender

Parameters	Male Mean±SD	Woman Mean±SD	Total Mean±SD	p
Age (years)	51.12±7.85	56.63±8.39	52.92±8.41	0.005*§
Height (cm)	168.82±11.18	156.44±7.47	164.67±11.61	<.001*‡
Weight (kg)	91.77±11.96	95.85±19.77	93.39±15.14	0.259§
BMI (kg/m²)	32.91±9.90	39.24±7.95	35.11±9.65	<.001*‡
Neck circumference (cm)	45.39±3.67	45.56±5.89	45.47±4.5	0.878
Waist circumference (cm)	115.16±8.24	119.85±11.11	116.80±9.47	0.011*‡
Hip circumference (cm)	123.82±9.62	131.52±13.33	126.35±11.55	0.004*§
Waist/hip ratio	0.93±0.06	0.91±0.05	0.92±0.05	0.143

*Significance level: ($p<0.05$), **Significance level: ($p<0.001$), §: Student -t test, Mann-Whitney U test, BMI: body mass index, SS: standard deflection

Correlation analysis of the obtained demographic data and anthropometric measurement values was performed separately for both genders and it was determined that in men, there was a moderate positive correlation between neck circumference and hip circumference and weight values ($p<0.05$; $0.5<r<0.7$), and a weak positive correlation between waist circumference and BMI values ($p<0.05$; $0.2<r<0.5$). While a moderate positive correlation was observed between waist circumference, hip circumference and weight values ($p<0.05$; $0.5<r<0.7$), a weak positive correlation was observed with waist-hip ratio ($p<0.05$; $0.2<r<0.5$). While a weak negative correlation was found between hip circumference values and waist-hip ratio ($p<0.05$; $0.2<r<0.5$), a moderate positive correlation was found with weight values ($p<0.05$; $0.5<r<0.7$). While there was a high negative correlation between BMI and height ($p<0.05$; $0.7<r<0.9$), there was a weak positive correlation between weight ($p<0.05$; $0.2<r<0.5$) (Table 2).

Table 2. Correlation results of demographic and anthropometric measurements of male patients with obstructive sleep apnea

		Neck circumference	Waist circumference	Hip circumference	Waist hip ratio	Size	Weight	BMI
Age	**r**	0.009	0.082	0.222	-0.172	0.076	0.022	-0.117
	p	0.950	0.564	0.113	0.224	0.593	0.880	0.410
Neck circumference	**r**		**0.479 ****	**0.548 ****	-0.137	-0.035	**0.697 ****	**0.360 ****
	p		**0.000**	**0.000**	0.334	0.806	**0.000**	**0.009**
Waist circumference	**r**			**0.673 ****	**0.308 ***	0.155	**0.637 ****	0.175
	p			**0.000**	**0.026**	0.273	**0.000**	0.216
Hip circumference	**r**				**-0.492 ****	0.062	**0.543 ****	0.187
	p				**0.000**	0.661	**0.000**	0.186
Waist hip ratio	**r**					0.091	0.037	-0.040
	p					0.522	0.795	0.780
Size	**r**						0.117	-0.804 **
	p						0.409	0.000
Weight	**r**							0.437 **
	p							0.001

*Significance level: ($p<0.05$), **Significance level: ($p<0.001$), r: correlation coefficient, BMI: body mass index

When the correlation analysis of female patients diagnosed with OSAS was examined, a high positive correlation ($p<0.05$; $0.7<r<0.9$) was found between neck circumference and waist and hip circumference values, a moderate positive correlation ($p<0.05$; $0.5<r<0.7$) with BMI, and a weak positive correlation ($p<0.05$; $0.2<r<0.5$) with weight values. When waist circumference values were examined, a high positive correlation ($p<0.05$; $0.7<r<0.9$) was found between hip circumference values, a moderate positive correlation ($p<0.05$; $0.5<r<0.7$) was found between weight and BMI values. A

moderate positive correlation ($p<0.05$; $0.5<r<0.7$) was found between hip circumference values and weight and BMI values, and a weak negative correlation ($p<0.05$; $0.2<r<0.5$) was found between waist circumference values and waist-hip ratio. In women, unlike men, a moderate positive correlation was observed between BMI and age ($p<0.05$; $0.5<r<0.7$), a high positive correlation with weight ($p<0.05$; $0.7<r<0.9$), but no correlation was found with height (Table 3).

Table 3. Correlation results of demographic and anthropometric measurements of female patients with obstructive sleep apnea

		Neck circumference	Waist circumference	Hip circumference	Waist hip ratio	Size	Weight	BMI
Age	**r**	0.195	0.227	0.215	0.003	-0.371	0.272	**0.465***
	p	0.328	0.254	0.281	0.986	0.057	0.170	**0.014**
Neck circumference	**r**		**0.712****	**0.721****	-0.150	-0.253	**0.388***	**0.516****
	p		**0.000**	**0.000**	0.454	0.203	**0.046**	**0.006**
Waist circumference	**r**			**0.868****	0.110	-0.187	**0.564****	**0.658****
	p			**0.000**	0.585	0.350	**0.002**	**0.000**
Hip circumference	**r**				**-0.395***	-0.211	**0.513****	**0.623****
	p				**0.041**	0.291	**0.006**	**0.001**
Waist hip ratio	**r**					0.069	0.020	-0.022
	p					0.731	0.921	0.912
Size	**r**						0.230	-0.236
	p						0.249	0.235
Weight	**r**							0.889**
	p							0.000

*Significance level: ($p<0.05$), **Significance level: ($p<0.001$), r: correlation coefficient, BMI: body mass index

DISCUSSION

OSAS patients according to gender, significant differences were found in age, height, BMI, waist and hip circumference values. It was observed that all parameters except age were lower in men than in women. While BMI showed a positive correlation with neck circumference and weight in men and a negative correlation with height, all parameters except waist-hip ratio and height showed a positive correlation in women. According to the obtained data, it was seen that neck circumference showed a statistically significant positive correlation in addition to BMI in OSAS patients , this correlation was higher in women, but there was no significant difference between the sexes. It was seen that our findings were consistent with the literature (6).

Neck circumference or waist/hip ratio in OSAS There are studies reporting that it is a (14-16). In a study conducted on obese women, it was reported that those with a neck circumference of 38 cm and above had a sensitivity of (14). In our study, the neck circumference was 45 cm in both genders and this value was higher than the value in the literature.

In a study comparing obese and non-obese OSAS patients, the mean BMI was 24.37±3.09 kg/m^2 in non-obese individuals, while this index was 34.27±8.34 kg/m^2 in obese individuals, showing a statistically significant difference (17). In the same study, the neck circumference was measured as 36.10±3.62 cm on average in non-obese individuals, while it was measured as 39.21±4.18 cm on average in obese individuals, and it was reported that these values constituted a statistically significant difference (17). Kabeloğlu & Öztürk et al. reported that BMI values were 33.24±6.13 kg/m^2 in women and 30.04±4.22 kg/m^2 in men when evaluating patients with OSAS, and were significantly higher in women than in men (18). In a multicenter study conducted in the Turkish population and covering all regions, when anthropometric measurements were compared according to gender, it was reported that neck circumference was 42.58±0.10 cm in men and 39.24±0.16 cm in women, BMI value was 31.39±0.13 kg/m^2 on average in men with OSAS and 36.02±0.84 kg/m^2 in women, hip circumference was 110.41±0.26 cm on average in men and 118.84±0.58 cm in women, waist/hip ratio was 0.99±0.002 in men and 0.93±0.004 in women, and this difference was statistically significant, and there was no statistical difference in waist circumference values (14). Although results close to the literature were obtained in anthropometric measurements in this study, no significant difference was found in parameters other than age, height, BMI, waist and hip circumference measurements. It may be thought that sample size or population differences may cause this situation.

In a study comparing moderate and severe OSAS patients with the control group, BMI values were found to be 34.09±1.48 mm in severe OSAS patients, 30.15±1.59 mm in moderate OSAS patients, and 29.81±0.75 mm in the control group, and they reported that significant differences were found between severe OSAS patients and the control group (19). In the same study, waist circumference was found to be 107.50±2.93 cm in severe OSAS patients, 99.80±4.05 mm in moderate OSAS patients, and 96.70±2.45 mm in the control group, hip circumference was

found to be 113±3.03 mm in severe OSAS patients, 105.5±2.14 mm in moderate OSAS patients, and 106.4±1.36 mm in the control group, and they reported that there was no significant difference between the patient groups and the control group (19). In their study examining the relationship between OSAS severity and anthropometric measurements, Ayyıldız et al. reported that there were significant differences in body weight, BMI, waist circumference, hip circumference, waist/hip ratio and neck circumference in men according to the severity of OSAS, while in women, there were significant differences only in BMI and waist circumference values according to the severity (20). In a study examining the relationship between acromegaly and OSAS, BMI was found to be 31.09±2.92 kg/m^2 in patients with OSAS and 27.76±3.13 kg/m^2 in patients without OSAS, waist circumference was found to be 101.82±3.41 cm in patients with OSAS and 83.43±4.2 cm in patients without OSAS, hip circumference was found to be 97.36±2.12 cm in patients with OSAS and 96.51±2.53 cm in patients without OSAS, waist/hip ratio was found to be 1.06±0.21 in patients with OSAS and 0.84±0.13 in patients without OSAS, and significant differences were found in these parameters between patients with and without OSAS (21). In a study comparing sarcoidosis patients with and without OSAS, waist circumference was measured as 95.4±8.1 cm in those with OSAS and 89.3±10.3 cm in those without, and a statistically significant difference was found. No difference was found in other anthropometric measurements used as (22). Since anthropometric measurements were not evaluated according to gender, comparisons with this study could not be made.

CONCLUSION

As a result of the study, when the relationship between OSAS and anthropometric and demographic data was evaluated according to gender, it was concluded that there were significant differences in age, height, BMI, waist and hip circumference lengths. It is thought that the parameters where no significant difference was found may be due to the sample size. Therefore, it is recommended that studies be conducted to investigate the detailed morphology of OSAS patients with a larger population and healthy groups.

Conflict of Interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
The authors declare that they have received no financial support for the study.

Ethical Approval
The study ethic approval, Gaziantep Islam Science and Technology University Interventional Non Clinical Researches Ethic From the Board dated 03.11.2023 and numbered 2023/279 approval with has been taken.

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