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OBSTRUCTIVE SLEEP APNEA IN PATIENTS WITH OVERWEIGHT AND OBESITY

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ABSTRACT

Overweight and obesity is more common in the population, and represents a risk factor for obstructive sleep apnea (OSA).

The aim of the study was to obtain data on the occurrence of obstructive sleep apnea in Macedonia since there are no official statistics related to this issue and to examine its association with overweight and obesity.

The study included 200 patients with minimum positive 2 of 3 OSA symptoms that included snoring, witnessed apnea and daytime sleepiness. Body mass index (BMI) was calculated and patients were divided into groups according to BMI. After that all patients underwent polisomnography (PSG). After PSG all patients were divided into groups according to severity of OSA based on respiratory disturbance index (RDI). All patients with RDI over 5 were diagnosed with OSA.

According to BMI, 21 patients were with normal weight, 99 patients were overweight and 80 patients were obese. According to severity of OSA, 17 were with mild OSA with RDI between 5-15, 44 with moderate OSA with RDI between 15-30, and 80 patients were with severe OSA with RDI>30. Comparing the groups we came to the conclusion that with the increase of BMI, RDI was increasing too. Appearance of severe OSA showed a clinically significant difference in obese patients compared to normal and overweight patients. On the other hand, there was no significant difference in the severity of OSA in overweight patients. OSA was rarely seen in patients with normal weight.

Gaining weight increases the risk of OSA. BMI is perhaps simple but important predictor of OSA development, especially the severe form. ***Keywords:*** BMI, RDI**,** obesity

INTRODUCTION

Obstructive sleep apnea (OSA) is a common chronic disorder affecting about 2–4% of the adult population, with the highest prevalence reported among middle-aged men [1]. Obstructive sleep apnea (OSA) is characterized by recurrent episodes of partial and complete airway obstructions during sleep with repetitive apneas and hypopneas [2]. The obstructive events (apneas or hypopneas) cause a progressive asphyxia that increasingly stimulates breathing efforts against the collapsed airway, typically until the person is awakened [3]. OSA is often closely associated with other conditions which are recognized causes of morbidity and mortality such as obesity, metabolic syndrome, atherosclerosis, systemic inflammation, insulin resistance and type 2 diabetes mellitus [4, 5]. It has been reported that untreated OSA may shorten the lifespan of patients by up to 20 years [6]. Risk factors include snoring, male gender, middle age, menopause in women, obesity and a variety of craniofacial and oropharyngeal features such as a large neck circumference, retro- or micrognazia, nasal obstruction, enlarged tonsils/adenoids, macroglossia and low-lying soft palate [7]. On the other hand, modern society is currently faced with a serious global obesity epidemic. Recent estimates suggest that 60% of the adult population in industrialized countries is overweight (BMI $\geq$ 25 kg/m^2) and at least 30% is obese (BMI $\geq$ 30 kg/m^2) [8]. Obesity is a potent risk factor for the development and progression of sleep apnea. There is a consistent relationship between obesity and OSA, with a body mass index (BMI) ≥30 kg/m2 having been reported in 60-90% of OSA patients. As the prevalence of obesity increases, there is likely to be a parallel increase in the prevalence of OSA. The prevalence of OSA in the adult population is estimated to be about 25%, rising to 45% in obe se individuals [9].

The aim of the study was to obtain data on the occurrence of obstructive sleep apnea in Macedonia since there are no official statistics related to this issue and to examine its association with overweight and obesity.

METHODS

The study included 200 patients and was conducted at the University Clinic of Pulmonology and Allergy in Skopje. Inclusion criteria were positive 2 of 3 clinical symptoms for OSA. The symptoms were snoring, witnessed apnea and daytime sleepiness. Body mass index (BMI) was calculated and patients were divided into groups according to BMI. Patients with BMI from 18.5 to 25 were normal weight patients. Patients with BMI 25>30 were overweight, and with BMI>30 were obese patients. All patients underwent polysomnography. In this study we used polysomnograph Respironix, model Alice 5.

All results from polysomnography were scored manually according to standard criteria. Apnea, hypoapnea and arousals were also identified according to standard criteria and summarized in the form of a respiratory disturbance index (RDI). All patients with RDI below 5 were diagnosed as negative, patients with RDI 5>15 were diagnosed as having mild OSA, patients with RDI 15>30 as moderate OSA, and patients with RDI>30 were diagnosed as severe OSA.

RESULTS

The study included 200 patients of whom 51 were females with an average age of 49 ± 9 years and 149 were men with an average age of 47 ± 9 years. There were no significant clinical differences in age groups with BMI and RDI, but there was a difference in the occurrence of OSA in men versus women. A total of 109 (73.2%) male patients were diagnosed with OSA, and 31 (62.8%) of female patients. According to BMI, patients were divided into 5 groups (Table 1). There were no patients with BMI <18.5, 21 patients were with normal BMI, while 99 (49.5%) patients were overweight and 80 (40%) patients were obese.

Table 1. Patients stratified by BMI

BMI (Kg/m^2)	Number of patients
<18.5	0 (0%)
18.5-24.99	21 (10.5%)
25-29.99	99 (49.5%)
30-34.99	56 (28%)
35-39.99	20 (10%)
40>	4 (2%)

According to RDI, 59 (29.5%) patients were RDI < 5, or negative patients. 141 patient were diagnosed with OSA, of whom 17 (8.5 %) patients were RDI 5> 15, 44 (22%) patients were RDI 15 > 30, 80 (40%) patients were with RDI > 30 (Table 2).

Table 2. Patients stratified by RDI

RDI 0>5	59 (29.5%)
RDI 5>15	17 (8.5%)
RDI 15>30	44 (22%)
RDI >30	80 (40%)

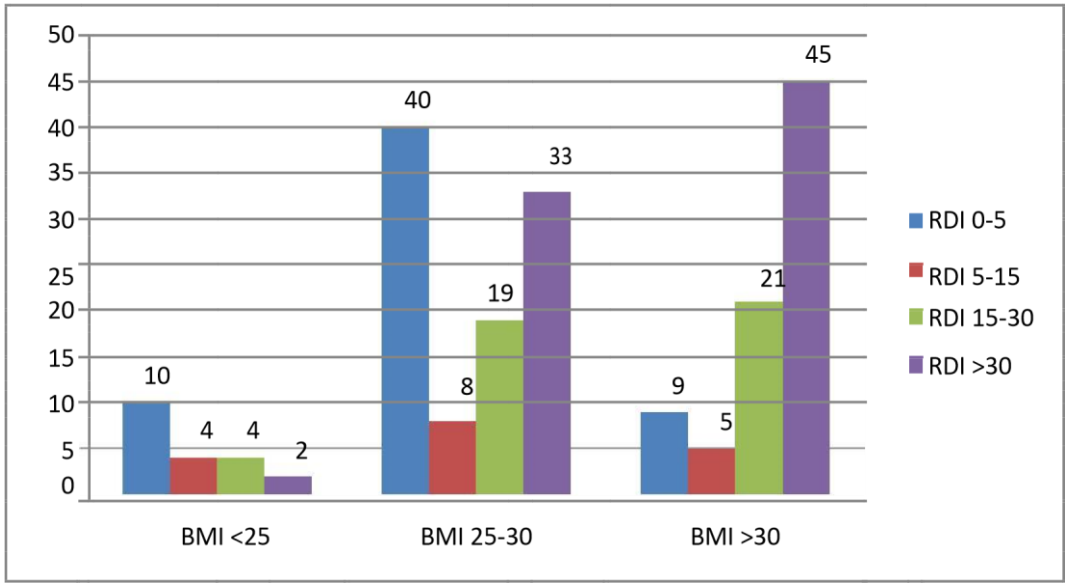

Fig. 1. Diagnosis of OSA in relation to BMI

Patients with BMI <25 had the lowest chance to be OSA positive. The emergence of severe OSA significantly increases with increasing BMI. In overweight patients there was no significant difference in the occurrence of OSA.

Table 3. Comparison between RDI groups according to BMI

Groups	RDI	BMI
		X ± SD
1	1-4.99	27.44 ± 2.98 [a, b]
2	5-14.99	28.05 ± 3.70 [c]
3	15-29.99	29.64 ± 4.12 [a, d]
4	> 30	31.92 ± 4.23 [b, c, d]

(a), p=0.022; (b), p=0.000; (c), p=0.001; (d), p=0.009

Patients who were OSA negative, had statistically significant lower BMI compared to patients with moderate and severe OSA. Patients with mild and moderate OSA had statistically significant lower BMI compared to those with severe OSA.

Table 4. Comparison between BMI groups according to RDI

Groups	BMI	RDI
		X ± SD
1	18.5-24.9	11.38 ± 11.26 [a,c]
2	25-29.9	23.15 ± 21.74 [b,d]
3	30-34.9	36.07 ± 21.97 [a,b]
4	35-40	48.50 ± 8.63 [c, d]
5	> 40	44.50 ± 3.90

(a), p=0.002; (b), p=0.012; (c), p=0.000; (d), p=0.000

There was no significant difference in RDI among patients with normal weight and overweight. But with BMI increasing, we found parallel RDI increase. Patients with normal weight and overweight had a significantly smaller RDI compared to obese patients. Statistical comparison with patients with BMI>40 was not made, because the number of patients in that group was very small.

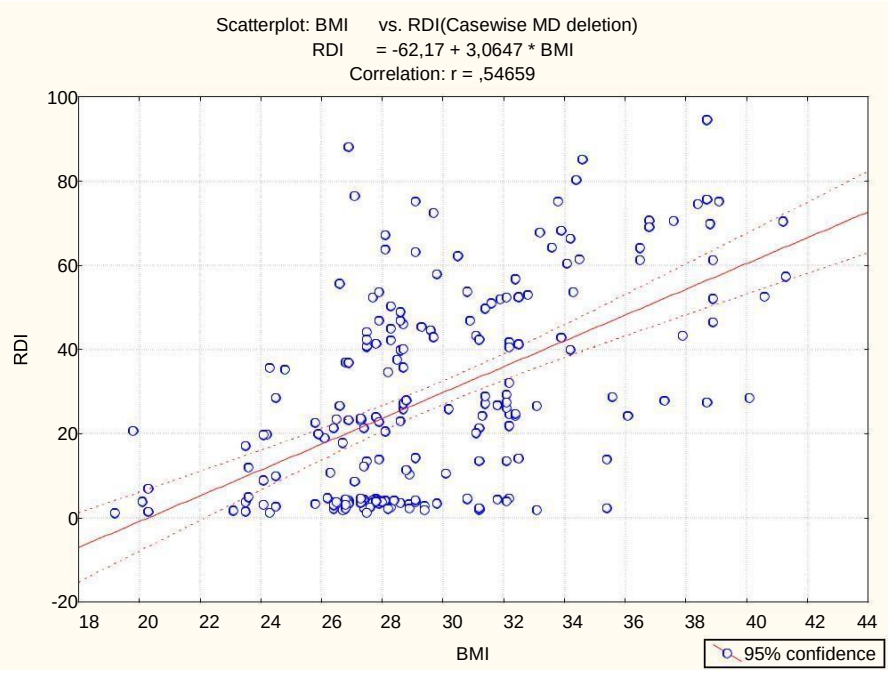

Fig. 2. Correlation between BMI and RDI

Correlation was found between BMI and RDI (r = 0.546, p = 0.000). With the increase of BMI there was a detectable increase in RDI.

DISCUSSION

Several risk factors, including obesity, male sex, age, and heritable factors, have been associated with an increased prevalence of obstructive sleep apnea in the general population [1]. OSA is primarily regarded as a male disorder. In our study 149 patients were male and 109 (73.2%) were OSA positive. 51 patients were female, and 32 (62.8%) of them were OSA positive. Also, in our study we male patients predominated, which is in agreement with the, as well as a higher percentage of female positive OSA patients. Our results were similar to those reported byFranklin KA et al, who concluded that OSA occurred in 50% of females aged 20–70 yrs [10]. However, the number of female patients in our study was small.. The average age of female patients was 49 ± 9 years and the average age of male patients was 47 ± 9 years.

We found no significant statistical age difference in patients with different BMI and RDI. Obesity is one of the strongest sleep apnea risk factors [11, 12, 13, 14]. Furthermore, recent estimates suggest that 60% of the adult population in industrialized countries is overweight (BMI ≥ 25 kg/m^2) and at least 30% is obese (BMI ≥ 30 kg/m^2) [8]. In our study we got even greater percentage of patients with obesity compared to global estimates. From 200 patients who came to our clinic with suspicion of OSA, only 10.5% had normal BMI. A high percentage of 49.5% of all patients were overweight (BMI ≥ 25 kg/m^2), and 40% of patients were obese with BMI ≥ 30 kg/m^2. Seventy percents of patients who were referred to the Clinic were diagnosed with OSA.

Half of the normal weight patients were negative for OSA. This frequency of OSA in normal weight patients was significantly lower than in overweight and obese subjects. This is consistent with findings reported in the literature, since obesity is the principal risk factor for OSA [15, 16, 17]. In the overweight group, 40% did not have OSA, and most of the diagnosed positive patients had severe OSA. The best prevalence estimates of OSA in the genera l population are derived from six large studies conducted worldwide.

These studies suggest that approximately 25% of adults with a BMI between 25 kg/m^2 and 28 kg/m^2 have at least mild OSA [1, 15, 18, 19, 20, 21]. In our study only 8% of overweight patients had mild OSA, but because we included patients with clinical symptoms of OSA, 52% of patients had moderate to severe OSA. Nevertheless, we found no clinically significant differences in patients with normal weight and overweight patients who were negativ e or had mild OSA. But there was a significant difference in the severe form of OSA.

There might be other factors for occurrence of severe OSA in normal and overweight patients. Namyslowski et al. observed no significant relationship between BMI and sleep study parameters (RDI, apnea index, hypopnea index and desaturation index) in overweight patients [22]. Similar results have been presented by Pillar who observed a significant correlation between BMI and AHI in the large population of patients referred to sleep laboratory. This correlation was moderate and weakened when the group was restricted to cases with only overweight patients [23]. In the obese group most patients were with severe OSA, with significant differences in severity of OSA in the groups with normal and overweight patients. This implies that as BMI increases, the severity of OSA also increases, being most severe in the more obese patients.

This data is consistent with a large number of other studies in the literature. In the study by Namyslowski et al. which compared sleep parameters between overweight and obese patients, a significant relationship was found between the increase in BMI and sleep parameters in obese subjects only, but not in overweight patients [22]. On the other hand, Akita et al. observed no significant correlation between BMI and either AHI or desaturation rate in obese patients. There was only a tendency for the increase of AHI together with the increase in BMI [24]. Vgontzas found in a group of 250 obese men and women that only 50% of men and 8.5% of women had AHI more than 30 during the night.

There was no difference in mean BMI in the group with and without apnea [25]. In severe obesity (BMI > 40 kg/m^2), the prevalence of sleep apnea was estimated to vary between 40 and 90% [26, 27, 28, 29, 30]. In our study there were 4 patients with BMI > 40 and all 4 patients were diagnosed with severe OSA, but they did not have very high RDI as some patients with lower BMI. Probably severe obesity leads to OSA, but maybe severe obesity does not play such a big role in the severity of OSA. However, our study included a small number of patients and for obtaining better results we need a larger sample.

CONCLUSION

Obesity is a potent risk factor for the development and progression of sleep apnea. Gaining weight increases the risk of OSA. BMI is perhaps simple but important predictor of OSA in the group of obese patients. There seems to be no correlation between overweight patients and RDI.

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