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IMPROVING THE QUALITY OF LIFE IN PATIENTS WITH SNORING AND OBSTRUCTIVE SLEEP APNEA THROUGH INTRAORAL APPARATUS

ABSTRACT

of dissertation for the award of scientific and educational degree "Doctor"

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The dissertation contains 165 standard pages and is illustrated with 6 tables, 81 figures and 3 appendices. The literature includes 332 literary sources, of which 7 in Cyrillic and 325 in Latin.

The dissertation is discussed and directed to the defense of the Department of Dental Materials Science and Propaedeutics of Prosthetic Dentistry at the Medical University "Prof. Dr. Paraskev Stoyanov ”- Varna on November 29, 2021.

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The materials on the defense are available in the Scientific Department of MU - Varna and are published on the website of the Medical University - Varna.

Note: In the abstract the numbers of the tables and figures do not correspond to the numbers in the dissertation.

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I. INTRODUCTION

Sleep is a rapidly reversible state of sensory reduction and stereotyped posture. It is characterized by inhibition of sensory transmission and volitional activity of skeletal muscles, as well as a marked reduction in metabolic processes. Irritability and the body's ability to respond to external stimuli are significantly suppressed during sleep.

Sleep apnea is a common and potentially dangerous sleep disorder, characterized by alternating periods of cessation and resumption of breathing, as well as increased resistance of the upper respiratory tract. Among the main symptoms of the disease are severe snoring and periods of complete lack of breathing during sleep, and during the day - morning headaches, fatigue, severe drowsiness and difficulty concentrating. Sleep apnea is associated with an increased risk of cardiovascular disease, hypertension and traffic accidents due to strong daily somnolence.

Snoring, as a symptom of sleep apnea, is described as a loud noise when breathing during sleep, the result of vibration of structures in the pharynx and oropharynx. There is a lack of objective measurements and a specific definition of snoring in the scientific literature. Most often, the history of snoring is based primarily on subjective data from the patient or the story of his close relative.

The high prevalence of sleep apnea, the many unexplored questions and data published by various authors on its impact on the overall physical and mental health of patients and their quality of life, gave rise to our desire to work on this so relevant to modern times. society theme. Any new study of the concomitant factors for the development of the disease, as well as the possibilities for its prevention and treatment, are undoubtedly necessary and are a contribution to good clinical practice and in the daily lives of patients.

Most patients do not share their sleep problems with their doctors, but seek help to treat comorbidities related to respiratory sleep disorders: hypertension, fatigue, cardiovascular disease and diabetes. These symptoms in patients are not associated with OSA and no studies are performed for sleep-related respiratory disorders that remain undiagnosed for a long time.

At the same time, many of these patients visit their dentist, who could recognize the signs of OSA if trained to do so. Such an experience would be potentially life-saving with the timely and correct referral of the patient for treatment to the relevant specialist in the interdisciplinary team. Fortunately, most of these patients have pronounced intraoral symptoms, and with a careful history they share their physical and social problems. Therefore, the qualifications of dentists can be crucial for this group of patients.

II. PURPOSE AND TASKS

2.1. Purpose

The aim of this dissertation is to study the effectiveness of diagnostic and therapeutic approaches to improve the quality of life in patients with snoring and OSA and pathological dental status.

2.2. Tasks

To achieve this goal, we set ourselves the following tasks:

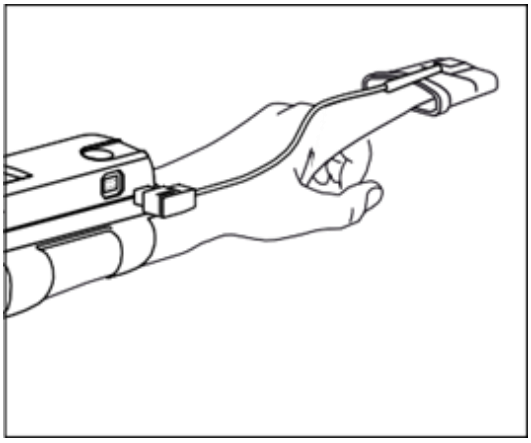
1. To identify patients with symptoms of snoring and OSA, suitable for dental treatment.
2. To diagnose with modern methods the main clinical characteristics of these patients (oral status and polysomnographic examination).
3. To analyze the dynamics of the functional indicators of respiration of patients with snoring and OSA before and after treatment with splints and CPAP.
4. To study the individual quality of life of patients with respiratory disorders during sleep before and after treatment with intraoral devices and CPAP.
5. To develop a diagnostic and therapeutic algorithm in adult patients with snoring and OSA and pathological dental status.

III. METHODOLOGY

Open pharynx Obstructive sleep apnea, Obstructive pharynx

FIG. 1. Presentation of the position of the pharynx in normal and obstruction [331]

O
S
A



O
S
A

A) Criteria for inclusion of persons

- Persons over 18 years of age
- With symptoms of OSA
- With normal or pathological dental status
- Completed informed consent
- No concomitant systemic diseases

б) Exclusion criteria

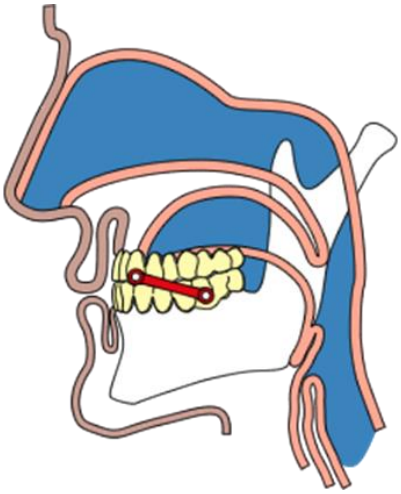
- Persons under 18 years of age
- No symptoms of OSA
- With normal dental status
- Without completed informed consent
- With concomitant systemic diseases

J

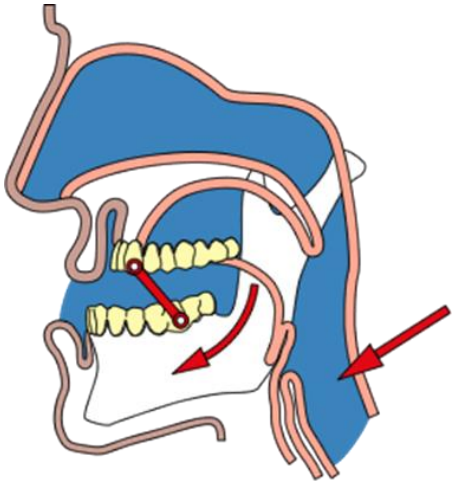
– AHI < 10

J

In the treatment of snoring and OSA, oral devices are used, which are personalized for the specific patient. Oral devices are devices that are designed to work and stabilize the lower jaw to keep the airways open during sleep.



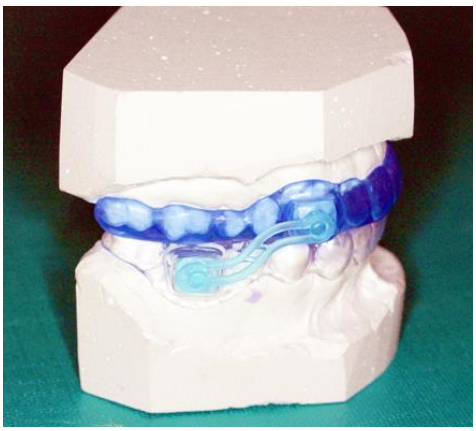
When the mouth is closed: the respiratory tract is open.



When the mouth is open, the airways dilate further

FIG. 3. Schematic representation of the position of the intraoral apparatus in open and closed position of the lower jaw [332]

Personal oral devices are manufactured on patient fingerprints or models of oral structures. It is made of biocompatible materials and involves both the upper and lower jaw.



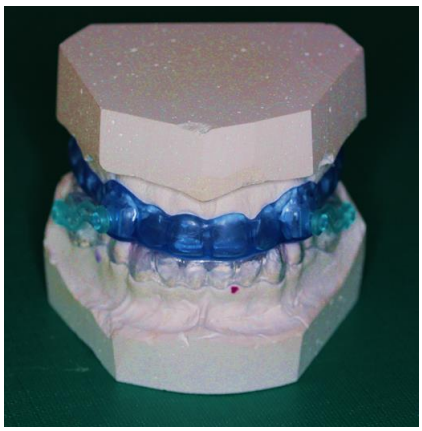


FIG. 4. Ecodent Silensor-sl intraoral devices

In case of sudden protrusion, the movement is smooth in the connector. The S-shape helps for smoother movement in the connector.

To reduce side effects, the rail must be made according to the following requirements:

Patient	• Lack of inflammation and pain in the joint • Condition of the dentition - at least one tooth from a tooth group is available • No expulsion, class 3 • BMI < 30 kg/m^2

Intraoral device	• To cover all teeth • The jaws are not firmly connected • Individual adaptation • Regulation of protrusion • Comfort • No metal

Stages of treatment with an intraoral device:

FIG. 5. Profile photo and full face

FIG. 6. Open and closed bite

FIG. 7. Imprint of the upper and lower jaw

FIG. 8. Use of an occlusion register to determine individual values for the degree of mandibular protrusion

FIG. 9. Marking in central occlusion

FIG. 10. Marking in maximum retrusion

FIG. 11. Marking in maximum protrusion and on average of both occlusions

FIG. 12. Occlusion registrar

The clinical trial was conducted after obtaining permission from the Commission on Ethics of Research at MU-Varna / protocol / decision №99, meeting on 14.01.2021.

IV. RESULTS AND DISCUSSION

4.1. Identification of patients with symptoms of snoring and OSA, suitable for dental treatment

120 patients with a mean age of 47.7 years ± 9.3 years (33-69 years) (Fig. 13) were studied, with a predominance of men by 70.8% and a male to female ratio of approximately 3: 1.

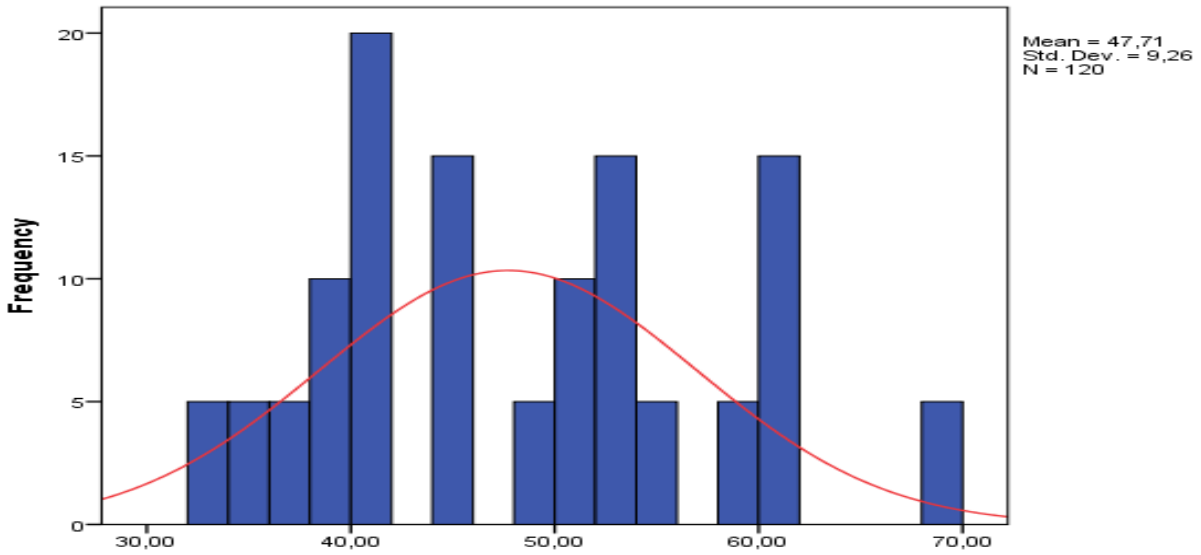


FIG. 13. Distribution of patients by age

A significant age difference was found between the studied men and women (p = 0.001), with men being younger than women (46.00 years to 51.85 years, respectively) (Fig. 14).

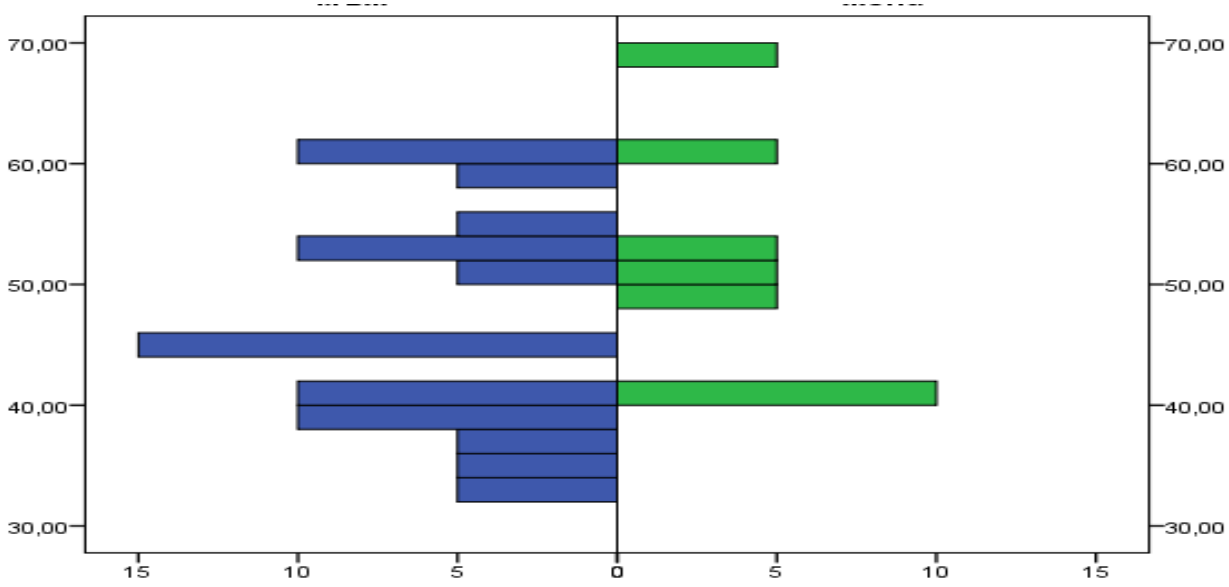


FIG. 14. Age pyramid by gender

According to the average value of BMI, it can be said that the studied patients fall into the group of those with overweight 30.5 kg / m2 ± 6.2 kg / m2, with BMI ranging from 20.1 kg / m2 to 41.5 kg / m2. The analysis of BMI by sex showed that men are mostly in the group of obese (32.7 kg / m2 ± 4.8 kg / m2), while women are mostly in the norm (25.1 kg / m2 ± 5.6 kg / m2) (p <0.001) (Fig. 15). According to the results, 66.7% of patients are overweight and obese.

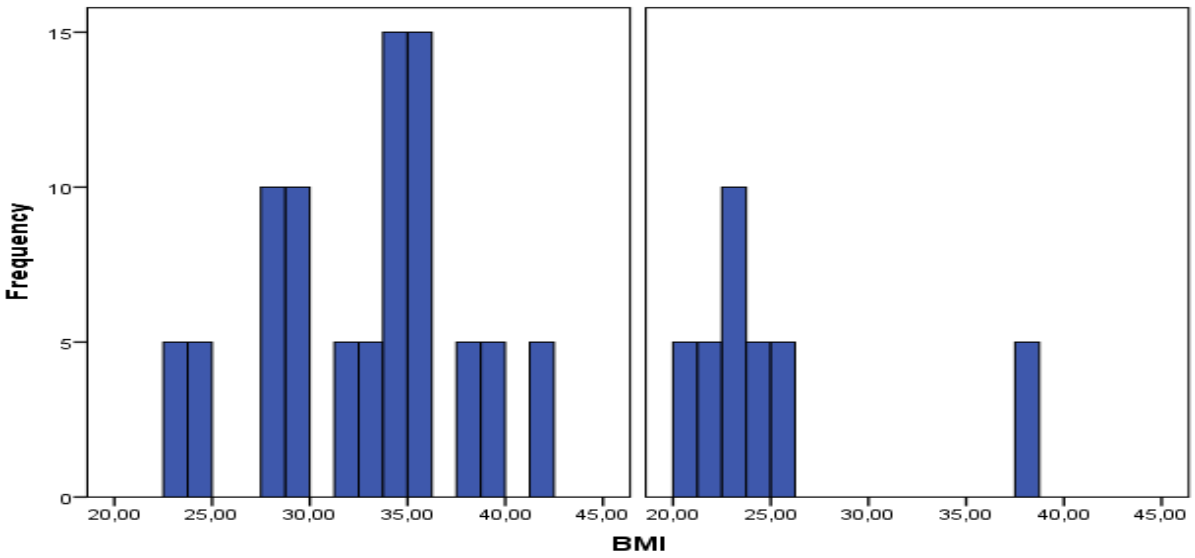


FIG. 15. Distribution of patients by sex and BMI

We studied the strength of snoring according to each patient's own assessment. All patients surveyed snored, with half of the subjects reporting that they snored very loudly or louder than speech (Fig. 16).

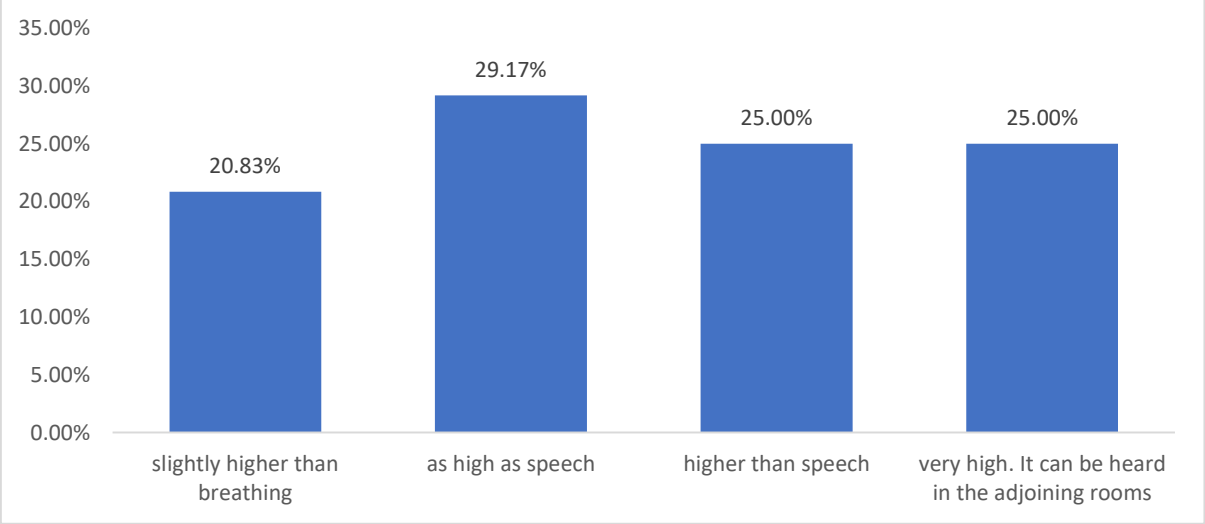


FIG. 16. Distribution of patients according to the strength of snoring

There was a significant difference in the strength of snoring by gender, with stronger snoring correlated with male gender (Spearman $\rho = 0.322$; $p < 0.001$) (Fig. 17).

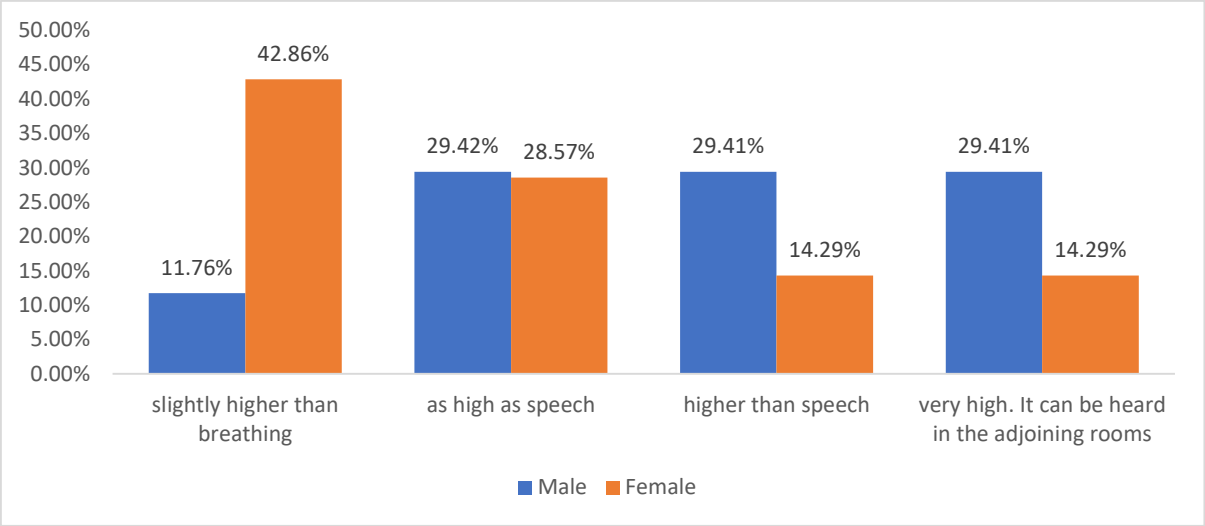


FIG. 17. Distribution of patients by sex and strength of snoring

A significant difference was also found in the mean age of patients in terms of snoring strength, which shows that with age the strength increases ($p < 0.001$) and patients over 52.8 years of age snore the highest (Fig. 18). . A positive moderate relationship was found between the two indicators ($r = 0.312$; $p = 0.001$), and it can be said that in 9.8% of cases the strength of snoring changes with the patient's age.

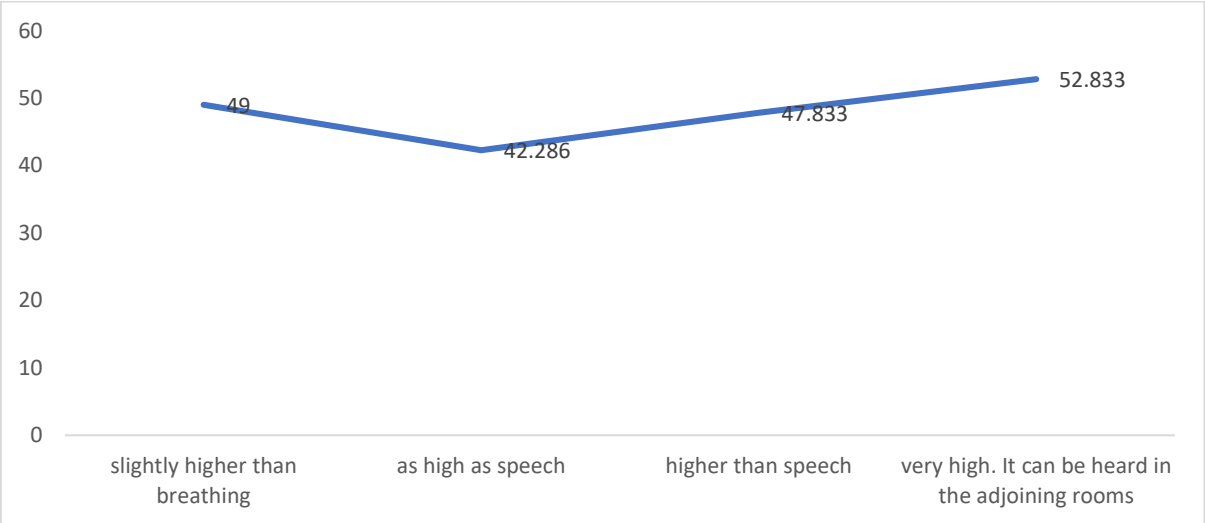


FIG. 18. Average age according to the strength of snoring

A similar trend was found for BMI, where with increasing BMI the strength of snoring increases ($p < 0.001$) and patients with BMI over 34.6 kg / m2 snore the highest (Fig. 19). A positive strong relationship between BMI and snoring strength was also found ($r = 0.642$; $p < 0.001$), and it can be said that in 41.2% of cases the snoring strength changes according to BMI.

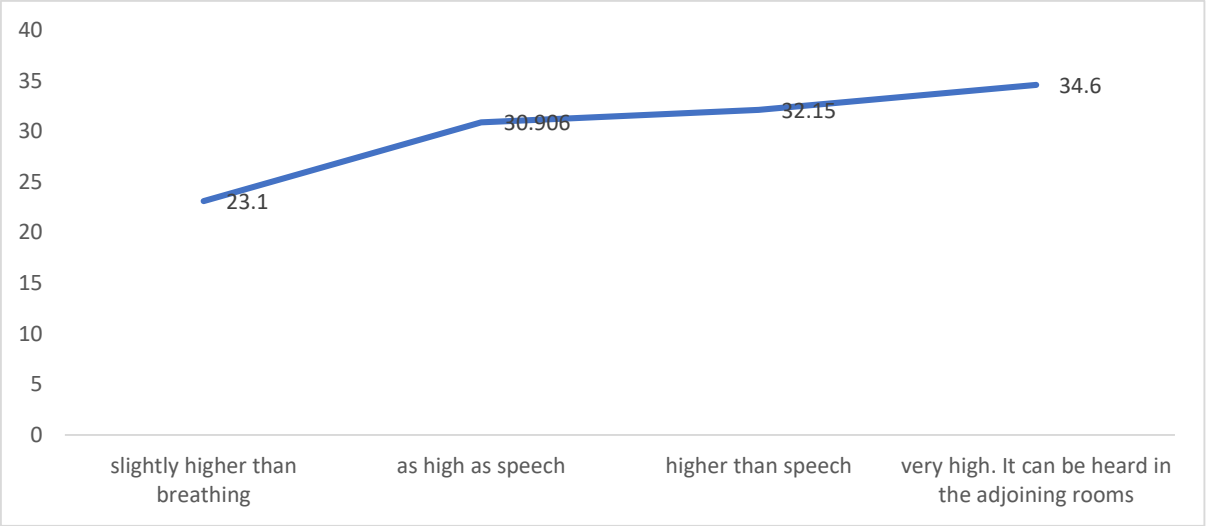


FIG. 19. Change in the strength of snoring according to BMI

Half of the patients reported snoring almost every night, with only 4.2% reporting never or almost never snoring, mainly patients who reported that their snoring was slightly higher than their breathing (Fig. 20).

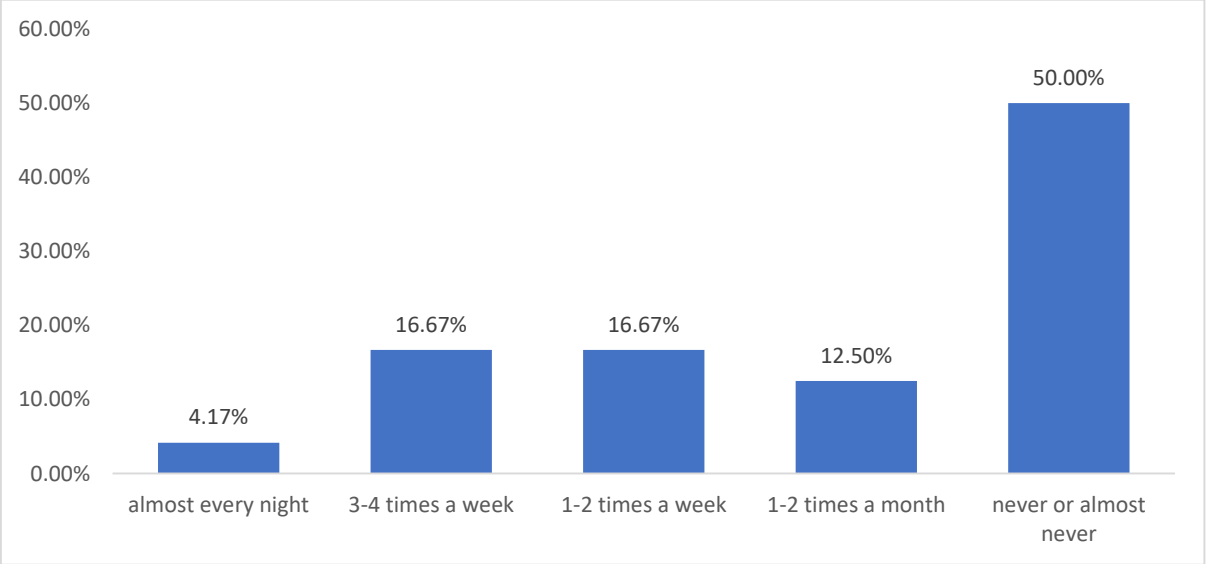


FIG. 20. Frequency of snoring

The analysis of the frequency of snoring by sex showed that men snore more often than women ($p < 0.001$) (Fig. 21), and the increased frequency of snoring correlates with male gender (Spearman $\rho = 0.342$; $p < 0.001$).

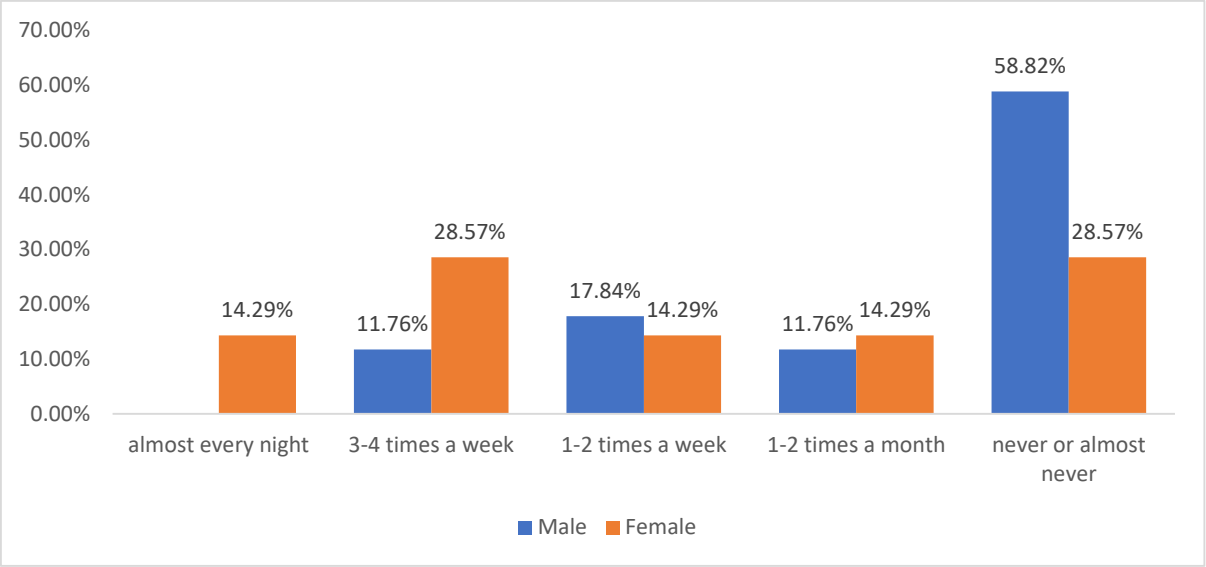


FIG. 21. Frequency of snoring by sex

Although a significant difference was found in the mean age of patients according to the frequency of snoring ($p < 0.001$). No relationship was found between the two indicators (Fig. 22).

On the other hand, in the analysis of the influence of BMI on the frequency of snoring, it was found that with increasing BMI increases the frequency of snoring ($p < 0.001$) (Fig. 23), establishing a strong positive relationship between the two factors ($r = 0.662$; $p < 0.001$), and it can be said that in 43.8% of the cases the frequency of snoring changes according to BMI.

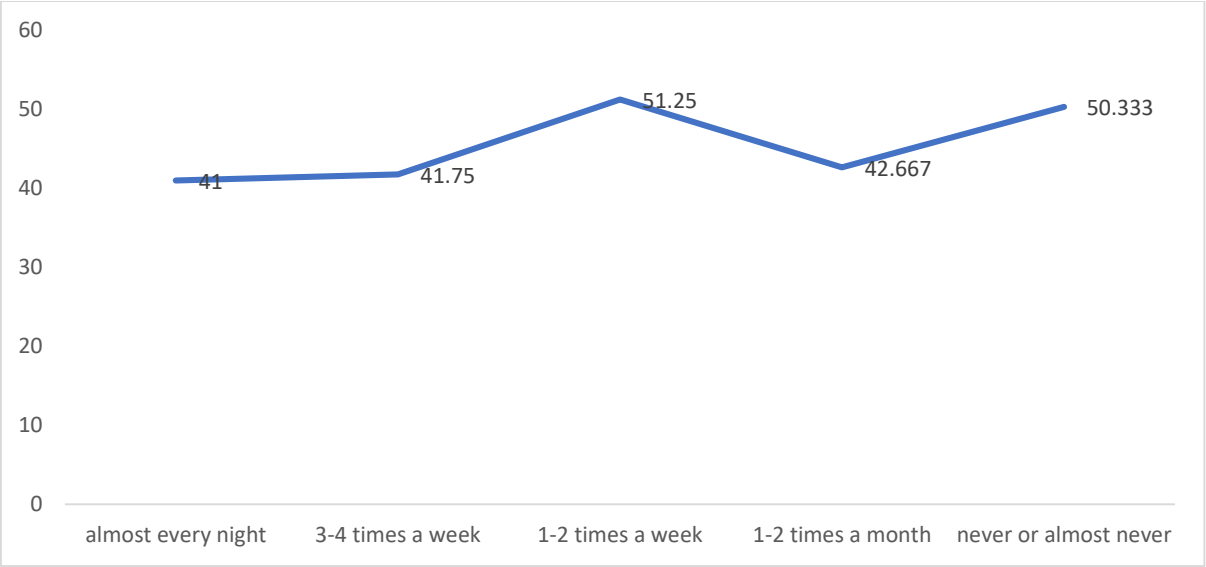


FIG. 22. Average age and frequency of snoring

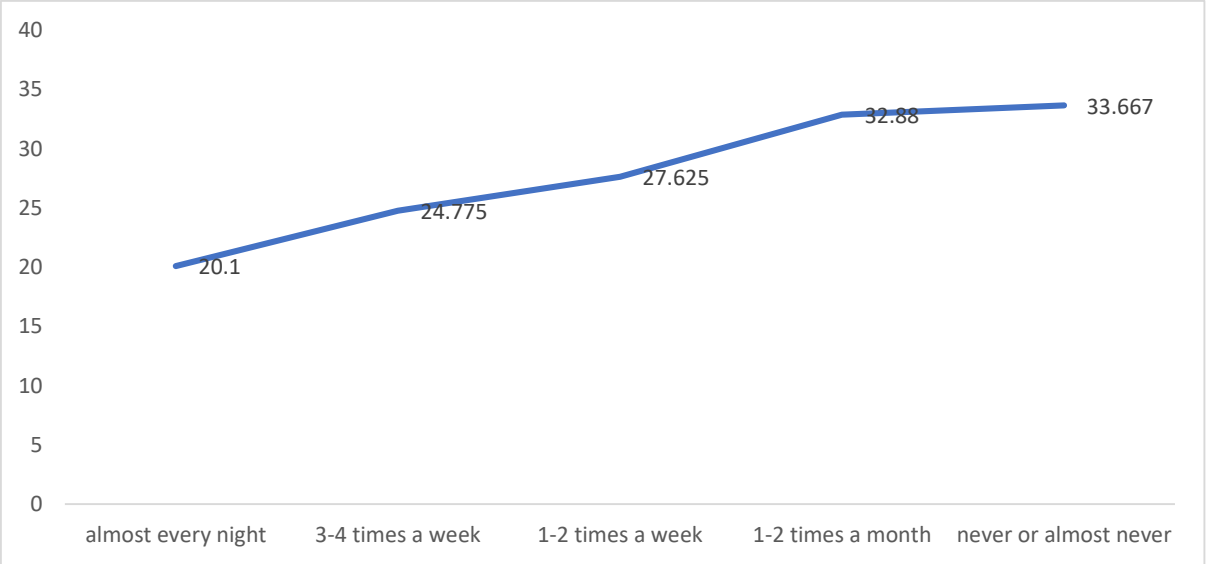


FIG. 23. BMI and frequency of snoring

Just over half of the patients reported that their snoring disturbed others (58.3%), and this was mainly true for men (p <0.001) (Fig. 24).

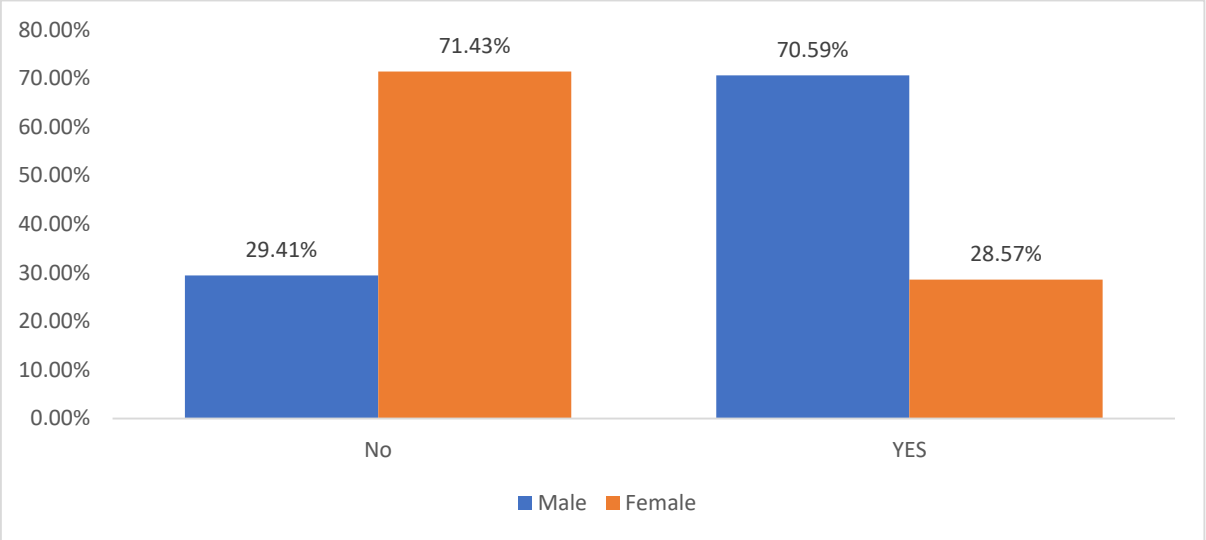


FIG. 24. Disturbing others by snoring according to gender

The majority of patients who reported that their snoring disturbed others indicated that they snored very loudly or louder than speech (p <0.001) (Fig. 25). There is also a strong relationship between the strength of snoring and disturbance of others (Spearman ρ = 0.662; p <0.001).

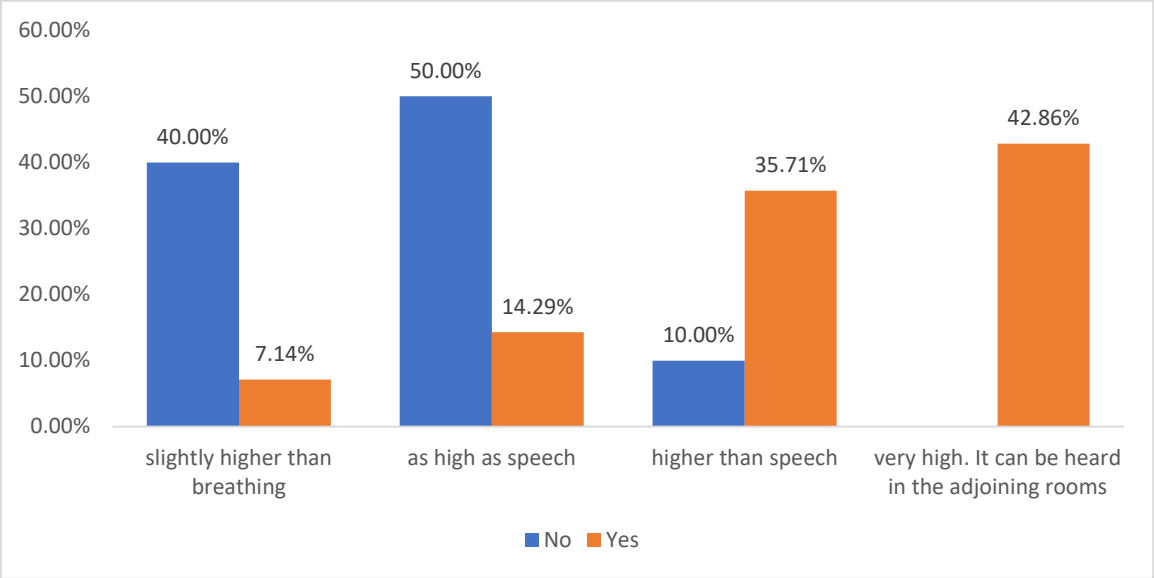


FIG. 25. Relationship between the power of snoring and disturbing others

More than 2/3 (66.7%) say they have stopped breathing during sleep, with 16.7% saying it happens almost every night (Fig. 26).

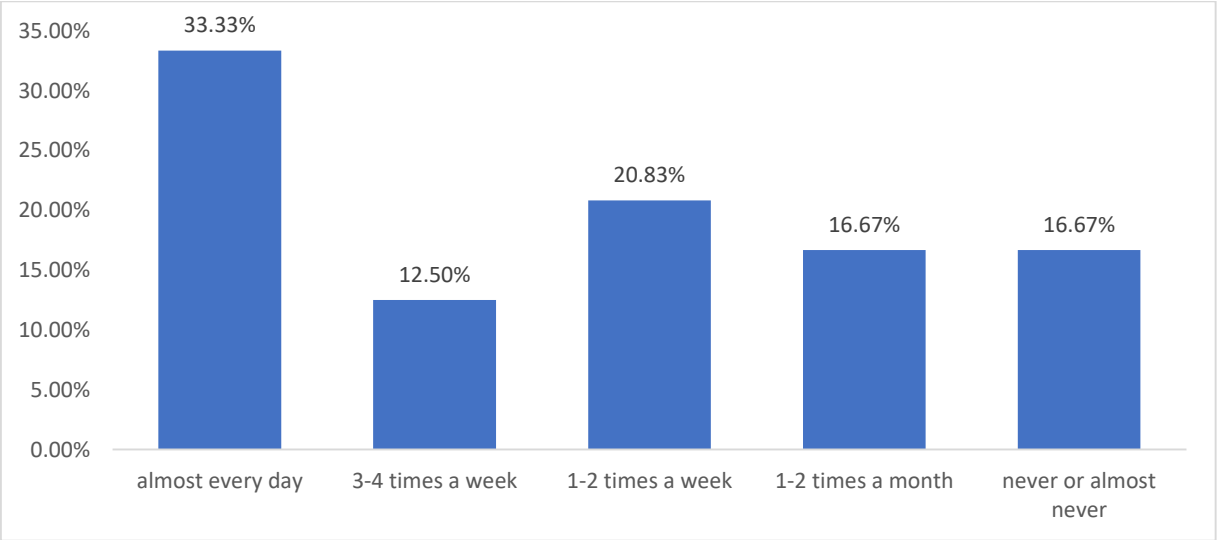


FIG. 26. Stop breathing during sleep

Examination of the results by gender revealed a significant difference between men and women ($p = 0.001$), with a higher frequency of sleep apnea correlating with males (Spearman $\rho = 0.368$; $p < 0.001$) (Fig. 27).

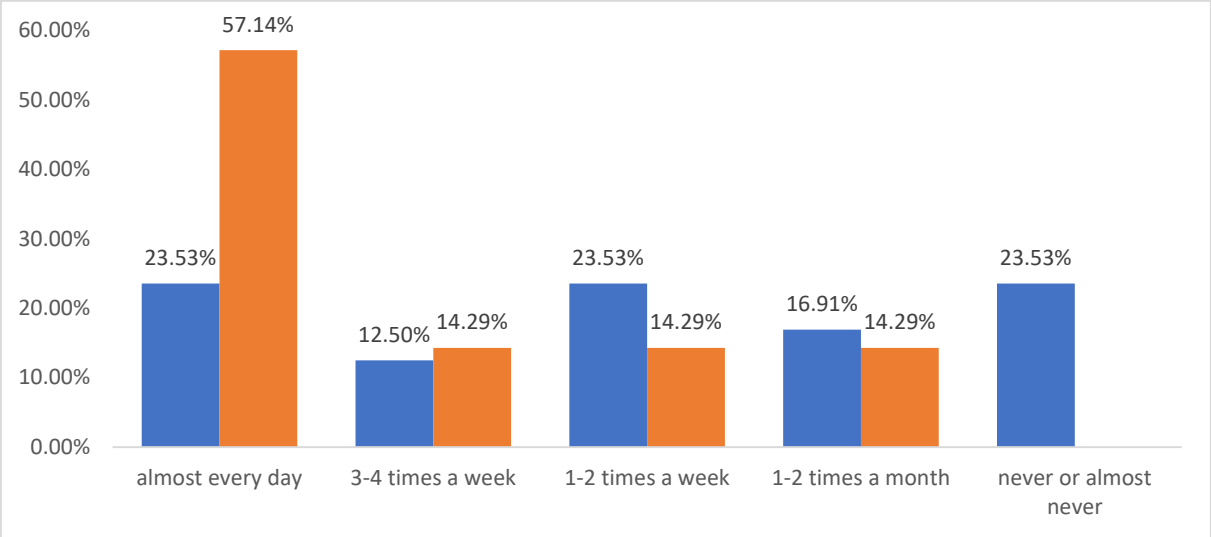


FIG. 27. Stop breathing during sleep according to gender

There was also a significant difference in the mean age of the subjects according to the frequency of sleep apnea (p = 0.007), and it can be said that this sign of OSA becomes more frequent after 46 years (Fig. 28).

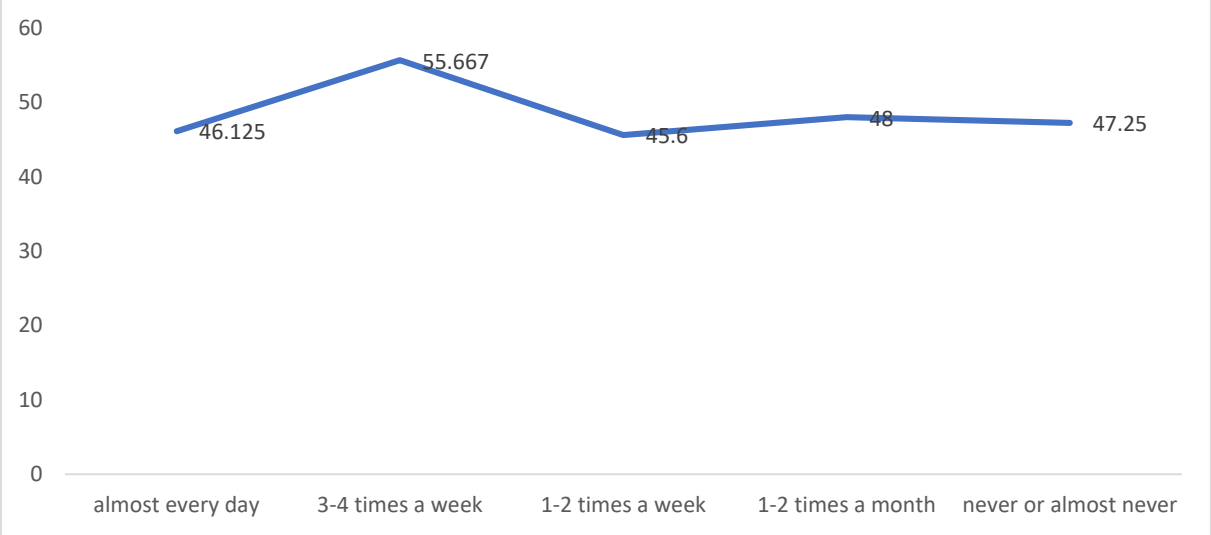


FIG. 28. Average age according to the frequency of respiratory arrest during sleep

From the point of view of BMI, it can be said that sleep apnea is more frequent with an increase in BMI (p <0.001), with the most at risk being obese patients (Fig. 29). There was also a strong proportional relationship between the frequency of sleep snoring and BMI (r = 0.518; p <0.001). According to the results, it can be assumed that in 26.8% of cases of respiratory arrest during sleep the cause is high BMI or obesity.

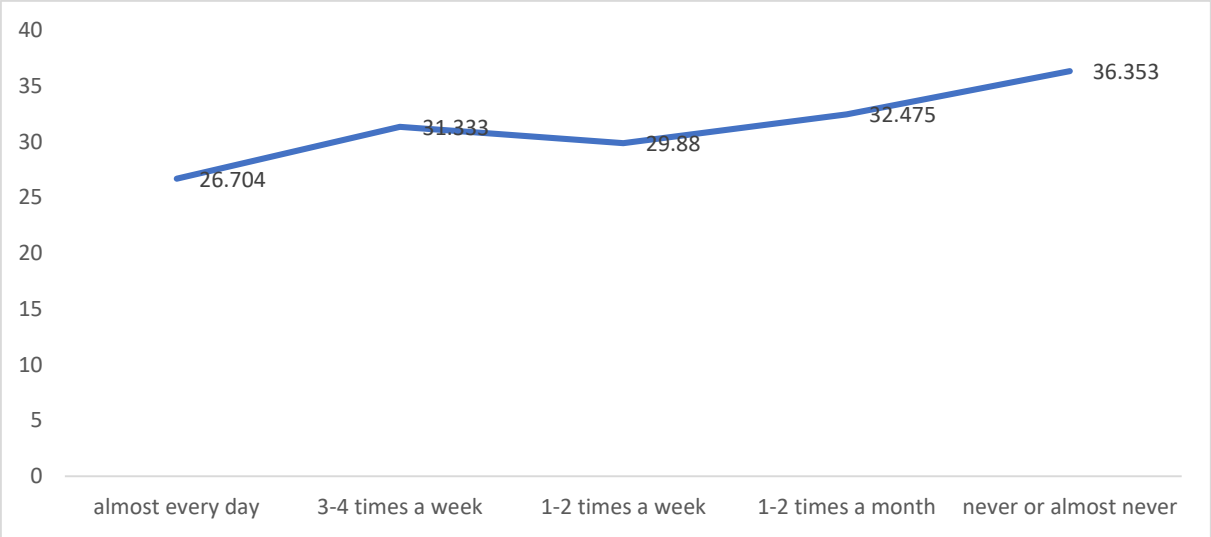


FIG. 29. BMI according to the frequency of respiratory arrest during sleep

A study of the relationship with the frequency of snoring and sleep apnea found a strong relationship (Spearman ρ = 0.624; p <0.001) between the two factors, indicating that the more often a patient snores, the more often he stops snoring. breathes during sleep (Table 4).

Table 4. Relationship between the frequency of snoring and respiratory arrest during sleep

How often do you snore?	Has anyone noticed that you stop breathing during sleep?					Total
	never or almost never	1-2 times a month	1-2 times a week	3-4 times a week	almost every night	
never or almost never	5	0	0	0	0	5
	12,5%	0,0%	0,0%	0,0%	0,0%	4,2%
1-2 times a month	15	0	5	0	0	20
	37,5%	0,0%	20,0%	0,0%	0,0%	16,7%
1-2 times a week	10	5	0	5	0	20
	25,0%	33,3%	0,0%	25,0%	0,0%	16,7%
3-4 times a week	5	5	0	5	0	15
	12,5%	33,3%	0,0%	25,0%	0,0%	12,5%
almost every night	5	5	20	10	20	60
	12,5%	33,3%	80,0%	50,0%	100,0%	50,0%
Total	40	15	25	20	20	120
	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%

¼ (25.0%) of the studied patients indicate that they feel tired after sleeping 3-4 times a week (Fig. 30).

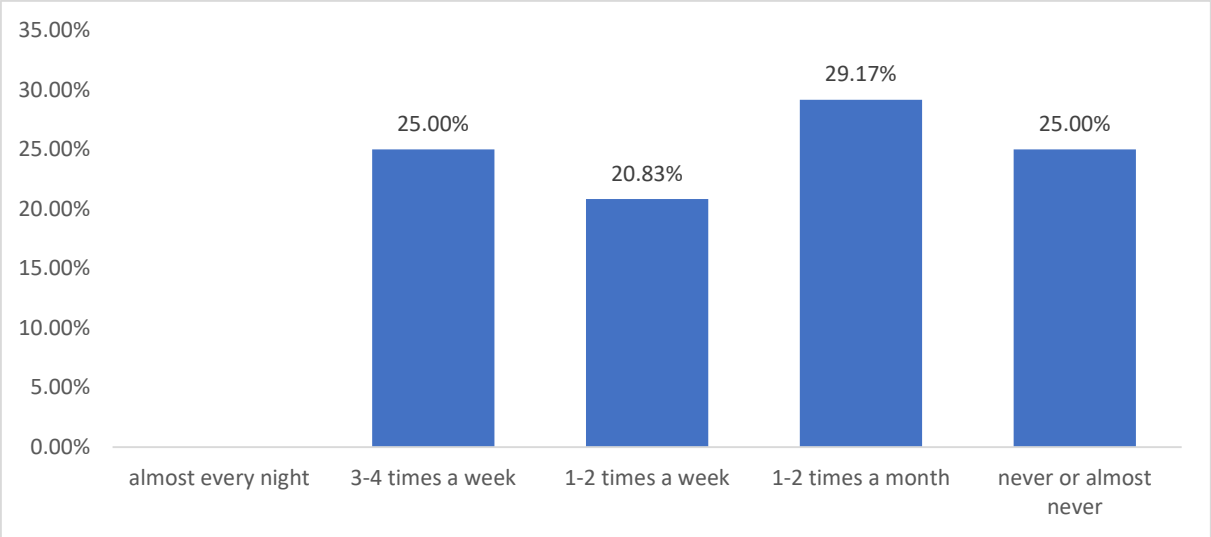


FIG. 30. Frequency of feeling tired after sleep

It was found that there is a strong relationship between sleep apnea and sleep fatigue (Spearman $\rho = 0.620$; $p < 0.001$), which shows that the more often a patient stops breathing during sleep, the more -often feeling tired after sleep (Table 5.).

Table 5. Relationship between the frequency of respiratory arrest during sleep and the feeling of fatigue after sleep

How often do you feel tired after sleeping?	Has anyone noticed that you stop breathing during sleep?					Total
	never or almost never	1-2 times a month	1-2 times a week	3-4 times a week	almost every night	
never or almost never	25	0	5	0	0	30
	62,5%	0,0%	20,0%	0,0%	0,0%	25,0%
1-2 times a month	10	10	5	5	5	35
	25,0%	66,7%	20,0%	25,0%	25,0%	29,2%
1-2 times a week	5	0	5	15	0	25
	12,5%	0,0%	20,0%	75,0%	0,0%	20,8%
3-4 times a week	0	5	10	0	15	30
	0,0%	33,3%	40,0%	0,0%	75,0%	25,0%
Total	40	15	25	20	20	120
	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%

There was a moderate relationship between BMI and the frequency of sleep fatigue ($r = 0.464$; $p < 0.001$), and in 21.5% of cases obesity was the cause of sleep fatigue.

Although 25.0% of patients state that they never or almost never feel tired when awake, only 8.3% state that this happens almost every day (Fig. 31).

It was found that there is a strong dependence (Spearman $\rho = 0.600$; $p < 0.001$) between sleep apnea and the feeling of tiredness when awake, which shows that the more often the patient stops breathing during sleep the more often he feels tired when he is awake (Table 6).

There was also a strong relationship between BMI and the feeling of fatigue when the patient was awake ($r = 0.586$; $p < 0.001$), which shows that in 34.4% of cases obesity is a factor in creating feelings of fatigue when the subjects are awake (Fig. 32).

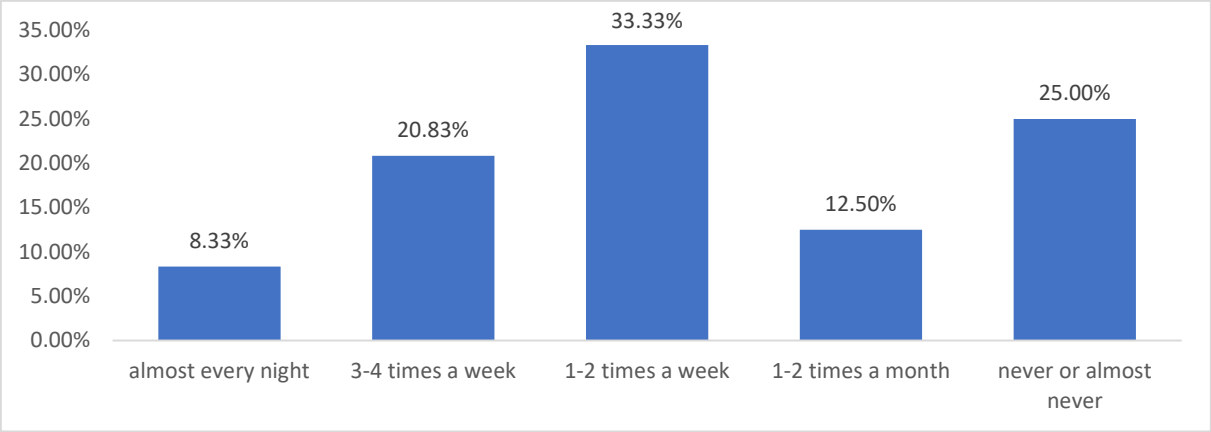


FIG. 31. Frequency of feeling tired when the patient is awake

Table 6. Relationship between the frequency of respiratory arrest during sleep and the feeling of fatigue when the patient is awake

When you're awake, do you feel tired and out of shape?	Has anyone noticed that you stop breathing during sleep?					Total
	never or almost never	1-2 times a month	1-2 times a week	3-4 times a week	almost every night	
never or almost never	20	0	10	0	0	30
	50,0%	0,0%	40,0%	0,0%	0,0%	25,0%
1-2 times a month	10	5	0	0	0	15
	25,0%	33,3%	0,0%	0,0%	0,0%	12,5%
1-2 times a week	5	10	5	15	5	40
	12,5%	66,7%	20,0%	75,0%	25,0%	33,3%
3-4 times a week	5	0	10	0	10	25
	12,5%	0,0%	40,0%	0,0%	50,0%	20,8%
almost every night	0	0	0	5	5	10
	0,0%	0,0%	0,0%	25,0%	25,0%	8,3%
Total	40	15	25	20	20	120
	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%

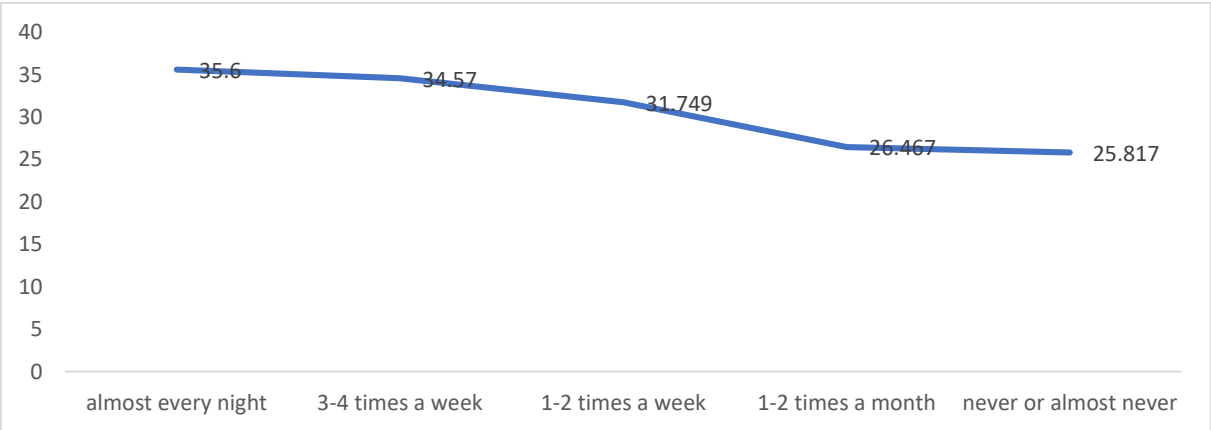


FIG. 32. BMI according to the feeling of fatigue when the patient is awake

About 1/3 (33.3%) of the patients indicated that there were cases when they fell asleep while driving, mainly men with obesity (BMI 34.7 kg / m2).

Nearly half of the patients (45.8%) report hypertension and 33.3% are unaware of their health. 20.8% of the surveyed persons are without hypertension.

Snoring is estimated to occur in 3% to 12% of children [103, 131] and up to 59% of adults. [124]

The prevalence of snoring in adults varies from 2 to 86% depending on the data collected (eg polysomnography (PSG), questionnaires for subjects or bed partners) and the definition of snoring (type and frequency) [126]. In a telephone survey conducted in the UK, 26% of men and 20% of women under the age of 24 reported regular snoring. The prevalence is highest in the age group between 45 and 54 with 62% of men and 45% of women snoring. The prevalence decreased in the age group> 65 years, in which 47% of men and 31% of women reported snoring [207].

According to numerous Asian, North American and European longitudinal and cross-sectional studies of up to 72,000 subjects, the risk of developing hypertension, diabetes, hypercholesterolemia or those suffering from heart attack or stroke is significantly higher in participants who snore [129, 231, 323].

Patients with OSA have a variety of symptoms, including excessive daytime sleepiness, snoring, non-refreshing sleep, fatigue, insomnia, episodes of shortness of breath or suffocation. OSA can be associated with a myriad of clinical consequences such as increased risk of systemic hypertension, coronary vascular disease, congestive heart failure, cerebrovascular disease, glucose intolerance, impotence, obesity, pulmonary hypertension, gastroesophageal reflux and impaired concentration. [23, 105, 136, 151, 200, 219, 220, 313]

OSA occurs between 5% and 10% of the United States population. [279, 317] The prevalence of high risk of OSA in the United States is 26%. [124] Despite the relatively high prevalence of OSA, diagnosis and treatment may be delayed. Nevertheless, OSA remains undiagnosed in 82% of men and 93% of women with this condition. [316] Early identification and treatment of OSA provides significant relief to people, prevents complications of OSA, and reduces overall health care costs. [219] A better understanding of the pathogenesis, risk factors, diagnosis and treatment of OSA has the potential to improve early detection of OSA and prevent adverse effects on the individual and society.

Obesity is an important risk factor for the development of OSA [317, 318]. In the current study, the relative share of overweight and obese subjects was 66.7%. The role of overweight as a causative factor of OSA has been confirmed by many studies. The prevalence of OSA in obese or severely obese patients is almost twice as high as in normal-weight adults [269].

In a population-based study of 2148, the prevalence of obesity was significantly higher in people with OSA than in those without OSA, whether men (22 vs. 8%) or women (32 vs. 18%) [80].

Another study of 161 obese patients (BMI ≥30 kg / m2) showed that OSA was present in more than 50% of subjects and severe in 25% [226]. Among obese patients (BMI ≥40 kg / m2), an prevalence of OSA of up to 98% has been reported (20).

Using data from a cohort population study of sleep in Wisconsin, Young et al. [319] found that in 41% of adults with mild or severe sleep apnea (AHI) ≥5) and in 58% of those with AHI ≥15, sleep disturbance was due to overweight (BMI ≥25 kg). / m2).

In studies examining the prevalence of OSA in hypertensive populations, 20% –40% of people were subsequently diagnosed with comorbid OCA [45, 308, 316] with a frequency of

up to 71% among drug-resistant hypertensives. [105] The results of the present study show that 45.8% of the subjects have hypertension.

4.2. Diagnosis with modern methods of the main clinical characteristics of these patients (oral status and polysomnographic examination).

The study of the dynamics of the functional indicators of respiration of patients with snoring and OSA showed that the cardiovascular risk in half of the persons was low 52.2% (Fig. 33). The analysis of the type of snoring and cardiovascular risk revealed a positive moderate dependence (r = 0.300; p = 0.001), which shows that with increasing strength of snoring increases cardiovascular risk. Positive moderate dependence on cardiovascular risk was also found in terms of the frequency of snoring (r = 0.415; p <0.001), with 45.5% of people who snore almost every night have a high cardiovascular risk.

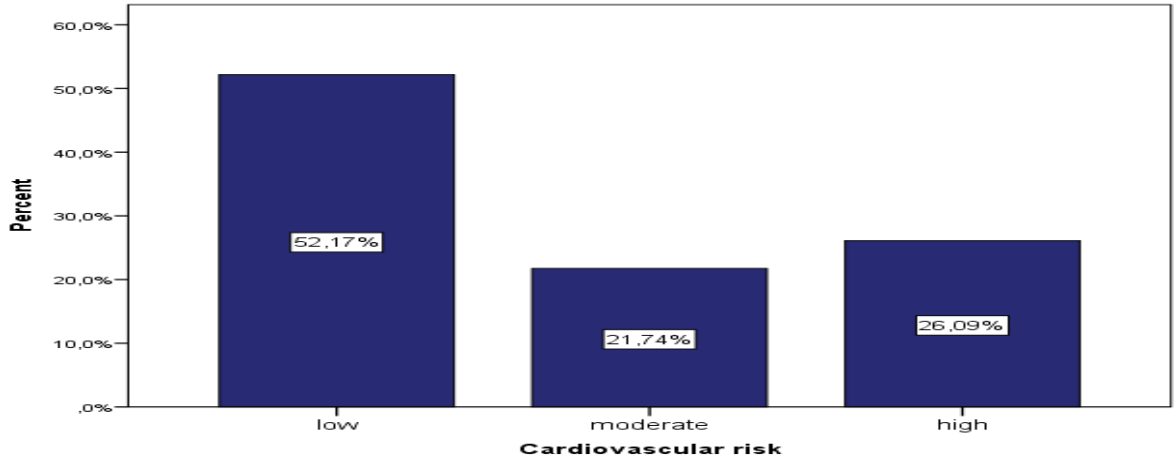


FIG. 33. Distribution according to cardiovascular risk

An interesting result is that there is a significant difference in cardiovascular risk according to the sex of the subjects (p = 0.023), as 56.2% of men have a low risk and 42.9% of women have a high risk (Fig. 34).

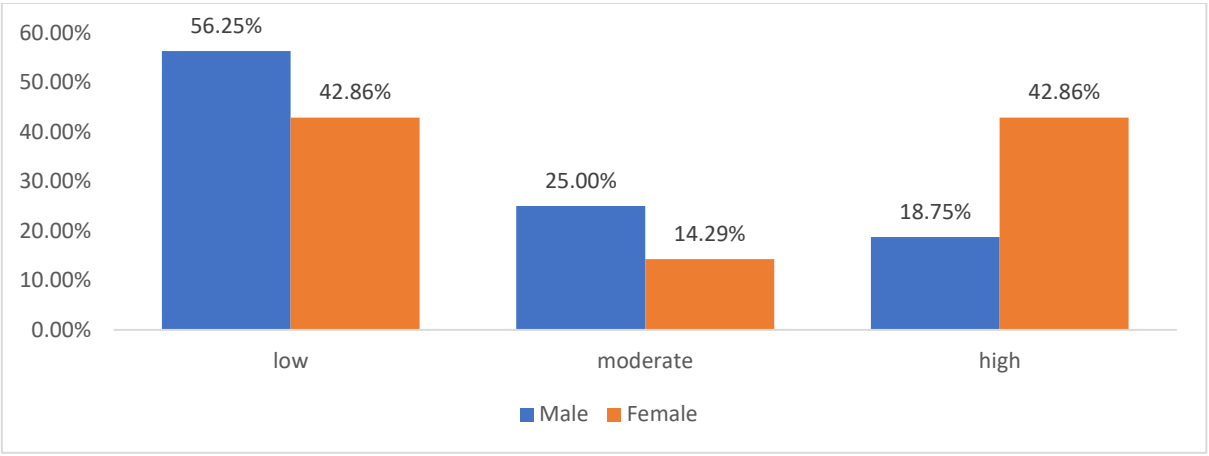


FIG. 34. Gender and cardiovascular risk distribution

A significant difference was also found with regard to the age of the patients (p = 0.003), which shows that high age over 50 years is associated with high cardiovascular risk (Fig. 35).

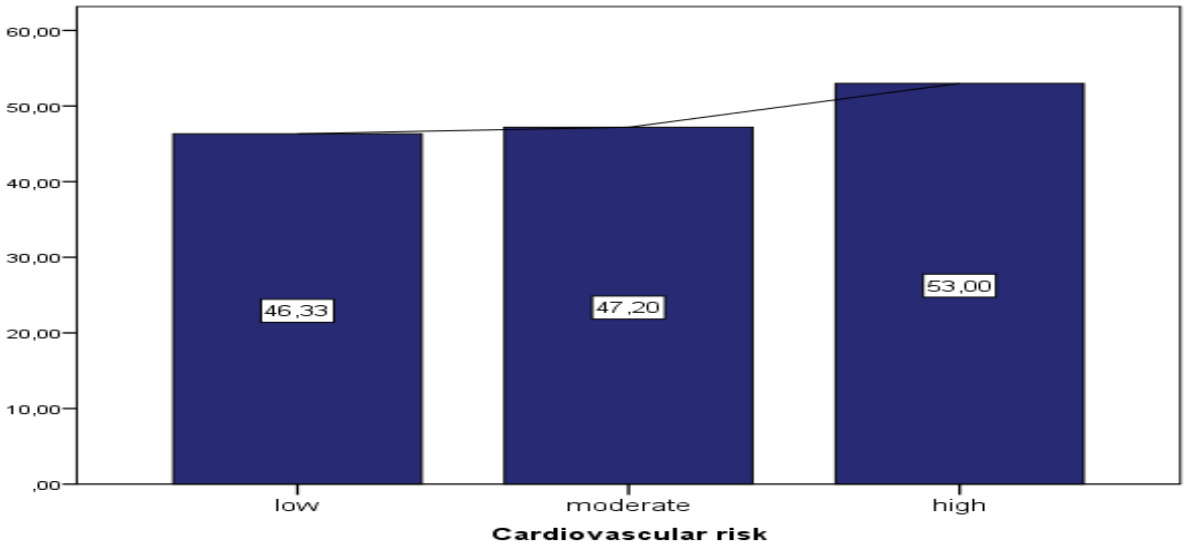


FIG. 35. Cardiovascular risk by age

High BMI> 30 kg / m2 was also associated with increased cardiovascular risk (p = 0.007) (Fig. 36).

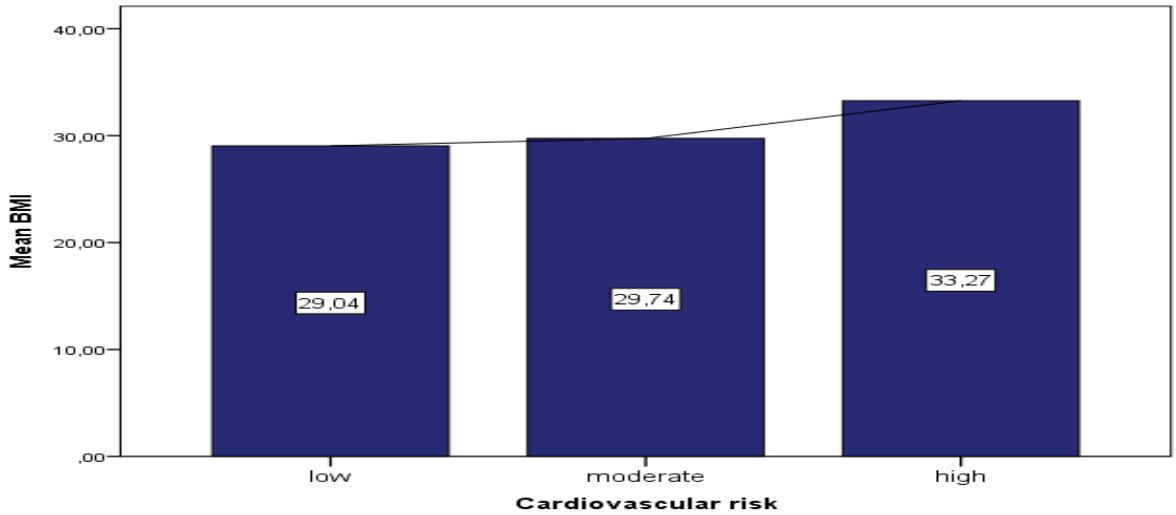


FIG. 36. Cardiovascular risk according to BMI

More than ¾ (73.9%) of the studied patients were at high risk for OSA, with a significant gender difference (p <0.001) (Fig. 37). Male sex is a risk factor, doubling the risk of OSA (RR = 2,042 (1,380-3,020) p <0.001).

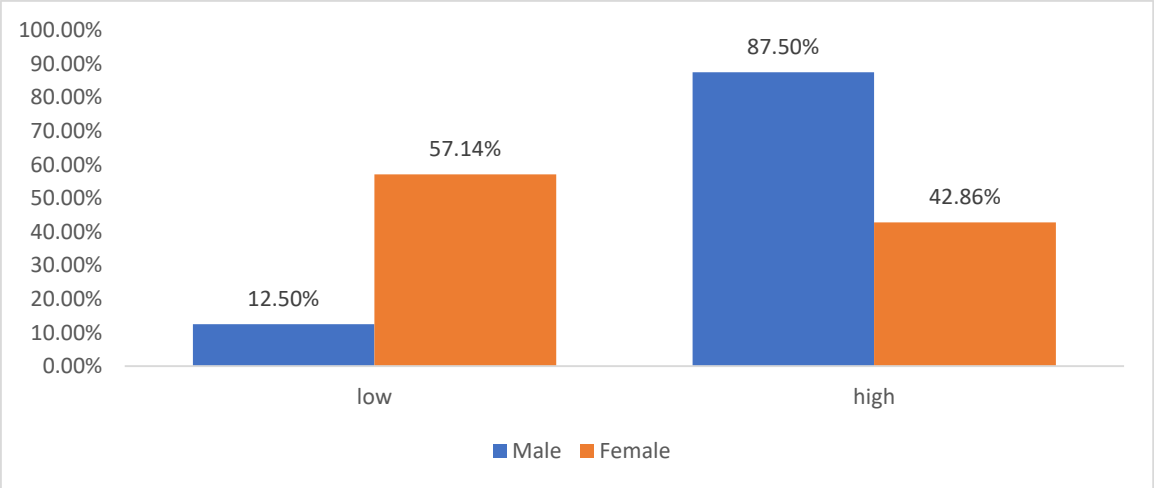


FIG. 37. Risk of OSA by gender

There was a strong relationship between overweight and obesity and the risk of GMS (r = 0.813; p <0.001), with all individuals who were overweight or obese at high risk of GMS.

There was a significant difference (p <0.001) and a strong relationship (r = 0.663; p <0.001) between snoring strength and the risk of OSA, with individuals who snore higher than speech and have a very high risk of OSA.

A similar trend was observed with regard to the frequency of snoring and the risk of OSA, with a strong relationship (r = 0.724; p <0.001) between the two factors. Patients who snore 3-4 times a week and almost every night are at high risk of OSA.

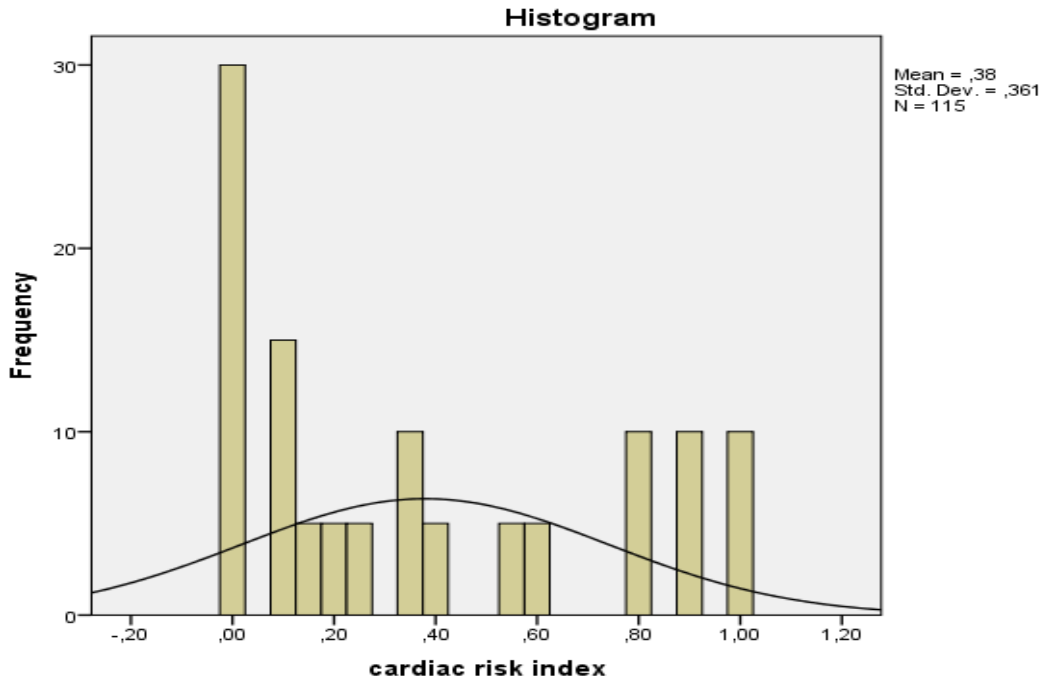


FIG. 38. CRI mean

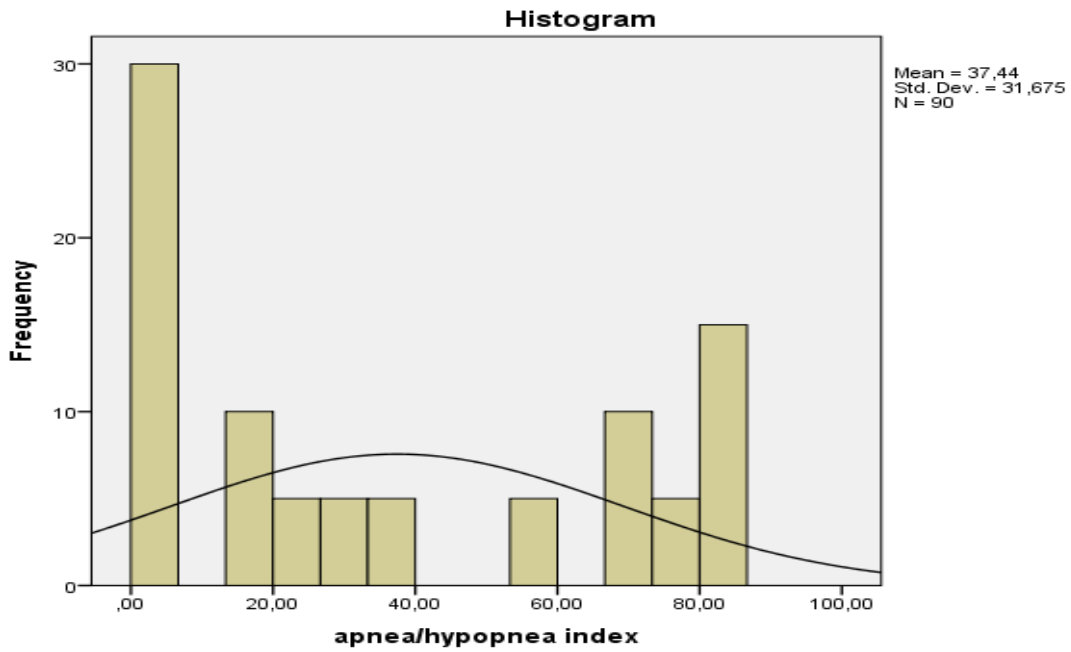


FIG. 39. AHI mean

There was a significant difference between men and women (p = 0.004), as AHI in men was almost 2 times higher than in women (Fig. 40).

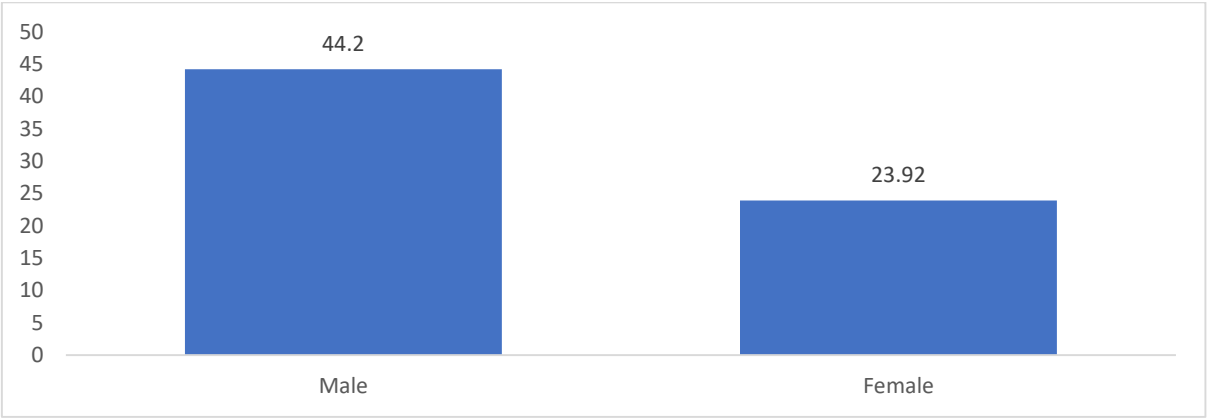


FIG. 40. Comparative analysis of AHI by gender

Weak, moderate to positive relationship between age and AHI (r = 0.246; p = 0.019) was found.

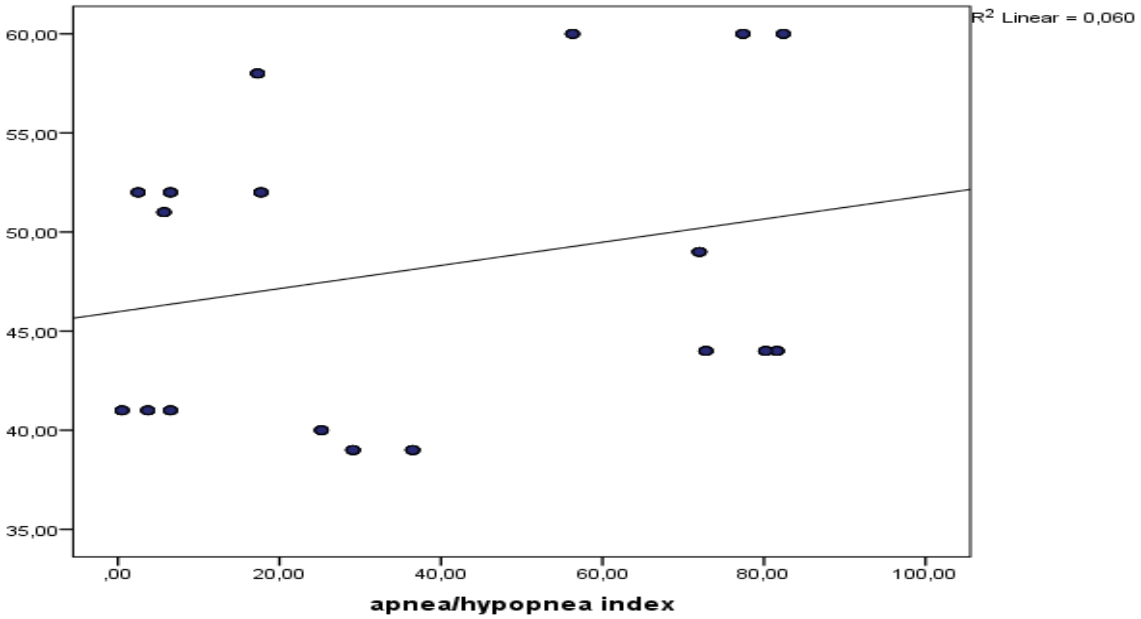


FIG. 41. Correlation analysis between age and AHI

A moderate positive relationship between BMI and AHI was found (r = 0.470; p <0.001).

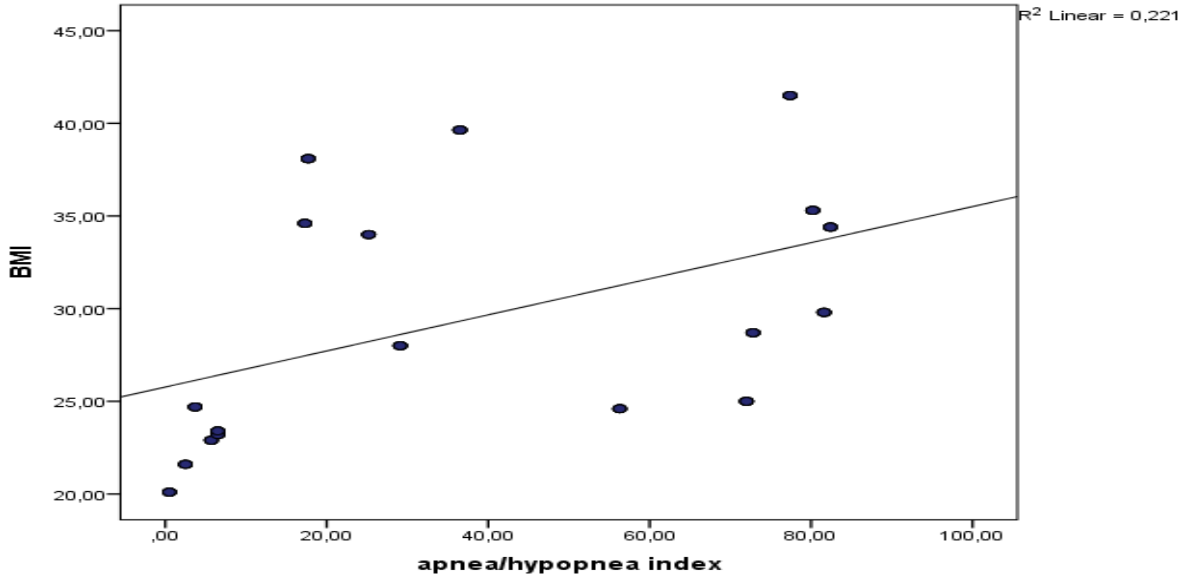


FIG. 42. Correlation analysis between BMI and AHI

Analysis of the relationship between snoring strength and AHI showed a positive moderate dependence (r = 0.593; p <0.001), indicating that AHI increased with snoring strength.

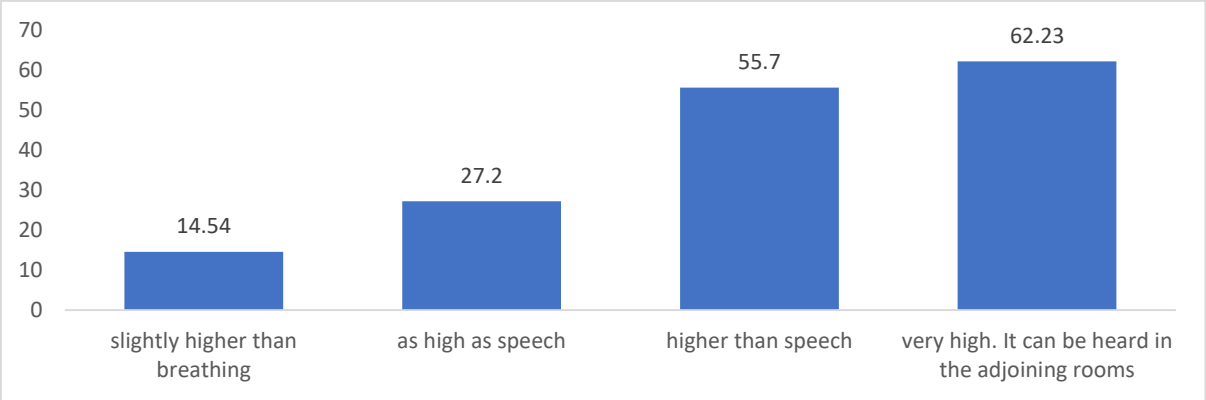


FIG. 43. Comparative analysis of AHI and snoring power

The frequency of snoring correlates strongly positively with AHI (r = 0.687; p <0.001), and the more often the subject snores, the higher the AHI.

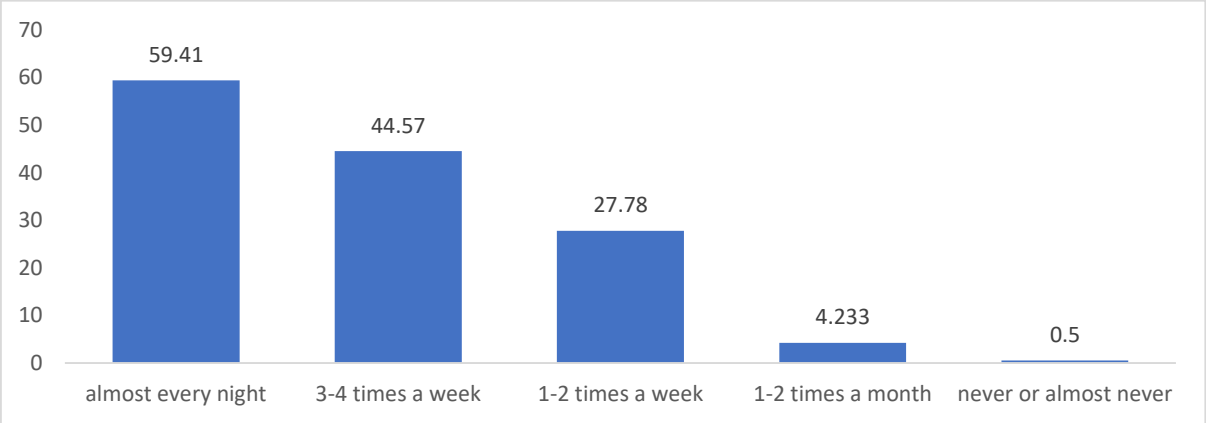


FIG. 44. Comparative analysis of AHI according to the frequency of snoring

There was a significant difference between AHI and the presence of hypertension (p <0.001), with people with hypertension having about 3 times higher AHI.

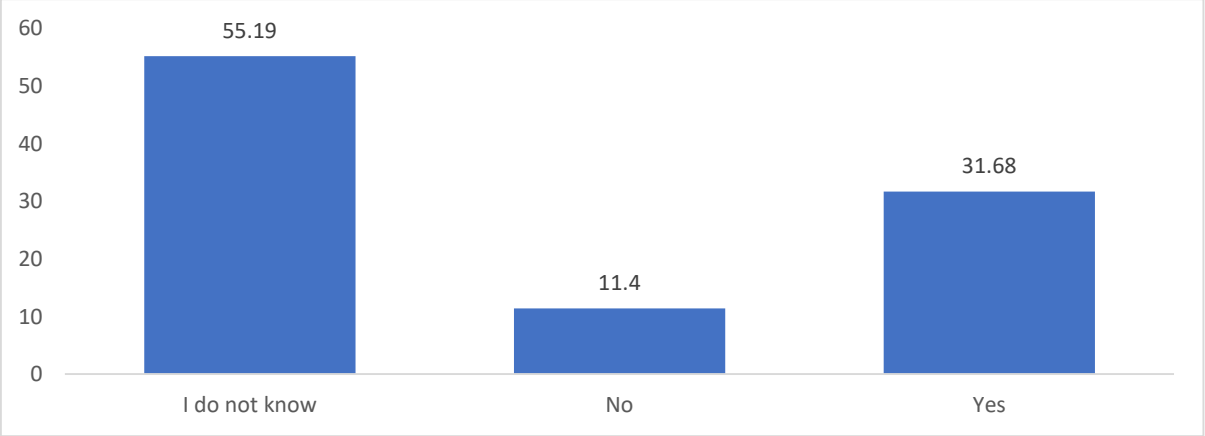


FIG. 45. AHI and the presence of hypertension

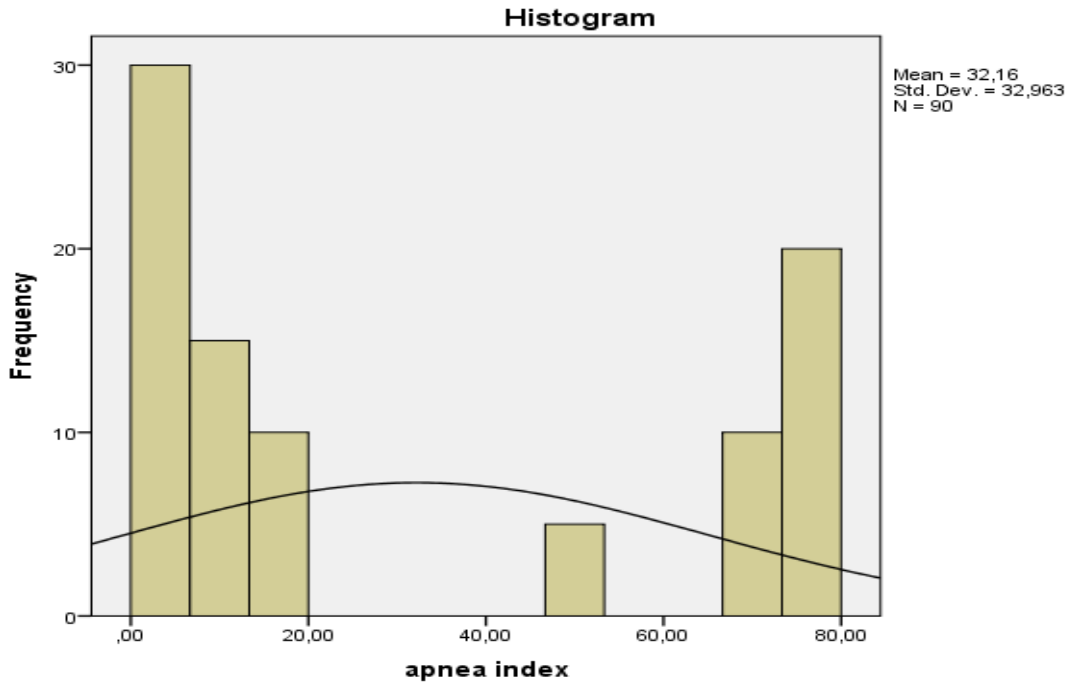


FIG. 46. AI mean

The results on AI show the same trend as AHI. There was a significant difference in AI by gender (p = 0.024), with AI being higher in men.

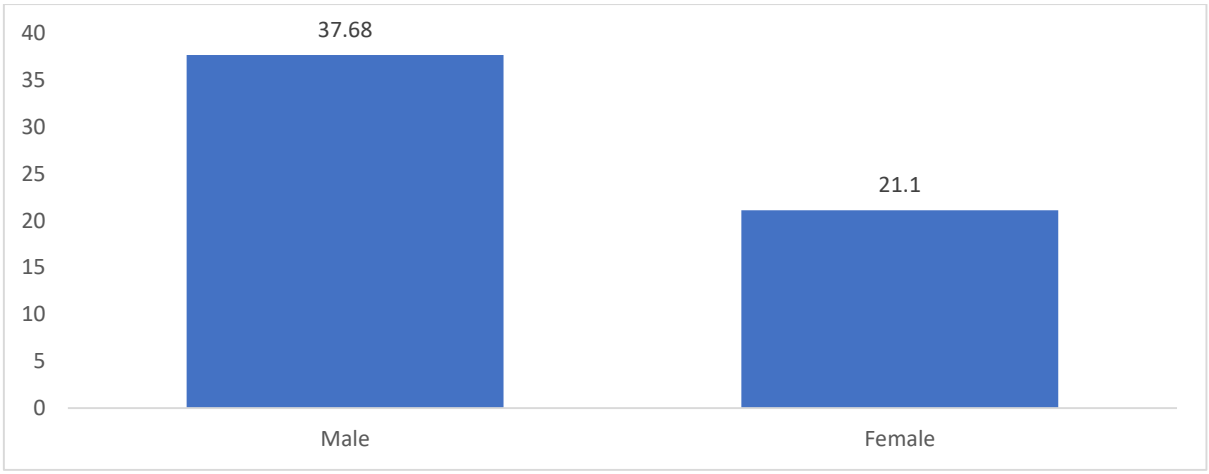


Fig.47. AI by gender

The analysis of the relationship between age and AI showed a moderate positive relationship (r = 0.306; p = 0.003), which shows that with increasing age, AI also increases. A positive moderate relationship was also found between BMI and AI (r = 0.398; p <0.001), which indicates that obesity is associated with high AI.

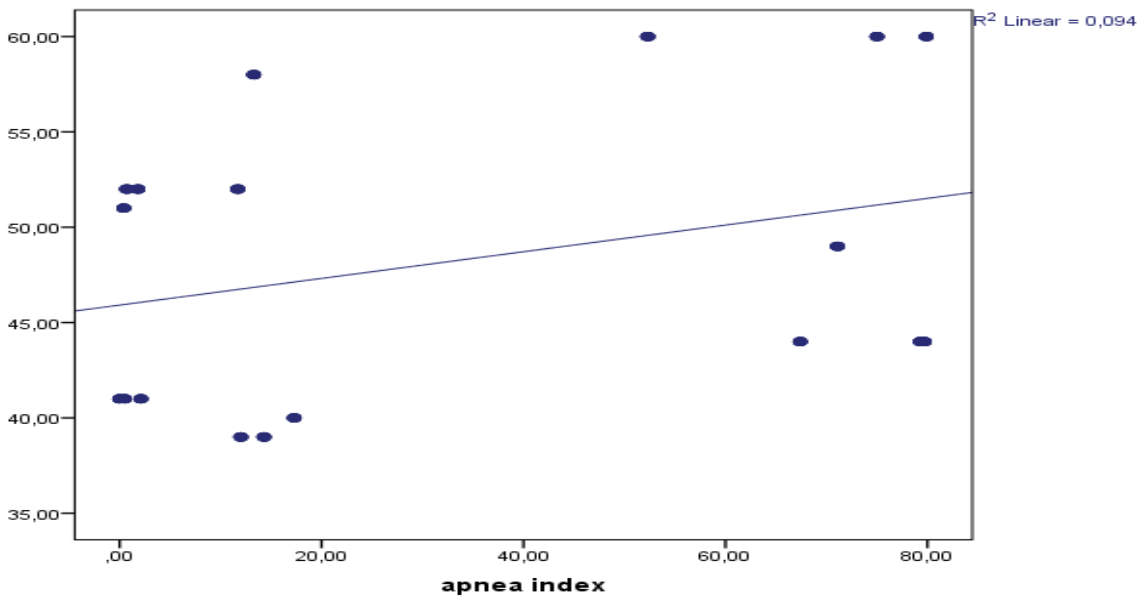


FIG. 48. Correlation analysis between age and AI

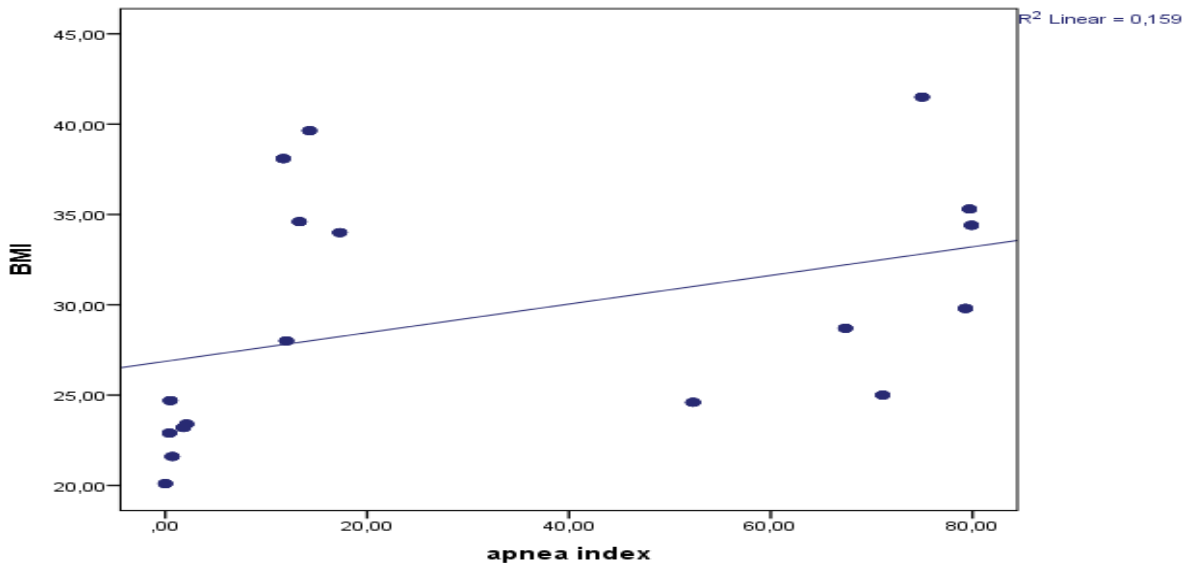


FIG. 49. Correlation analysis between BMI and AI

A moderate relationship between snoring strength and AI was found ($r = 0.557$; $p < 0.001$).

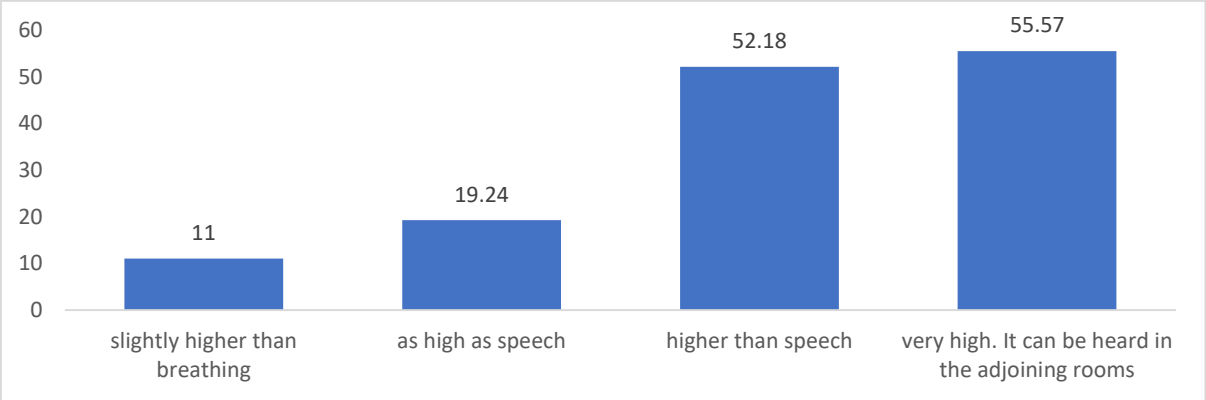


FIG. 50. The power of snoring and AI

A strong relationship between snoring frequency and AI was found (r = 0.616; p <0.001).

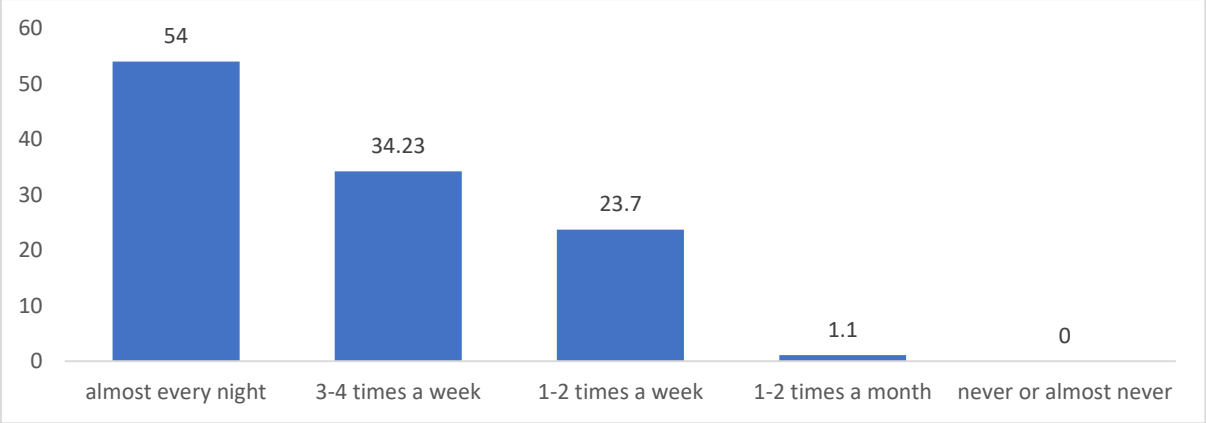


FIG. 51. Snoring frequency and AI

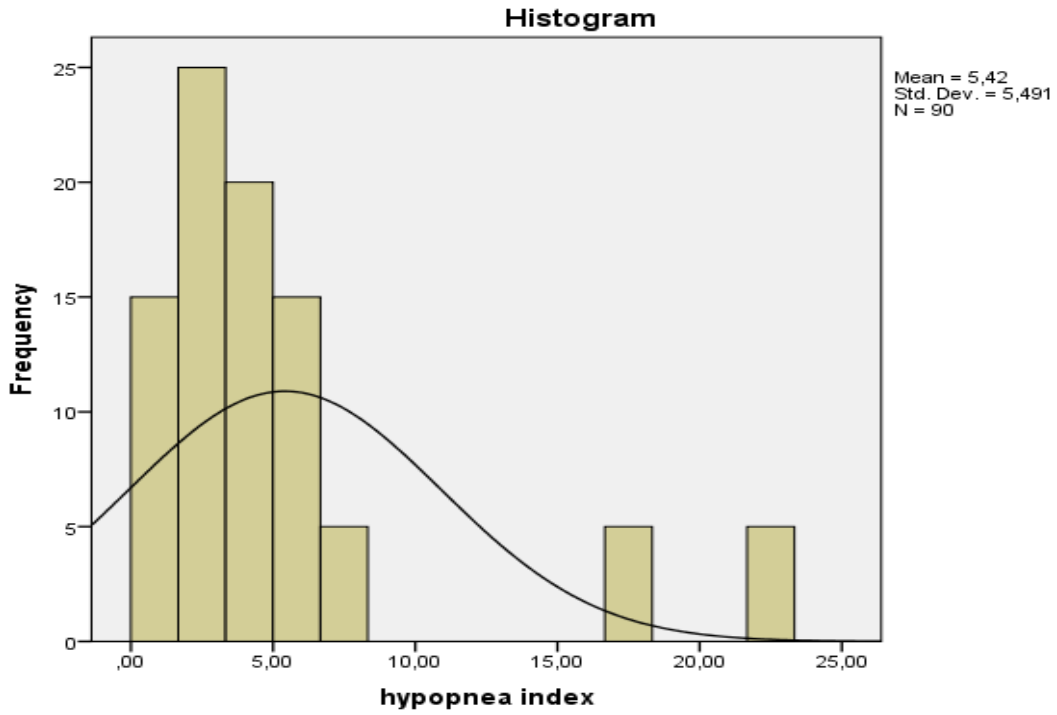


FIG. 52. HI mean

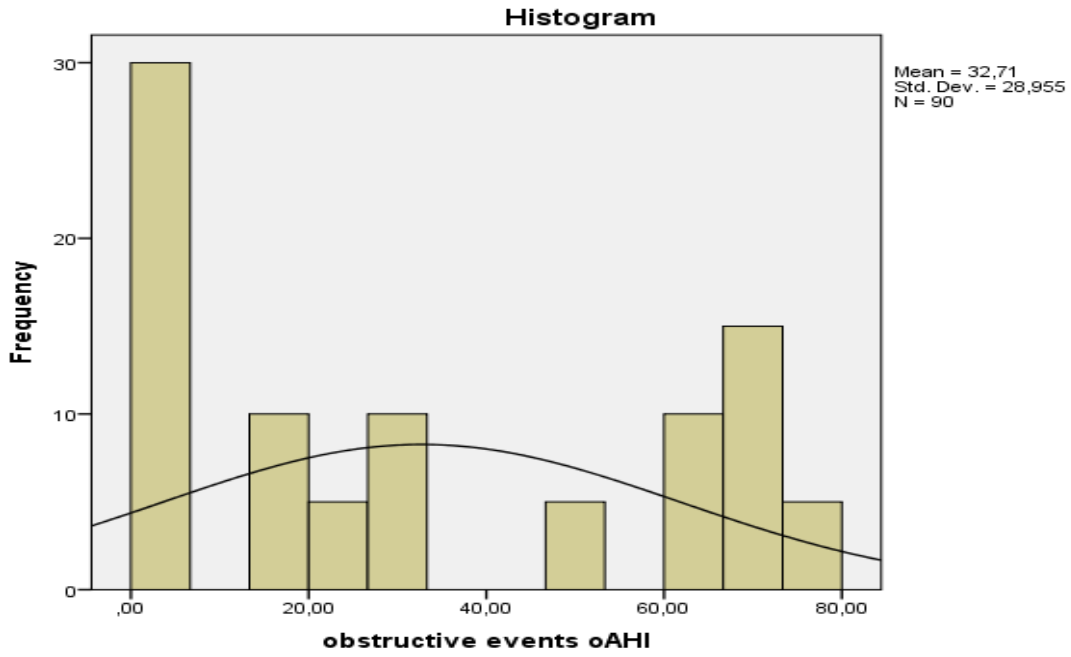


FIG. 53. oAHI mean

Treatment with splints was performed on 30 patients, of whom 60% had class II dentition, 73.3% had a deep bite and 66.7% had reduced lower facial height.

The analysis of the data shows that patients with class II dental disease have a higher risk of OSA (p = 0.001), and a strong relationship between the two indicators was found (r = 0.600; p <0.001) (Fig. 54). 17.5 times higher risk of developing OSA (OR = 17.5) (2.66-114.85).

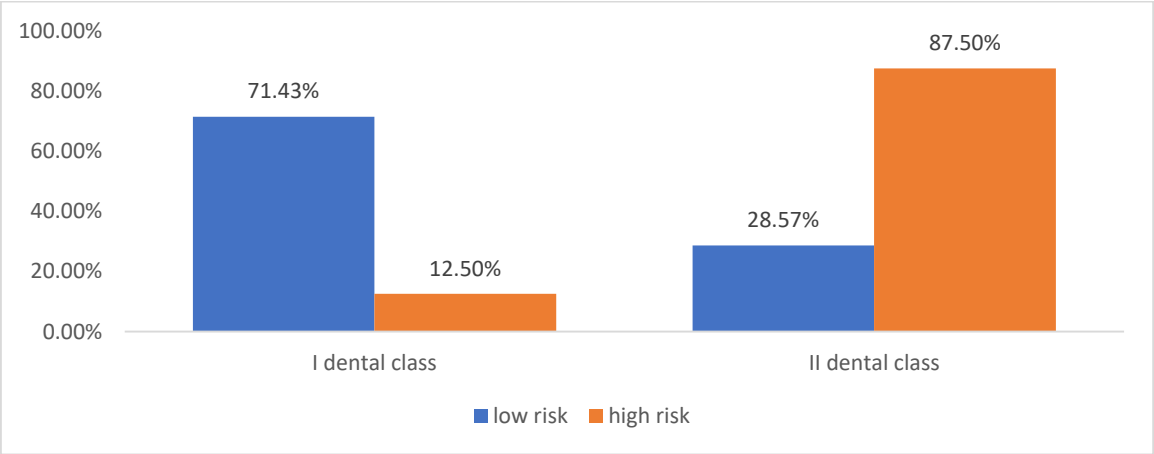


FIG. 54. Risk of OSA and dental grade

Patients with a deep bite have a higher risk of OSA (p = 0.002), with a strong relationship between the two indicators (r = -0.639; p <0.001) (Fig. 55).

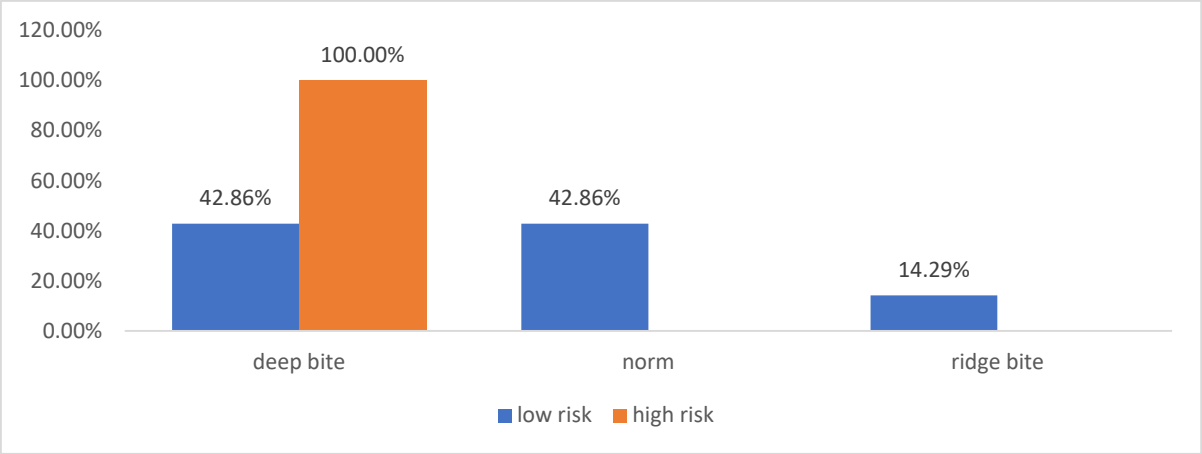


FIG. 55. Risk of OSA and vertical deviations in occlusion

Patients with reduced lower facial height have a higher risk of OSA than those with normal lower facial height ($p < 0.001$), with a significant relationship between lower facial height and the risk of OSA ($r = -0.756$; $p < 0.001$) (Fig. 56).

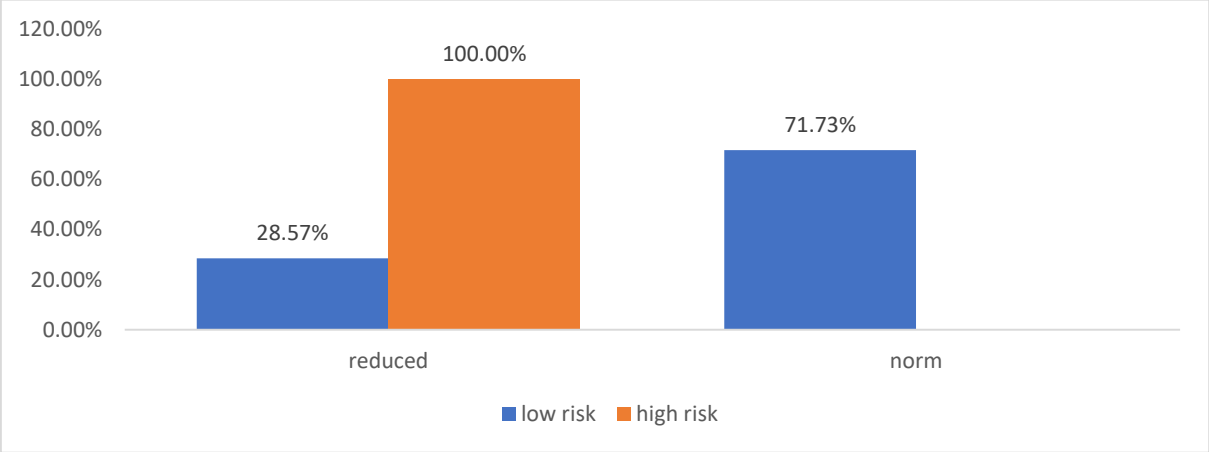


FIG. 56. Risk of OSA and lower facial height

4.3. Analyzing the dynamics of the functional indicators of the respiration of patients with snoring and OSA before and after treatment with splints and CPAP.

There was a significant difference in CRI in patients with and without treatment ($p < 0.001$), as well as between treatments ($p < 0.001$) (Fig. 57). Low-risk patients perform better with intraoral devices, while moderate-risk and high-risk patients perform better with CPAP.

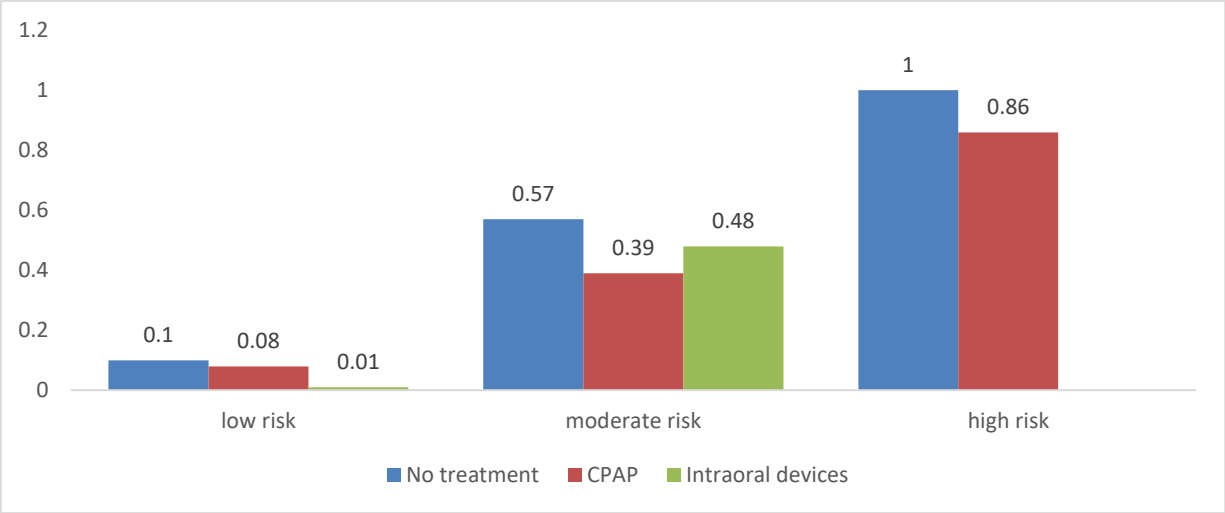


FIG. 57 Comparative analysis of the change in CRI according to the conducted treatment

A significant difference according to the conducted treatment was also found with regard to AHI ($p < 0.001$), as in both types of treatment there was a significant improvement in AHI (Fig. 58).

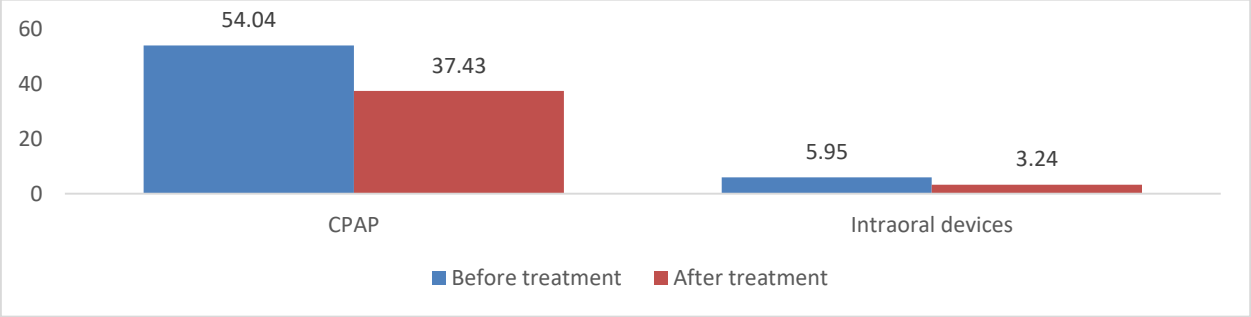


Fig.58. Comparative analysis of the change in AHI according to the performed treatment

A significant difference according to the conducted treatment was also found with regard to HI ($p < 0.001$), as in both types of treatment there was a significant improvement in HI (Fig. 59).

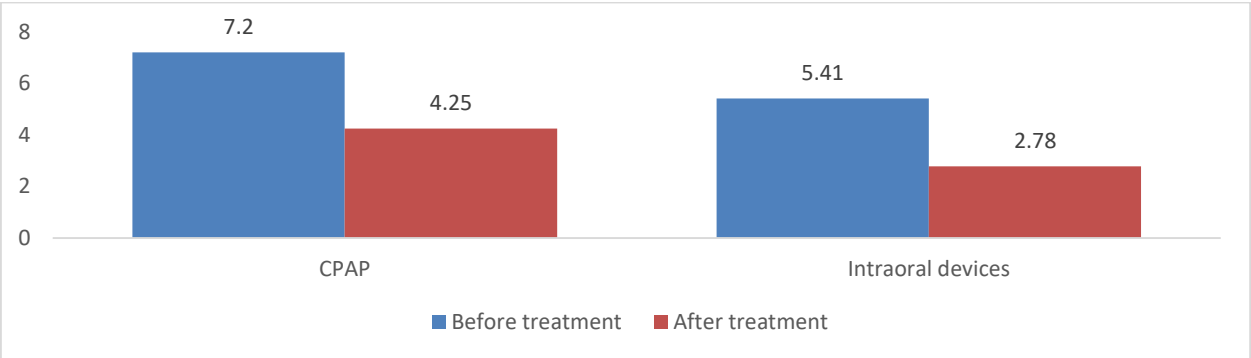


FIG. 59. Comparative analysis of the change in HI according to the conducted treatment

A significant difference according to the treatment was also found with respect to oAHI (p <0.001), and in both types of treatment there was a significant improvement in oAHI (Fig. 60).

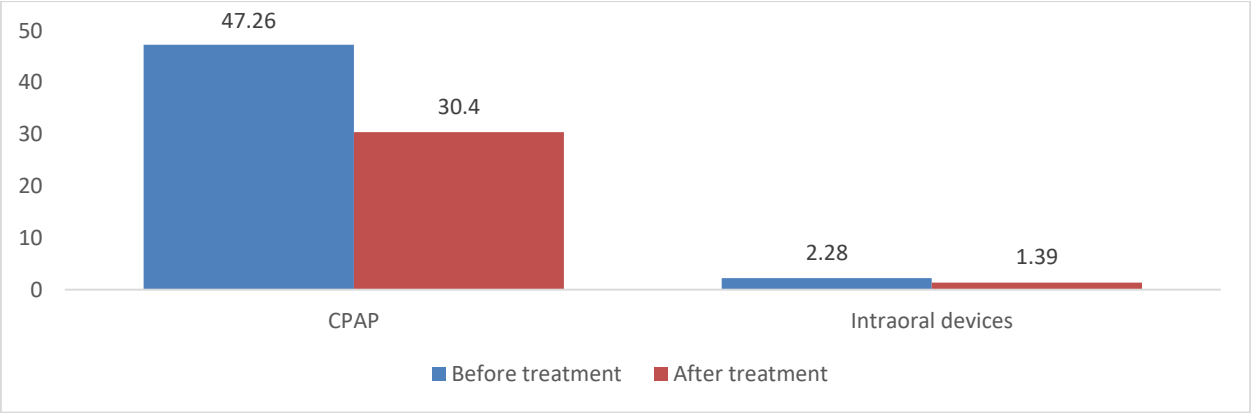


FIG. 60. Comparative analysis of the change in oAHI according to the performed treatment

4.4. Study of the individual quality of life of patients with respiratory disorders during sleep before and after treatment with intraoral devices and CPAP.

The mean estimate of daily functioning was 4.55 ± 0.95, ranging from 2.73 to 6.27.

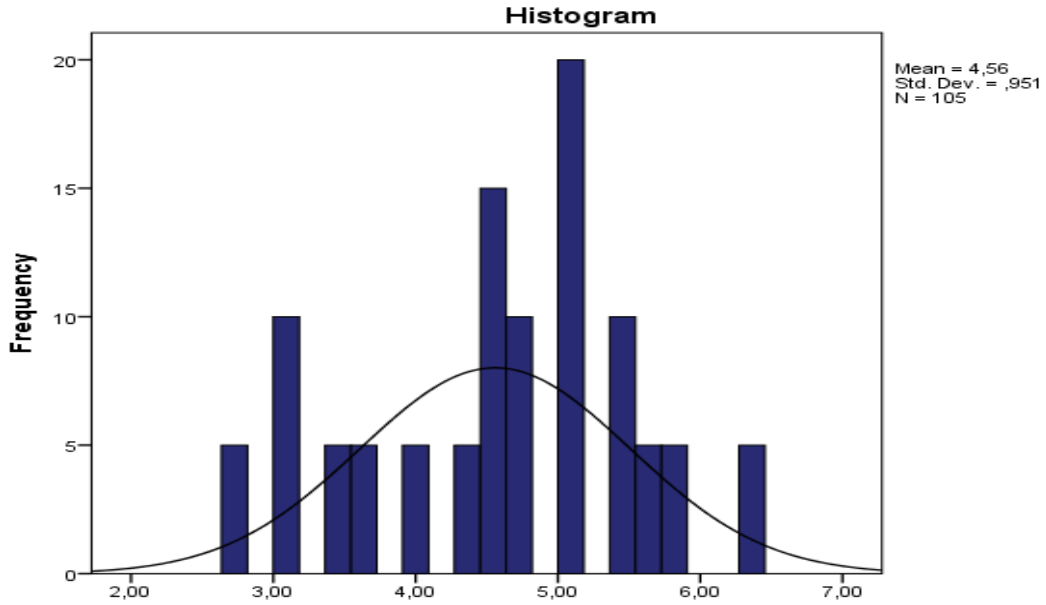


FIG. 61 Average value of daily functioning

There was a significant difference in the assessment of QOL for daily functioning according to the treatment (p = 0.008), as patients treated with intraoral devices have better QOL (Fig. 62).

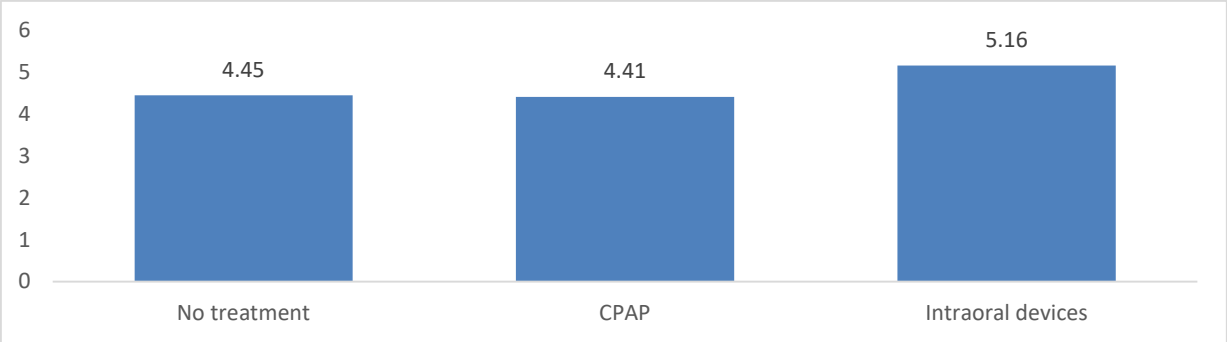


FIG. 62. Comparative analysis of the assessment of QoL for daily functioning according to the conducted treatment

There was a significant difference in the assessment of QoL for daily functioning by gender (p <0.001), with women having better QoL.

FIG. 63 The assessment of QoL for daily functioning by gender

No relationship was found between the relationship and the assessment of daily functioning. On the other hand, a negative relationship was found between BMI and daily functioning (r = -0.621; p <0.001).

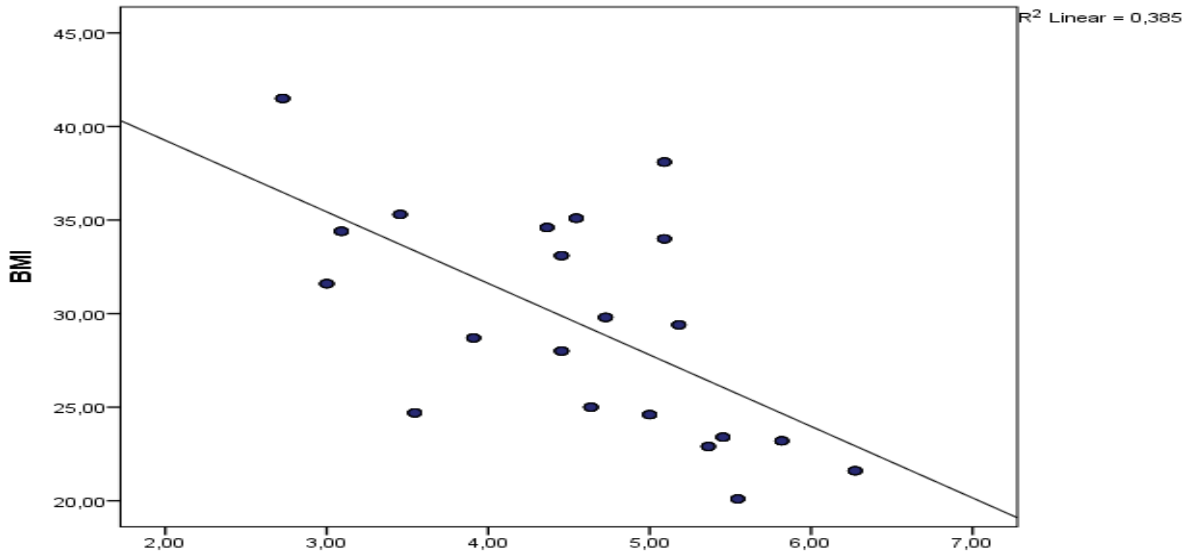


FIG. 64. Correlation analysis between BMI and daily functioning

Daily functioning correlated negatively with the strength of snoring (r = -0.520; p <0.001), and the more strongly the subject snores, the lower the assessment of daily functioning.

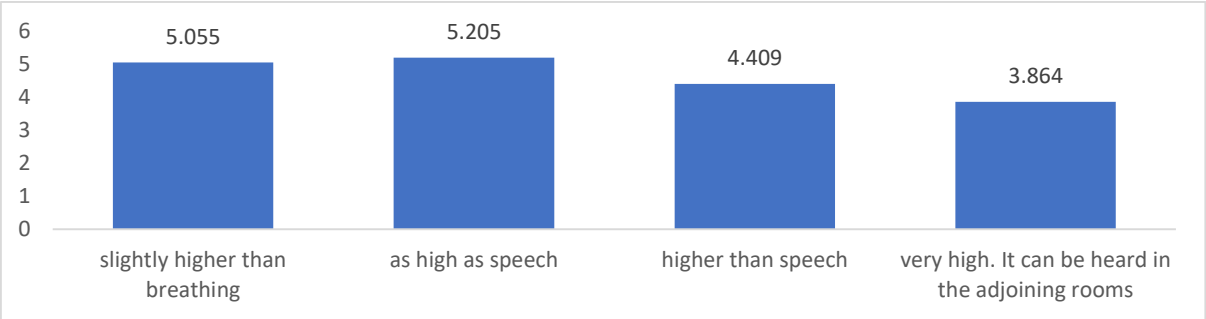


FIG. 65. Snoring power and daily functioning

The frequency of snoring also has a negative impact on the daily functioning of patients with OSA (r = -0.574; p <0.001), with the lowest score being those who snore almost every night.

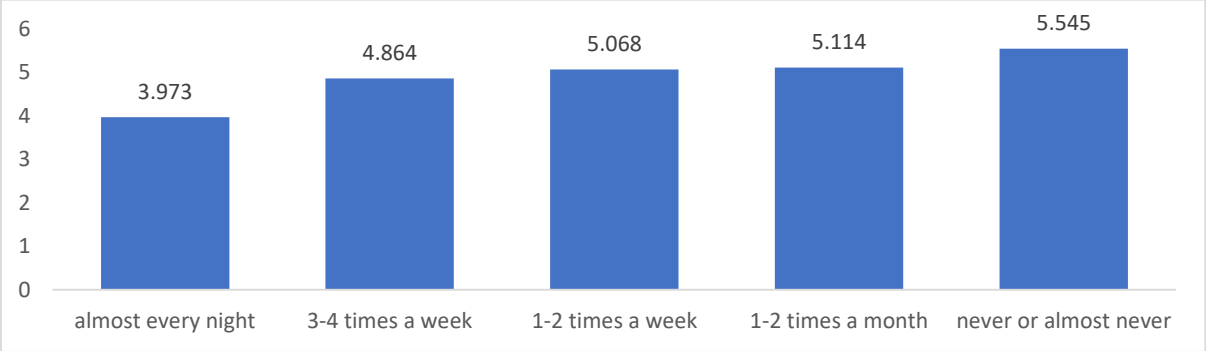


FIG. 66. Frequency of snoring and daily functioning

The average score of social interactions is 4.73 ± 1.26, the minimum is 2.38 and the maximum is 6.92.

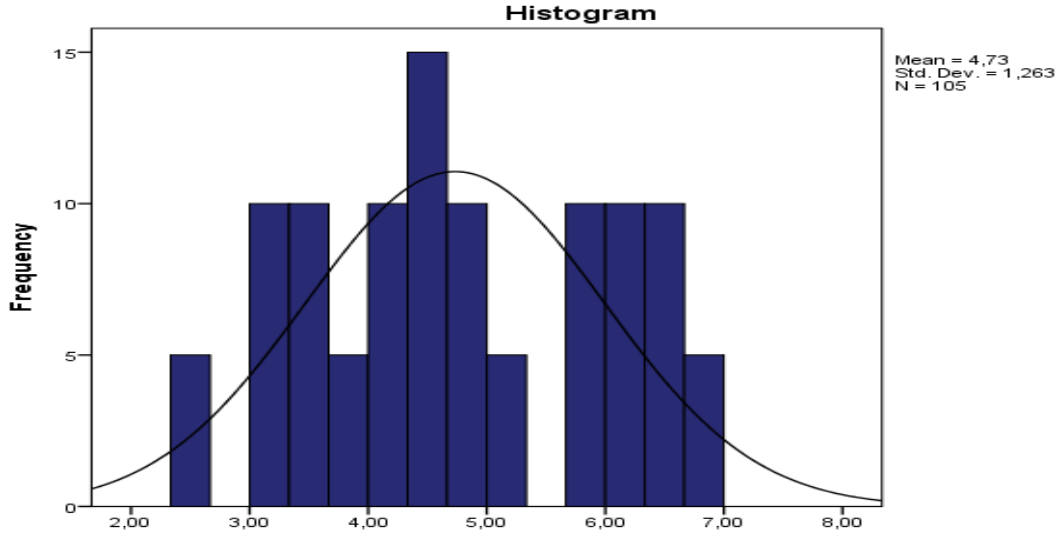


FIG. 67. Average value of social interactions

There was a significant difference in the assessment of QoL for social interactions according to the treatment ($p < 0.001$), as patients treated with intraoral devices have better QoL (Fig. 68).

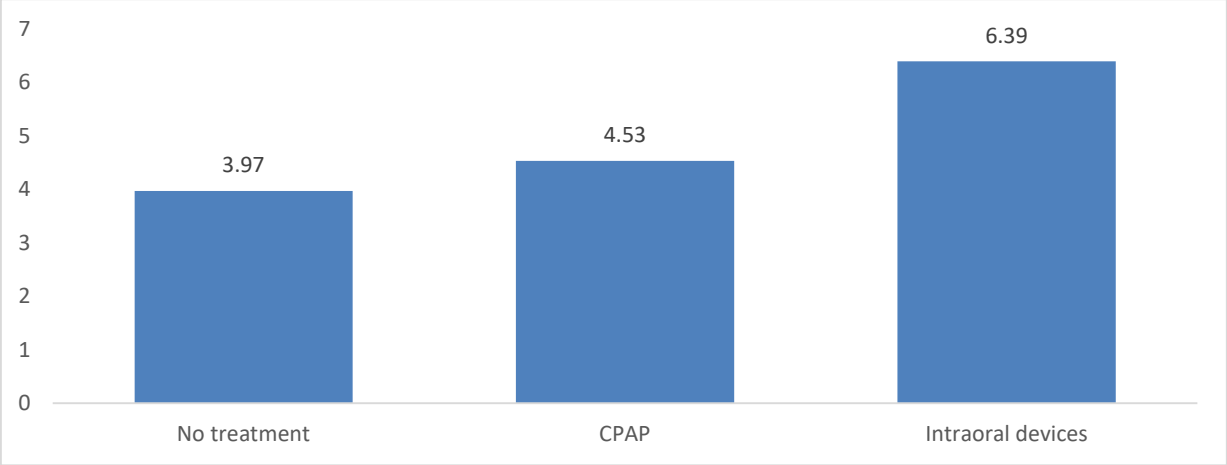


FIG. 68. Comparative analysis of the assessment of QoL for social interactions according to the conducted treatment

There was a significant difference in the assessment of social interactions by gender ($p < 0.001$), with women having better QoL.

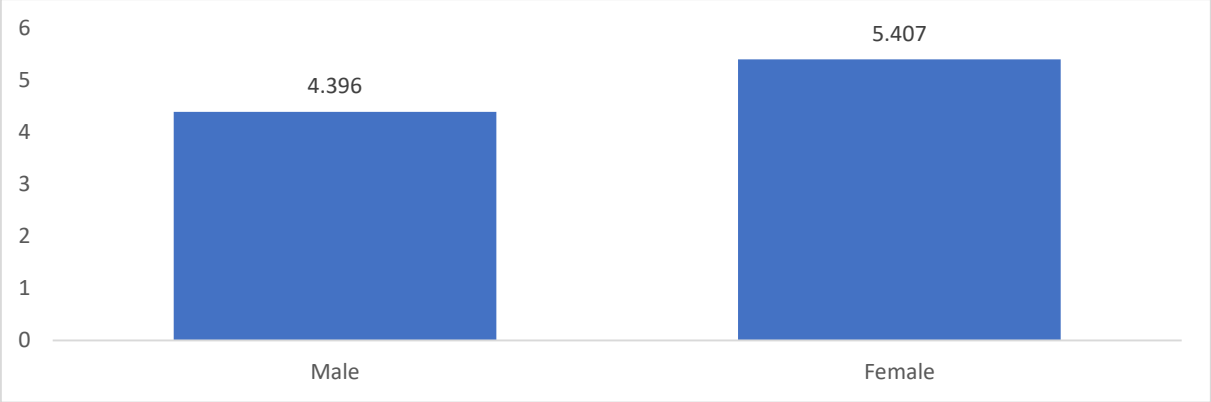


FIG. 69. Social interactions by gender

Weakly negative dependence between age and social interactions was found ($r = -0.281$; $p = 0.004$). However, a strong dependence ($r = -0.732$; $p < 0.001$) was found with BMI, which indicates that obesity is associated with a reduced assessment of social functioning in patients with OSA.

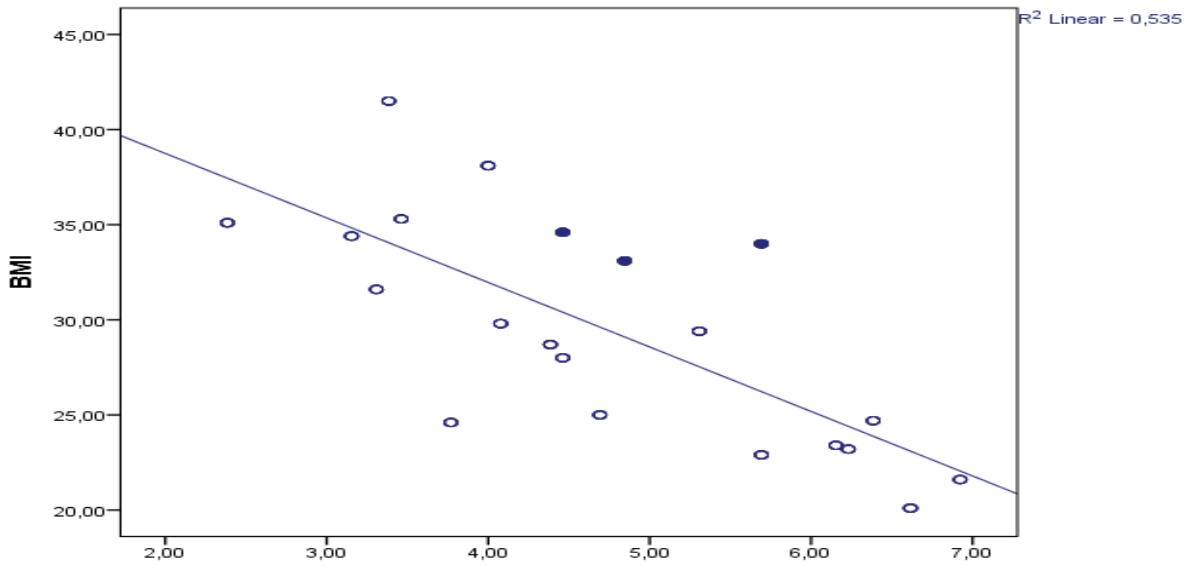


FIG. 70. Correlation analysis between age and social interactions

The analysis of the relationship between snoring strength and social functioning revealed a strong negative dependence (r = -0.630; p <0.001), which shows that strong snoring is associated with a low score for social interactions.

The frequency of snoring has an extremely strong negative impact on social interactions (r = -0.820; p <0.001), and people who snore every night have a very low score for social interactions.

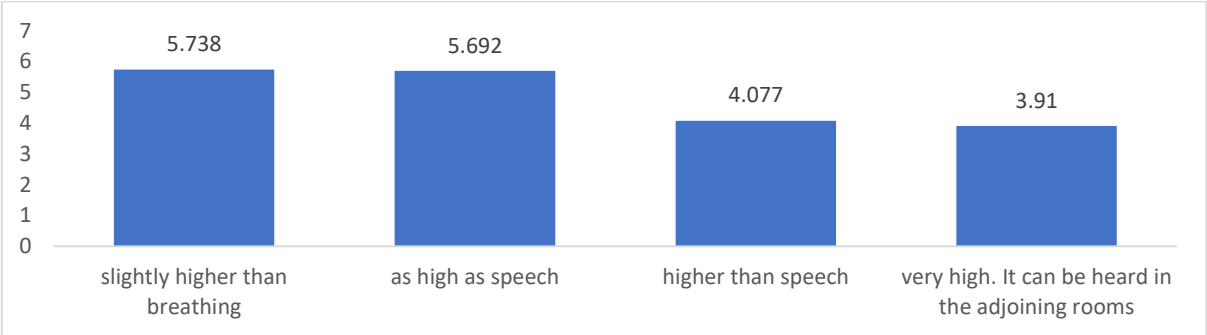


FIG. 71. Strength of snoring and social interaction

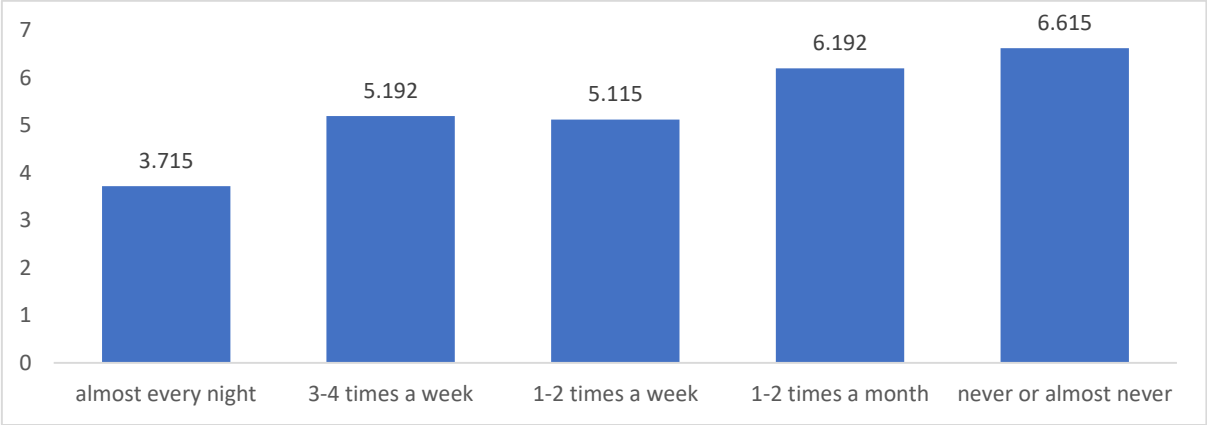


FIG. 72. Snoring frequency and social interaction

The mean score of emotional functioning is 4.83 ± 0.98, with a minimum of 3.00 and a maximum of 6.45.

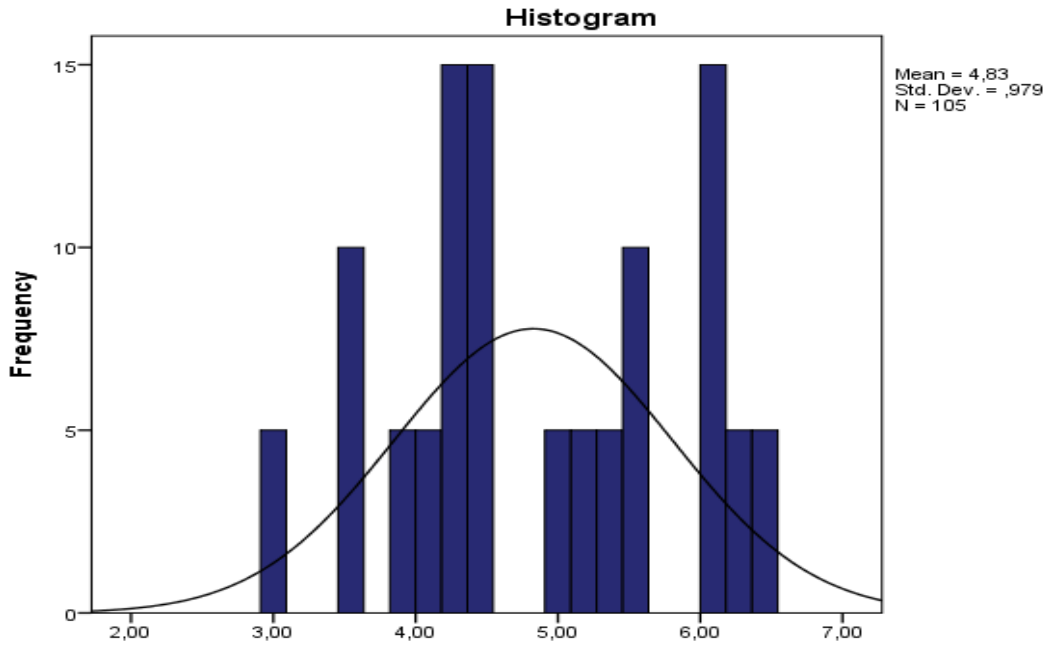


FIG. 73. Average value of emotional functioning

There was a significant difference in the assessment of QoL for emotional functioning according to the treatment (p <0.001), as patients treated with intraoral devices have better QoL (Fig. 74)

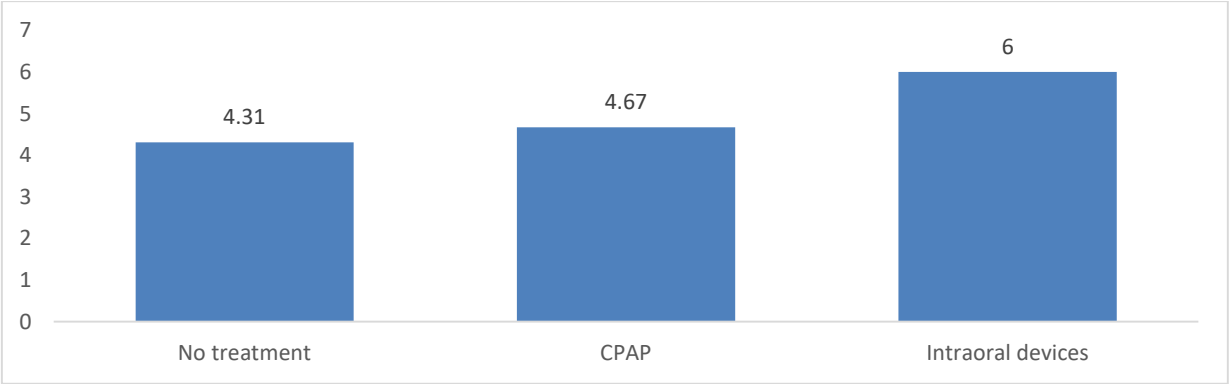


FIG. 74. Comparative analysis of the assessment of QoL for emotional functioning according to the conducted treatment

When assessing this area of QoL, it was again found that women have better QoL (p <0.001).

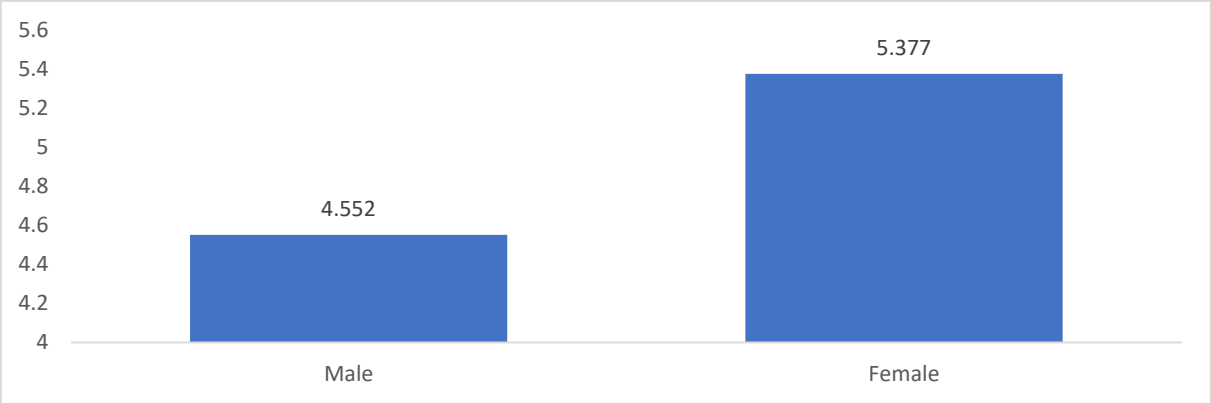


FIG. 75. Emotional functioning and gender

This area of QoL correlates moderately negatively with age (r = -0.317; p = 0.001), and with increasing age QoL deteriorates in terms of emotional functioning.

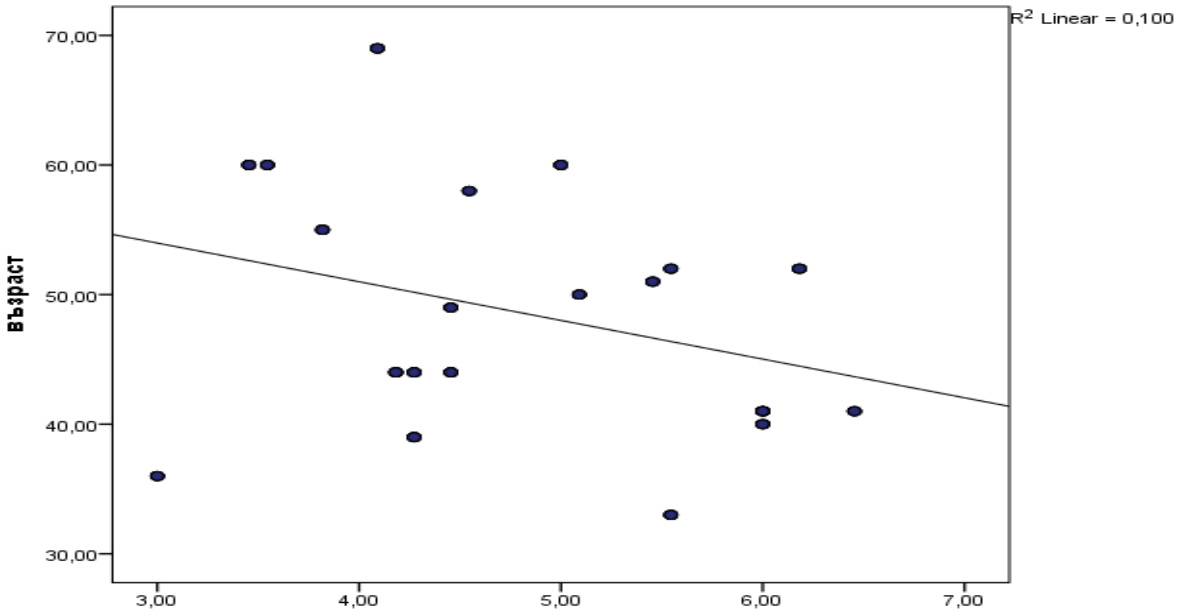


FIG. 76. Correlation analysis between age and emotional functioning

BMI also correlated negatively with emotional functioning, strongly influencing the assessment of QoL (r = -0.708; p <0.001), with obesity in patients with OSA associated with decreased assessment of QoL in the area of emotional functioning.

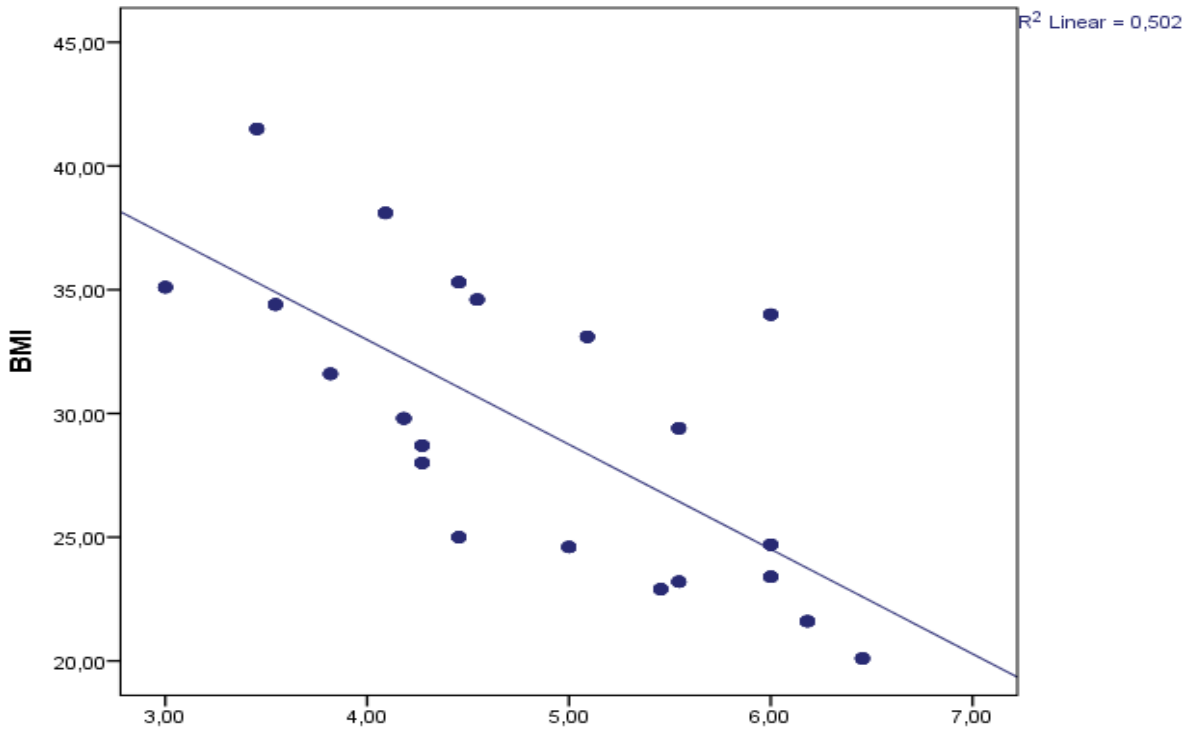


FIG. 77. Correlation analysis between BMI and emotional functioning

As in other areas, snoring strength has a strong negative effect on QoL (r = -0.652; p <0.001). Similar results were reported for snoring frequency (r = -0.780; p <0.001).

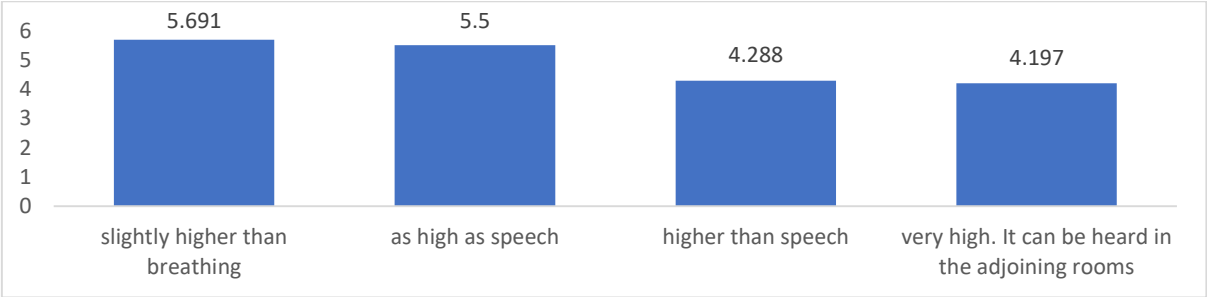


FIG. 78. Snoring strength and emotional functioning

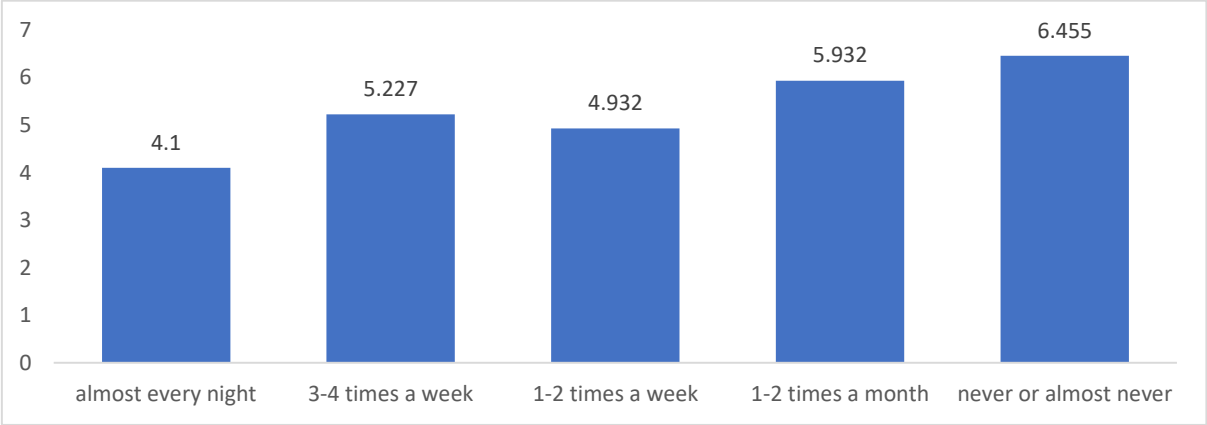


FIG. 79. Frequency of snoring and emotional functioning

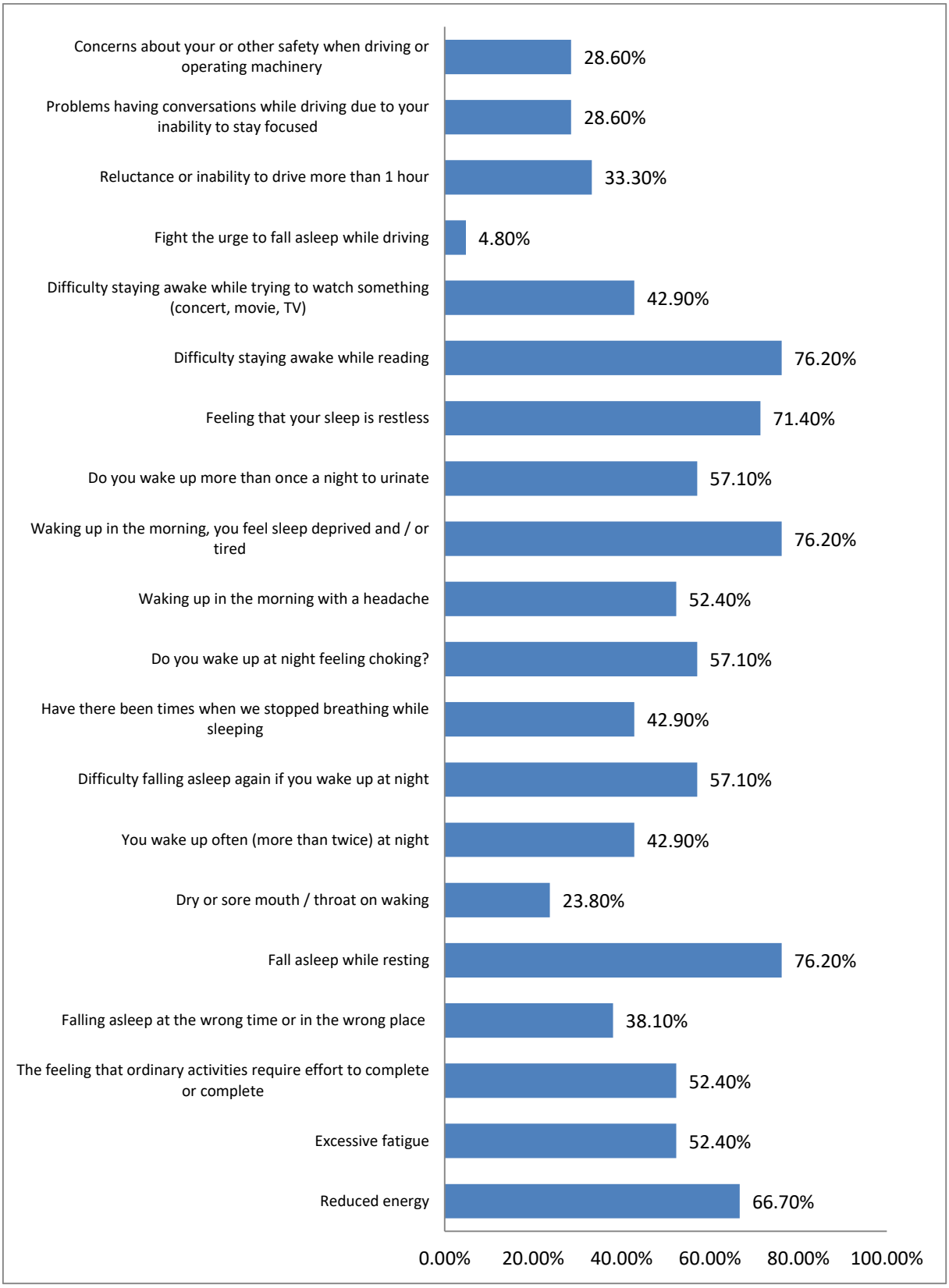


FIG. 80. Main difficulties

The main difficulties experienced by the studied patients are that they fall asleep while resting, wake up tired in the morning, have restless sleep, find it difficult to stay awake while reading and have low energy.

All three studied areas of QoL correlated negatively with AHI.

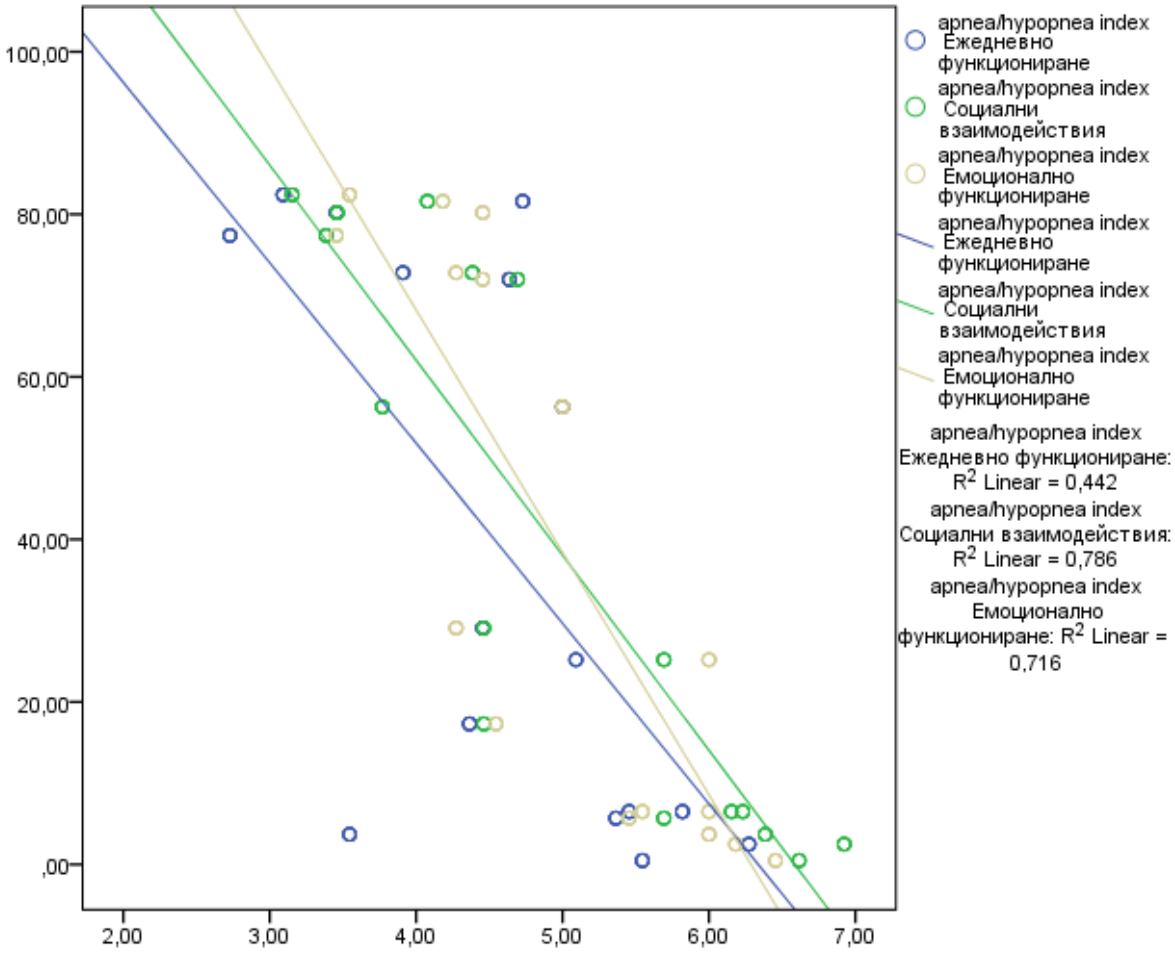


FIG. 81. Correlation analysis of the separate areas for QL and AHI

The effects of OSA on QOL are not limited to excessive daytime sleepiness and an increased risk of cerebrovascular and cardiovascular events. The results of this study conclude that OSA clearly affects important areas of QoL that remain unexplored in the sleep laboratory. The concept of healthy quality of life usually refers to patients' perception of performance in at least one of four important areas: 1) somatic sensation; 2) physical function; 3) emotional state; and 4) social interaction [253]. The QoL domains that participated in this study correspond to the same dimensions.

In addition, this study was useful in elucidating the clinical features of OSA.

Given the relationship between QoL damage and the severity of sleep apnea, QoL should be measured directly. Measurement of physiological parameters cannot be used as a substitute for a healthy quality of life in sleep apnea. Recently, a number of investigations have included the measurement of QoL in the evaluation of the effect of treatment methods in OSA [73, 86, 99].

Symptoms reported by patients with OSA include fatigue, daytime sleepiness, poor sleep quality, impaired concentration, memory loss, headaches, and mood swings, and affect the disorder. [207] They have a significant impact on an individual's health-related quality of

life. Assessment of QoL is one of the most important starting points in providing personal care to patients with OSA.

The impact of obstructive sleep apnea on quality of life is not limited to excessive daytime sleepiness. From this study, it is clear that the assessment of quality of life in obstructive sleep apnea should be included in key areas that include daytime symptoms, nocturnal symptoms, activity limitations, emotional function, and interpersonal relationships. Therefore, obstructive sleep apnea contributes significantly to damage to all areas of what is commonly referred to as 'quality of life related to health'. The correlation between impairment of quality of life and the severity of sleep apnea increases the need for direct measurement of health in obstructive sleep apnea.

4.5. Development of a diagnostic-therapeutic algorithm in adult patients with snoring and OSA and pathological dental status.

After reviewing the literature, the results of the various clinical trials of the American Academy of Sleep Medicine (AASM) and the American Academy of Dental Sleep Medicine (AADSM) and their recommendations, as well as the results of our study, we can recommend the following diagnostic - therapeutic algorithm for patients with snoring and OSA.

The first steps in diagnosing patients with snoring are to take a medical history, fill out specialized questionnaires and make a clinical assessment of the patient, which is performed by an ENT or sleep medicine specialist.

Taking a detailed history of snoring and, if possible, the partner makes it possible to obtain important information about snoring. The anamnesis includes the following points:

Specific assessment of snoring	• History of complaints (eg every night, intermittently) • Occurrence at night (constant / periodic, related to body position) • Causal situations or risk factors (eg alcohol or nicotine consumption, presence of allergic or non-allergic rhinitis, nasal congestion) • Snoring pattern (eg regular or irregular frequency, volume, nature of the sound)
Anamnesis of sleep	• Insomnia • Night awakenings (eg, related to shortness of breath) • Lack of concentration during the day • Daytime drowsiness • Reduction of overall productivity • Complaints of dry mouth or headache in the morning
Concomitant diseases	• Cardiovascular disease (eg hypertension, arrhythmia, myocardial infarction, stroke) • Overweight or obese • Diabetes

From a diagnostic point of view, snoring is often accompanied by obstruction of the upper respiratory tract and therefore an attempt should be made to distinguish between snoring and snoring as a symptom of OSA.

Often pathological structures in the upper respiratory tract can cause snoring with or without obstruction of the upper respiratory tract. Following the surgical removal of these pathological structures, a new assessment of snoring characteristics is required.

There are various questionnaires in the scientific literature that include snoring as a symptom associated with OSA. To date, there is no validated questionnaire designed to distinguish snoring from OSA-related snoring. Questionnaires usually assess the strength of snoring, but this information does not allow to distinguish snoring.

The purpose of the clinical examination is to identify changes in the upper respiratory tract that may cause snoring or obstruction of the upper respiratory tract. As with a medical history, the results of the clinical examination may be very similar in snoring and those with upper airway obstruction. Upper airway anatomical findings can cause snoring with or without upper airway obstruction. The ENT specialist examines the following structures:

- Nostrils
- Soft Tissues of the nose
- Bone and cartilage nasal skeleton
- Nasal septum
- Nose turbines
- Nasopharynx

Due to its structural composition, the oropharynx is at the beginning of the collapse of the upper respiratory tract. Narrowing of the oropharynx can affect airflow and therefore cause snoring. A clinical examination of the oropharynx should include the following:

• Size and position based on language
• Size of the tonsils
• Size and position of the soft palate
• The size and position of the uvula

Clinical and endoscopic evaluation of these structures provides mainly information about these anatomical structures at rest.

Polygraphy or polysomnography is used to study and analyze sleep, and polysomnography is the gold standard for diagnosing sleep-related breathing disorders.

After being diagnosed with snoring and OSA by an ENT specialist, the patient is referred to a PDM specialist to examine dental and periodontal status, mucosal condition, tongue size, and occlusion abnormalities. Patients with distally located MS, with a deep bite and a shortened lower facial third are prone to breathing problems and are suitable for the use of intraoral devices to affect snoring. If the intraoral device is considered a therapeutic measure, the ability of the lower jaw to medialize should be assessed. Patients with medial bite are not suitable for treatment with intraoral devices. Due to the load on the periodontal structures and the need for good retention of the devices, it is necessary that the patients who will be affected by oral devices have at least one tooth from a tooth group in the lateral area and the teeth have good or initial and moderate periodontal disorders.

The following algorithm can be recommended for patients with snoring and OSA:

Snoring	Characteristic	A team of specialists	TREATMENT
Snoring without morphological changes in the airways	➢ Average volume ➢ Snoring from time to time ➢ Deeper tone ➢ Regular breathing ➢ Restful sleep	ENT PDM specialist	Treatment with oral devices medializing MS and opening the airways. It is made by a PDM specialist
Snoring as a result of airway obstruction - deviation of the nasal septum, uvula elongata, changes in the soft palate, hyperplasia of the tonsils	➢ High volume ➢ Every night ➢ In the form of an explosion ➢ With respiratory arrest ➢ Restless sleep	ENT PDM specialist	1. Surgical treatment to remove airway obstruction. 2. If snoring continues after the surgical treatment - treatment with oral devices for medialization of MS and opening of the airways
Snoring and sleep apnea	➢ High volume ➢ Every night ➢ In the form of an explosion ➢ With respiratory arrest ➢ Restless sleep ➢ Insomnia ➢ Reduced QOL	Interdisciplinary treatment team including pulmonologist, neurologist, cardiologist, psychiatrist, sleep medicine specialist PDM specialist	Treatment with CPAP devices and after improvement of the condition it is possible to switch to the use of oral devices for medialization of MS

In patients with primary snoring without OSA, treatment with oral devices is recommended, as it reduces the frequency and intensity of snoring, improves sleep quality for both snoring patients and their partners, and improves quality of life.

When prescribing therapy to patients with OSA with oral devices, it is necessary for the dentist to assist in the development of personalized devices that are consistent with the characteristics of the patient. When the oral device is designed for the specific patient, greater effectiveness of treatment and influence on the architecture of sleep is achieved. Better influence of the physiological parameters of sleep is achieved, which leads to better daily functioning and better QoL.

Oral treatment should be monitored by a qualified dentist to avoid side effects associated with changes in occlusion or damage to tooth enamel. The beneficial effects of OSA treatment can be reduced by treatment-related side effects that can lead to dental problems.

In OSA patients after treatment of common diseases and CPAP treatment and with significant improvement in these patients, intraoral devices may be used as long-term maintenance therapy to keep the airway open during sleep and not obstruct breathing. during sleep.

The treatment of patients with sleep apnea is a long-term and difficult process involving an interdisciplinary team of pulmonologists, neurologists, cardiologists, psychiatrists and sleep medicine specialists.

CONCLUSIONS

1. Patients with symptoms of snoring and OSA are men over 45 years of age, overweight and obese.
2. Snoring correlates with male sex, age over 50 years and BMI over 30 kg / m2.
3. Feeling tired after sleep is associated with sleep apnea, snoring frequency and BMI.
4. The study of the dynamics of the functional indicators of respiration of patients with snoring and OSA showed that the cardiovascular risk in half of the persons is low 52.2%.
5. Cardiovascular risk correlates with snoring, female, age over 50, BMI> 30 kg / m2
6. AHI has a significant difference according to gender and correlates with age, BMI, strength and frequency of snoring and the presence of hypertension.
7. AI is associated with male gender, age, BMI, strength and frequency of snoring, the presence of hypertension.
8. The individual elements of the quality of life differ significantly between men and women, with women having a better life expectancy.
9. Daily functioning correlates negatively with BMI, strength and frequency of snoring.
10. Social interactions and emotional functioning are negatively correlated with age, BMI, strength and frequency of snoring.
11. The main difficulties experienced by the studied patients are that they fall asleep while resting, wake up tired in the morning, have restless sleep, find it difficult to stay awake while reading and have low energy.
12. OSA affects important areas of QoL that remain unexplored in the sleep laboratory.
13. Patients with class II dentition, deep bite and reduced height have a significantly higher risk of OSA compared to those with class I dentition and normal bite.

CONCLUSION

Snoring and obstructive sleep apnea (OSA) are common sleep disorders due to recurrent narrowing and collapse of the upper respiratory tract. Untreated OSA has been associated with a number of adverse health effects, including systemic hyper-stress, coronary artery disease, stroke, atrial fibrillation, increased motor vehicle accidents, congestive heart failure, daytime sleepiness, reduced quality of life, and increased mortality. Snoring is also an important social problem and contributes to a reduced quality of life of partners in bed through disturbed sleep. Snoring itself can have a negative impact on health, such as an increased risk of cardiovascular disease.

In recent years, intraoral devices have become an increasingly common treatment for OSA and snoring. Although positive airway pressure (CPAP) remains the most common and effective treatment for sleep apnea, intraoral devices offer effective therapy for many patients with OSA. These devices offer advantages over CPAP, as they do not require a source of electricity and are less cumbersome, especially when traveling. Intraoral devices are well tolerated in most patients and adherence to a therapeutic regimen may be better than CPAP.

CONTRIBUTIONS

Contributions of scientific and applied nature

1. For the first time in Bulgaria the frequency, risk factors, diagnosis, treatment and quality of life of patients with obstructive sleep apnea and dental pathology are assessed.
2. For the first time in Bulgaria the use of intraoral devices for the treatment of obstructive sleep apnea has been subjected to critical analysis.
3. Special attention is paid to the participation of the dentist in the multidisciplinary team for the treatment of obstructive sleep apnea and snoring.
4. The risk profile of patients with OSA among the Bulgarian population - male, overweight and obesity, the strength and frequency of snoring.
5. A diagnostic-therapeutic algorithm has been developed in adult patients with snoring and OSA and pathological dental status.
6. A critical analysis of polygraphy in patients with dental pathology has been developed.

Contributions with an original character for the country

1. The quality of life of OSA patients treated with intraoral devices was studied for the first time.
2. The risk factors for snoring and OSA in patients with pathological dental status were studied for the first time.
3. Diagnosis of patients with suspected sleep apnea with a polygraph is performed for the first time.
4. The importance of the otorhinolaryngologist-dentist relationship in the diagnosis and treatment of patients with obstructive sleep apnea and snoring has been proven.
5. The requirements for reducing the side effects in the treatment of snoring with intraoral devices both in patients and in relation to the intraoral device have been established.

Contributions of a confirmatory nature

1. The role of the multidisciplinary team for early differentiation of the patient's path to different specialties is confirmed.
2. The use of intraoral devices in the treatment of mild forms of obstructive sleep apnea and snoring is confirmed (AHI <5).
3. It is confirmed that individually made devices are a better healing solution than factory-made.
4. The polygraph test is absolutely sufficient to diagnose patients with mild obstructive sleep apnea.

PUBLICATIONS RELATED TO THE DISSERTATION

1. Matev L. Applications Of The Methods Of Image Diagnosis In Obstructive Sleepapnea. International Bulletin of Otorhinolaryngology. 4/2019, 19-27
2. Matev L. Applications of Polysomnography and Apnea-graph in Obstructive Sleep Apnea. International Bulletin of Otorhinolaryngology. 4/2019, 28-32

3. Matev L., Arnautska Hr. Tools for assessing the quality of life in patients with obstructive sleep apnea. Varna Medical Forum, vol. 9, 2020, issue 2, 170-176 (in Bulgarian)