

Obstructive Sleep Apnea Syndrome and the correlation with obesity



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Alessandra Perazzoli de Souza

Master in Nursing

Alto Vale do Rio do Peixe University (UNIARP) - SC

ORCID: <https://orcid.org/0000-0001-6115-1388>

Paola Ribas Gonçalves dos Santos

Medical Student

Alto Vale do Rio do Peixe University (UNIARP) - SC

ORCID: <https://orcid.org/0000-0003-2882-559>

Flavia Eduarda Cachoeira

Medical Student

Alto Vale do Rio do Peixe University (UNIARP) - SC

ORCID: <https://orcid.org/0000-0002-1043-9813>

Micheli Martinello

PhD in Medical Sciences

Alto Vale do Rio do Peixe University (UNIARP) - SC

ORCID: <https://orcid.org/0000-0002-1517-1545>

Maykon Ribeiro

Graduating in Medicine

Alto Vale do Rio do Peixe University (UNIARP) - SC

ORCID: 0009-0007-6779-0576

ABSTRACT

Introduction: Sleep apnea is a chronic, disabling disorder that has alarming consequences, since its pathophysiological mechanism implies changes in respiratory control. It consists of partial or total obstruction of the upper airways resulting in reduction or interruption of oxygen flow for 10 seconds, interrupting sleep. **Method:** Bibliographic review study in the databases Scielo, Virtual Health Library (VHL) and Google Scholar published from 2008 to April 2021, in Portuguese and English being randomized clinical trials, excluding other types of studies. **Results:** After the selection of the articles, based on the inclusion and exclusion criteria, 16 articles were included for the elaboration of the analysis and the abstract. Obstruction of the upper airways in obese patients occurs by excess adipose tissue, which accumulates in some organs and makes the respiratory system narrower, aggravating its manifestation. The coexistence of Obstructive Sleep Apnea Syndrome with obesity exacerbates the risk factors and secondary complications for the development of other comorbidities such as hypertension and heart failure, as well as hormonal imbalance, increasing the plasma levels of ghrelin that predisposes the development of Diabetes Mellitus type 2. **Conclusions:** It is essential to apply therapeutic measures aimed at reducing upper airway obstruction, as well as its collapse, and it is necessary to associate the treatment to reduce obesity in order to improve pulmonary ventilation-perfusion of patients with these pathologies.

Keywords: Sleep apnea, Obesity, Sleep, Obstructive Sleep Apnea Syndrome (OSAS).

1 INTRODUCTION

Obstructive Sleep Apnea (OSA) is a condition that occurs through partial or total obstruction of the upper airways and results in reduction or interruption of oxygen flow for 10 seconds and, consequently, sleep interruption. However, when OSA is associated with five or more other symptoms, it is classified as Obstructive Sleep Apnea Syndrome (BEZERRA, 2021).

Defined as a chronic, disabling disorder, Obstructive Sleep Apnea Syndrome (OSAS) has alarming consequences, since its pathophysiological mechanism implies changes in respiratory



control. This manifests itself through repeated episodes of apnea and hypopnea that occur during sleep, leading to daytime hypersomnolence and cardio-respiratory changes and is extremely severe in obese people (PRADO, 2020)

Patients with OSAS are influenced by their quality of life since sleep is a physiological state characterized by a lowering of the level of consciousness. This process is responsible for the circadian cycle, hormonal balance and acts as a cardioprotective, humoral as well as muscular response (MAAHS PETER; MAAHS PETER; MAAHS SHULTZ, 2019). According to Lessa et. al (2020), sleep deprivation compromises several morphological mechanisms, such as neuronal synapses, memory establishment, limitations of perceptual processes, psychic-behavioral influences and the quality of life of the individual.

In addition, sleep is a determining factor in the maintenance of the endocrine-metabolic axis, being mainly responsible for the release of melatonin, serotonin, leptin and ghrelin. However, it is noticed that in the Obstructive Sleep Apnea Syndrome there are changes in the regulation and secretion of leptin and ghrelin, which act directly in the control of hunger and satiety. In this sense, it is noted that OSAS has a higher incidence in individuals with BMI greater than 30 kg/m², classified as obese (BRITO et al; 2021).

Therefore, the present study aims to understand the correlation between obesity and Obstructive Sleep Apnea Syndrome, and as specific objectives we sought to identify the characteristics of the profile of obese patients who had OSAS, analyze the pathophysiological mechanisms, as well as know the warning signs for the development of obstructive sleep apnea and how it impacts on the quality of life of individuals, focusing on obese patients.

2 METHODOLOGY

The present study was designed to analyze the correlation and impact of obesity on obstructive sleep apnea syndrome. For this, we used as methodology the bibliographic review that according to what reiterates Batista and Kumada (2021) is based on study sources that have already been recommended, as well as evaluated by other researchers, with the ultimate goal of investigating and improving existing research. For this, it was reviewed bibliographically by means of an electronic search in the following databases Keywords : Scielo, Virtual Health Library (VHL) and Google Scholar. The following words were used as descriptors: Sleep apnea. Obesity. Sleep.

In agreement with the objective, we included studies published from April 2008 to April 2021, in Portuguese and English, that had the following profile: randomized randomized clinical trials. As exclusion criteria for the selection of researches, we considered studies that were case reports, observational studies and poster presentations



After selecting the articles, based on the established inclusion and exclusion criteria, an analysis and interpretation of 16 references was performed. From the information obtained on the subject, a systematic analysis and summary was elaborated in order to understand and deepen on the correlation of sleep apnea and obesity.

3 DEVELOPMENT

Sleep is an active neural process and a constant and reversible physiological state characterized by a decreased state of consciousness and a limitation of

perceptual processes, its function is directly related to the homeostasis of the organism. Sleep consists of two fundamental stages, one of them is NREM (slow wave) sleep, which is composed of the absence of rapid eye movements and reduction of body movements, but always with a basal tonicity. The other stage is called REM sleep that unlike NREM, this has fast waves, with eye movements, dreams and is responsible for depression of the control of homeostatic functions (MAAHS PETER; MAAHS PETER; MAAHS SHULTZ, 2019).

In addition, sleep is a determining factor of the sleep-wake cycle and is indispensable for morphophysiological rhythmicity. A poor amount or quality of sleep is associated with type 2 diabetes, high blood pressure, cardiovascular disease, depression, and obesity. The latter being responsible for about 70% of sleep disorders, mainly with sleep apnea (MAAHS PETER; MAAHS PETER; MAAHS SHULTZ, 2019).

In this perspective, according to the World Health Organization (WHO), obesity is a chronic disease defined by excess adipose tissue and due to global globalization, it has become a pandemic scenario among all age groups and socioeconomic profiles, with higher prevalence in females (FERREIRA et al, 2017). This pathology implies several systemic complications, especially in individuals with sleep deprivation, who sleep a period of less than 7 hours. (GUIMARAES, 2020).

It is also known that sleep is responsible for hormonal regulation and that it has a direct correlation with the release of leptin and ghrelin (GUIMARÃES, 2020). These hormones act on metabolic balance, with leptin responsible for satiety and ghrelin for appetite. According to Pereira et al (2018) sleep deprivation and the ghrelin/leptin ratio are inversely proportional quantities, since there is an increase in ghrelin and prevalence of obesity in individuals with insufficient sleep time.

Sleep deprivation is considered the causal agent of several comorbidities, especially sleep apnea, which can be classified as central, mixed and obstructive. Central apnea originates from deficiency of the respiratory muscles due to an ineffective communication of the central nervous system with the respiratory bulb. Obstructive apnea is a defect in airflow caused by a partial or total obstruction of the upper airways (UA). In relation to the mixed classification, there is concomitantly the obstruction of the upper airways with a deficit in the respiratory muscles (NETO, 2016).

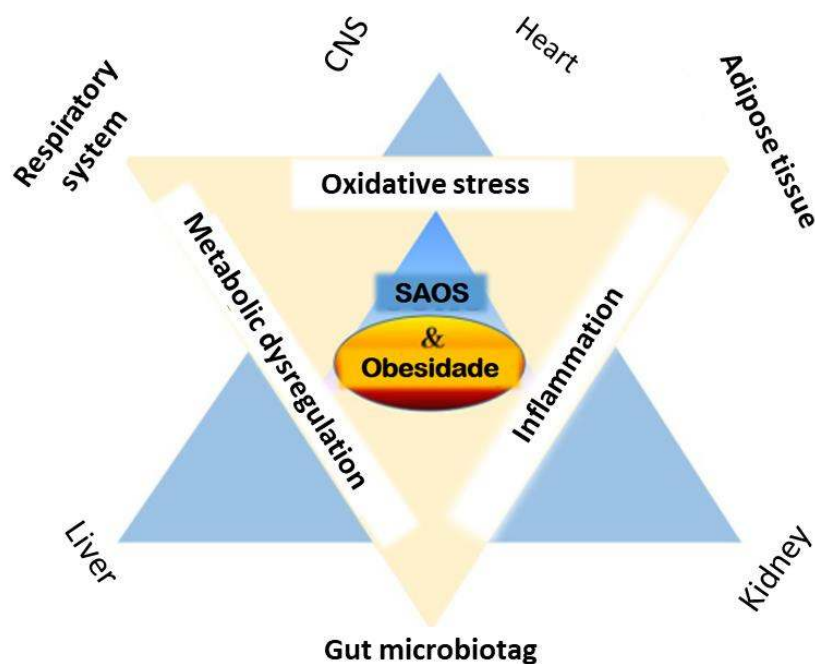


Note the relationship of sleep disorders in obese patients, among the pathologies arising from inadequate sleep, stands out the Obstructive Sleep Apnea Syndrome (OSAS) which is defined as episodes of absence of spontaneous breathing with a high frequency of 300 to 500 times per night and a duration of more than 10 seconds. This syndrome has a higher prevalence between the fourth and fifth decade of life and affects in most cases males, with the main risk factors being obesity, cardiac and metabolic abnormalities (PEROSSO, 2021).

Regarding epidemiological aspects, studies reveal that about 60-90% of patients with OSAS have a Body Mass Index (BMI) higher than 30 kg/m². There is also a higher prevalence in patients with grade III obesity in which the percentile is increased by up to 30 times when compared to society in general. The class of truck drivers, buses and employees with irregular work hours stands out, since these work activities provide the patient with an inadequate diet, a fragmented sleep period, as well as changes in the release of melatonin that directly influence the circadian cycle, favoring the occurrence of the syndrome (ZIMBERG, 2017).

Obesity affects several organs and systems, primary and secondary, becoming even more evident when it is related to the pathogenesis of OSAS (Figure 1). However, the main causes of sleep apnea are due to upper airway obstruction and altered respiratory control of the central nervous system. In obese individuals the pathophysiological mechanism for this sleep disorder occurs by the excess of body fat accumulated in some organs, such as the wall of the trachea and the muscles of the tongue, causing obstruction of the airways and causing OSAS (PRADO, 2020).

Figure 1 – Schematic representation of organs and systems, primary and secondary, associated with the pathogenesis of the OSAS relationship and obesity.



Source: Adapted from Kuvat, Tanriverdi and Armutcu (2020).



Other studies corroborate the relationship between obesity and OSAS, in which they show that the higher the Body Mass Index (BMI) the greater the risk of the individual developing it (BRITO et al., 2021). In addition, the presence of obesity is a great risk for OSAS since this condition can increase the amount of parapharyngeal fat and tongue, making the airways narrower and reduced. Thus, excess weight generates anatomical changes that decrease the diameter of the upper airways (PEROSSO, 2021).

With the decrease in pulmonary ventilation-perfusion as a consequence of partial and/or total obstruction of the upper airways, OSAS causes regular hypoxemia, constant awakening from sleep and routine oxyhemoglobin desaturations. This fact interferes with sleep levels establishing sleep difficulties, irregular sleep and snoring (MAAHS PETER; MAAHS PETER; MAAHS SHULTZ, 2019). In addition, Schmidt et al (2019) states that obesity significantly affects the reduction of lung volumes, which favors the development of hypercapnia in patients.

Another consequence of the interruption of breathing during sleep is the increased state of vigilance that exacerbates the activation of the sympathetic nervous system promoting the release of catecholamines such as noradrenaline, dopamine and adrenaline. This increase in sympathetic activity causes an increase in the action of the renin angiotensin aldosterone system and vascular tone, favoring the development of systemic arterial hypertension in obese patients with obstructive sleep apnea syndrome (SCHMIDT et al; 2019).

It is worth mentioning that the patient diagnosed with this syndrome may have other comorbidities concomitantly, and it is necessary to perform an integrated and expanded therapy. One of the main examples of the coexistence of pathology and OSAS is the increased release of atrial natriuretic factor that is responsible for the nocturia present in the syndrome. However, this compensatory vasodilator can generate myocardial hypertrophy and trigger congestive heart failure (PEROSSO, 2021).

A study conducted by Zimberg et al (2017) showed that obese patients with OSAS have as a consequence sleep restriction a hormonal imbalance that accentuates plasma levels of ghrelin that triggers the feeling of hunger and reduces insulin sensitivity, reflecting negatively on metabolic responses. Moreover, in the long term this disorder of homeostasis concomitant with obesity and insulin resistance generated by inadequate sleep, progressively leads the patient to a hypercaloric diet and the development of type II diabetes mellitus (DE PAULA, 2020).

In this sense, OSAS is a chronic, disabling disorder with alarming consequences. It manifests itself through repeated episodes of apnea and hypopnea that occur during sleep, leading to daytime hypersomnolence and cardiorespiratory changes and is extremely severe in obese people (PRADO, 2020). The most common warning signs are nocturnal snoring, nocturia, daytime headache,



personality disorders, psychiatric symptoms, and breathing pauses seen by others during sleep. (PEROSSO, 2021).

The patient can be diagnosed through anamnesis, physical examination, complementary exams and evaluation of risk factors and comorbidities. It is known that the gold standard for the diagnosis and stratification of the severity of obstructive apnea syndrome is polysomnography, which analyzes sleep regularity and the respiratory cycle. Patients with hypopnea are those who have 30% of the flow reduced for at least 10 seconds, or a microarousal and desaturation of 3%. For patients with apnea, a 90% reduction in flow is required in 10 seconds (DUARTE et al, 2022)

A cross-sectional study conducted at the Center for Childhood Obesity (COI), of the Clinical School of Nursing of the State University of Paraíba in 2019, when linking the classes of obesity with the variables of lifestyle, respiratory symptoms, quality of life and sleep, showed that among the respiratory symptoms, the high prevalence of shortness of breath (85%) and cough (60%), both affecting more individuals with marked obesity. The research revealed that poor quality of life and sleep had high prevalences in the sample, 60% and 70% respectively (BRITO et al, 2021).

Another study evaluated 19 patients with OSAS, revealed that apneas increased significantly on the second night after eating a high-fat diet. This fact corroborates the relationship between the syndrome and obesity (BRITO et al, 2021).

Thus, it is perceived the importance of controlling obesity to reduce the incidence of Obstructive Sleep Apnea Syndrome, since the simultaneous existence of these pathologies causes numerous complications to the body in an irreversible way. Given this fact, it is necessary to treat obesity through the adoption of nutritional diets, practice of physical activities and drug treatment correctly, when indicated, with the objective of weight loss and BMI reduction, in order to improve patient survival (SILVA; TAVARES; PINTO, 2015).

In addition to the treatment of obesity, it is essential to apply therapeutic measures for OSAS in order to avoid collapse of the upper airways. According to what Silva, Tavares and Pinto (2015) say, the main and most effective treatment for the syndrome is weight loss in obese people, as well as decreased intake of sedative drugs and alcoholic beverages. Another essential instrument is the use of CPAP (Continuous Positive Airway Pressure) that applies a positive inspiratory pressure continuously, through a nasobuccal mask, in order to increase hemoglobin saturation, decrease daytime hypersomnolence, hypercapnia, less sleep fragmentation, better neurocognitive function and quality of life (ABESO, 2008).

4 FINAL CONSIDERATIONS

Sleep deprivation, considered a period of less than seven hours, is a triggering factor of many comorbidities, especially sleep apnea that is subdivided into three types, such as central, obstructive



and mixed. The present study focused on obstructive sleep apnea syndrome and its pathophysiological mechanisms related to obesity.

In this perspective, it was noticed that in OSAS there is a failure in the airflow during sleep, which corroborates to a clinical picture of hypoxemia, hypercapnia, desaturation of oxyhemoglobin and interruption of breathing during sleep. It was noted that these implications mainly affect individuals with BMI greater than 30 kg/m², who are categorized as obese, since the obstruction of the upper airways in these patients occurs due to the excess of adipose tissue, which accumulates in some organs and makes the respiratory system narrower, aggravating the manifestation of this pathology.

In addition, it was understood that the coexistence of Obstructive Sleep Apnea Syndrome with obesity exacerbates risk factors and secondary complications for the development of other comorbidities. The association of these pathologies corroborates the hormonal imbalance, increasing the plasma levels of ghrelin, which induces a greater sense of hunger and reflects negatively on the reduction of insulin sensitivity, predisposing the patient to develop *type 2 diabetes mellitus*. Moreover, this correlation accentuates the incidence of systemic arterial hypertension and congestive heart failure in individuals.

It was evidenced through the bibliographic reference that several studies demonstrate that obesity worsens respiratory symptoms and favors the reduction of lung volumes, a fact that contributes to the etiology of OSAS. Thus, it is concluded that it is essential to apply therapeutic measures for obstructive sleep apnea syndrome, aiming at reducing upper airway obstruction, as well as its collapse. However, it is necessary not only the treatment of OSAS, but also the prevention and treatment of obesity through healthy habits, greater fluid intake and practice of physical activities, in order to improve pulmonary ventilation-perfusion in patients with these two comorbidities.



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