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THE RELATIONSHIP BETWEEN VISCERAL FAT AND RISK OF OBSTRUCTIVE SLEEP APNEA IN MEDICAL STUDENTS

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ABSTRAK

Pandemi COVID-19 menyebabkan perubahan gaya hidup mahasiswa yang memicu akumulasi lemak viseral. Akumulasi lemak viseral meningkatkan risiko *obstructive sleep apnea* karena menyebabkan kolapsnya saluran napas. Penelitian ini bertujuan untuk mengetahui hubungan antara lemak viseral dengan tingkat risiko *obstructive sleep apnea* pada mahasiswa kedokteran. Penelitian menggunakan desain *cross-sectional* pada 55 mahasiswa Fakultas Kedokteran Universitas Pembangunan Nasional Veteran Jakarta yang dipilih dengan teknik *simple random sampling*. Pengukuran lemak viseral menggunakan Tanita Body Composition Analyzer, sedangkan pengukuran tingkat risiko *obstructive sleep apnea* menggunakan kuesioner STOP-BANG. Terdapat perbedaan indeks massa tubuh antara kelompok lemak viseral normal dan tinggi (p=0,000). Tidak terdapat perbedaan usia, perilaku sedentari, dan kebiasaan makan antar kelompok lemak viseral (p>0,05). Hasil Uji *Chi-square exact* didapatkan hubungan antara lemak viseral dan tingkat risiko *obstructive sleep apnea* (p=0,018). Semakin tinggi lemak viseral, semakin tinggi tingkat *risiko obstructive sleep apnea.*

ABSTRACT

The Relationship between Visceral Fat and Risk of Obstructive Sleep Apnea in Medical Students. *The COVID-19 pandemic has caused changes in student's lifestyles, triggering visceral fat accumulation. Visceral fat accumulation increases the risk of obstructive sleep apnea because it causes airway collapse. This study aims to determine the relationship between visceral fat and the risk level of obstructive sleep apnea in medical students. The study used a cross-sectional design on 55 students from the Faculty of Medicine, Universitas Pembangunan Nasional Veteran Jakarta, using a simple random sampling technique. Visceral fat was measured using the Tanita Body Composition analyzer, while the obstructive sleep apnea risk level was measured using the stop-bang questionnaire. The body mass index differed between the normal and high visceral fat groups (p=0.000). There were no differences in age, sedentary behavior, and eating habits between visceral fat groups (p>0.05). Chi-square exact test results showed a relationship between visceral fat and the risk level of obstructive sleep apnea (p=0.018). The higher the visceral fat, the higher the risk level of obstructive sleep apnea.*

INTRODUCTION

The COVID-19 pandemic has significantly impacted human survival, especially in the health sector. Government policies regarding movement restrictions have led to changes in lifestyle, limited daily physical activity, and changes in eating patterns.[1] This can increase the incidence of obesity, especially among medical students who spend more time studying for hours in front of a laptop or study table, forgetting to exercise or paying attention to nutritional intake.[2] The research results on students at the Faculty of Medicine, Indonesian Muslim University in Makasar showed that 21.1% of 104 students were obese.[3] The results of another study on students at the Faculty of Medicine, Diponegoro University, showed that in obese subjects found an accumulation of visceral fat.[4] The accumulation of visceral fat around the pharynx can cause a narrowing of the upper airway, thereby increasing the risk of experiencing obstructive sleep apnea (OSA).[5] One of the symptoms that OSA can cause is excessive daytime sleepiness (EDS), which can disrupt the learning process of medical students.[6] People with OSA sleep disorders are at risk of experiencing cardiovascular diseases such as hypertension, coronary heart disease, congestive heart failure, stroke, and impaired cognitive function.[7]

The research results on students at the Faculty of Medicine, Udayana University, showed that 6.3% of 473 subjects had a high risk of OSA. There was a significant relationship between obesity and the risk of OSA.[8] The results of another study on adults in Japan stated that among patients with obesity, subjects with visceral fat obesity had the highest level of OSA severity.[9] The results of research at the University of Lampung show that obesity in males is a potent risk factor, with an OSA risk level of 4.6 times compared to males with normal weight.[10] This increased risk is related to the distribution of fat tissue in males with a main fat deposition pattern around the neck, trunk, and abdomen. In contrast, fat tissue in females is mainly found in the lower body (pelvis and thighs). Males also have higher levels of visceral fat and, therefore, have a higher risk of OSA than females.[11] Based on this rationale, male research subjects were selected in this study. Obesity can be measured using the body mass index (BMI) formula, but this technique cannot accurately picture body fat mass. The gold standard for measuring visceral fat is using a CT scan.[12]

However, there are several limitations to using CT scans, including cost, time, and radiation exposure for research subjects. Therefore, bioelectrical impedance analysis (BIA) was chosen as a measuring tool for this research. The results of the study showed that measuring visceral fat using BIA had a strong correlation with the results of measuring visceral fat using a CT scan ($r = 0.88$; $p < 0.0001$).[9] This study aims to determine the relationship between visceral fat and the risk level of OSA in medical students. The results of this research will be useful for society so that they are more aware of the importance of making preventive efforts by maintaining healthy eating habits and normal body weight.

METHOD

The research used a cross-sectional design and was carried out at the Physiology and Nutrition Laboratory Unit of the Medical Education and Research Center, Universitas Pembangunan Nasional Veteran Jakarta from November 2022 - January 2023. The research population was all active students of the Faculty of Medicine, Universitas Pembangunan Nasional Veteran Jakarta in the Academic Year 2022/2023, totaling 666 people. The calculation results showed that the sample size was 55 people. The research procedure began with an announcement via social media to the

research population. In the research, 76 potential subjects were found to meet the criteria. Next, simple random sampling was carried out using Ms. Excel to select subjects. The criteria for research subjects were male medical students who filled out the questionnaire completely and followed the procedures for collecting visceral fat data. Students who had upper respiratory tract anatomical abnormalities (small mandibular or maxillary bones), were experiencing or had a history of asthma, were consuming alcohol, and were consuming sedative substances or drugs (propofol, benzodiazepines, opioids) were excluded from the study. Sedentary behavior and eating habits were measured to obtain the characteristics of the research subjects. Sedentary behavior was measured using the Sedentary Behavior Questionnaire (SBQ) while eating habits were measured using the Adolescent Food Habit Checklist (AFHC) questionnaire.

Visceral fat was measured using the BIA Tanita Medical Body Composition Analyzer (MC-980MA Plus) with a scale of 1-12, indicating normal visceral fat, and a scale of 13-59, indicating high visceral fat.[13] The OSA risk level was measured using the STOP-BANG questionnaire based on eight symptom categories, namely: snoring, fatigue, apnea, history of high blood pressure, BMI, age, neck circumference, and gender.[14] The STOP-BANG questionnaire is a brief, validated screening tool that can identify people at high risk of OSA. The research results comparing four OSA screening questionnaires with the gold standard (polysomnography) in patients who came to the sleep clinic showed that the STOP-BANG questionnaire had the highest sensitivity in measuring the risk level of OSA, namely 97.55%.[15] The Indonesian version of the STOP-BANG questionnaire was tested valid and reliable in the community with a Cronbach-alpha of 0.694.[16] Research subject characteristics were analyzed to compare the characteristics of research subjects between the high visceral fat and normal visceral fat groups. Bivariate analysis used the Chi-square exact test to determine the relationship between visceral fat and OSA risk level.

RESULTS

The results showed that there were no differences in age characteristics, sedentary behavior, and eating habits between the normal and high visceral fat groups ($p > 0.05$); on the contrary, there were differences in BMI between the two visceral fat groups ($p = 0.000$) (Table 1).

Table 1. Characteristics of research subjects

No	Characteristics	Normal Visceral Fat	High Visceral Fat	*p-value*
1.	**Age** (mean ± SD)	19.95 ± 1.23	20.33 ± 1.23	0.166*
2.	**BMI** n (%)			
	Underweight	6 (100)	0 (0)	0.000 †
	Normoweight	15 (100)	0 (0)	
	Overweight	12 (100)	0 (0)	
	Obese	7 (31.8)	15 (68.2)	
3.	**Sedentary behavior** n (%)			
	Low	18 (85.7)	3 (14.3)	0.155 ‡
	Moderate	6 (54.5)	5 (45.5)	
	High	16 (69.6)	7 (30.4)	
4.	**Eating Habits** n (%)			
	Good	18 (72)	7 (28)	0.912 ‡
	Not good	22 (73.3)	8 (26.7)	

* *Mann-Whitney test*. † *Chi-square exact* test. ‡ *Chi-square* test

The Chi-square exact test results showed a significant relationship between visceral fat and the risk level of obstructive sleep apnea (p = 0.018). The higher the visceral fat, the higher the risk level of OSA (Table 2).

Table 2. Relationship between visceral fat and OSA risk level

Visceral Fat	OSA Risk Level						Total		*p-value*
	High		Moderate		Low				
	N	%	n	%	n	%	N	%	
High	1	6.7	5	33.3	9	60	15	100	0.018*
Normal	0	0	4	10	36	90	40	100	

** Chi-square exact test*

DISCUSSION

The research results showed that the average age of the research subjects was 20 years. There was no difference in age between the high visceral fat group and the normal visceral fat group (p = 0.166) (Table 1). Therefore, it can be concluded that the age factor does not influence the differences in OSA risk levels obtained in this study. Based on theory, age is a risk factor for OSA because, with increasing age, there is a decrease in lung recoil power, so mechanically it can cause a decrease in upper airway function. Older subjects also tend to experience airway collapse more quickly due to reduced collagen and the efficiency of upper airway dilator muscles. The age factor tends to be more influential at ages over 60 years.[5] Differences in BMI characteristics obtained in research can be a risk factor that can influence research results. This study's results align with previous research on 80 students at the Faculty of Medicine, Diponegoro University, which showed a significant relationship between BMI and visceral fat.[4] Visceral fat is one of the body components that can affect body weight. BMI is obtained from calculating body height and weight, so visceral fat as a body component also influences BMI.

The study found that all (100%) subjects with underweight, normoweight, and overweight BMI had normal visceral fat. In subjects with obese BMI, 15 (68.2%) subjects had high visceral fat, but 7 (31.8%) subjects had normal visceral fat. This shows that subjects with obese BMI do not necessarily have high visceral fat. BMI cannot accurately describe the amount of visceral fat. Based on another theory, visceral fat accumulation may have more influence on the risk of cardiovascular disease than BMI.[9] Most (85.7%) subjects with low sedentary behavior had normal visceral fat, and only 14.3% had high visceral fat. In moderate sedentary behavior, 54.5% of subjects had normal visceral fat, and 45.5% had high visceral fat. In high sedentary behavior, 69.6% of subjects had normal visceral fat, and 30.4% had high visceral fat. This shows that subjects with high sedentary behavior do not necessarily have high visceral fat.

The Chi-square test showed no difference in sedentary behavior between the high visceral and normal visceral fat groups (p = 0.155). The absence of differences in the characteristics of sedentary behavior in the two visceral fat groups could be due to the measurement of sedentary behavior using the SBQ questionnaire, which only measures sedentary behavior in the last week. The research results on 758 adults in Japan using an accelerometer instrument, which allows for measuring continuous sedentary behavior for 40 days, showed a significant relationship between sedentary behavior and visceral fat. The longer the sedentary behavior, the higher the visceral fat.[17]

The results showed no differences in eating habits between the high visceral and normal visceral fat groups (p = 0.912). Good eating habits were found in most (72%) subjects with normal visceral fat and 28% with high visceral fat. Poor eating habits were also found in the majority (73.3%) of subjects with normal visceral fat and 26.7% with high visceral fat.

The results of this study show that subjects with poor eating habits do not necessarily have high visceral fat. Different results were obtained in research, which found that eating habits were a risk factor for visceral fat accumulation. Individuals with good eating habits have significantly lower levels of visceral fat. On the other hand, individuals with poor eating habits have significantly higher levels of visceral fat.[18] Research on 91 students at the Faculty of Medicine, Krida Wacana Christian University, using the 3x24 hour Food Recall questionnaire and the Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ) to measure eating habits showed a significant relationship between macronutrient intake and visceral fat.[19] Characteristics of eating habits in this study were measured using the AFHC questionnaire. The questionnaire is filled out by *self-assessment*, so it is subjective, and the accuracy of the subject's answers depends on the subject's perception and honesty. This is thought to be why there were no differences in eating habits between the two groups of visceral fat.

The results of this study prove that visceral fat is an essential factor that influences the risk level of OSA. Other studies also found a significant relationship between visceral fat and OSA. In this study, visceral fat was measured using abdominal bioelectrical impedance analysis (A-BIA), and the severity of OSA was measured using polysomnography.[9] The results of this study prove that visceral fat is an important factor that influences the risk level of OSA. A high amount of visceral fat can lead to an increased risk of OSA because visceral fat accumulation around the pharynx can cause the narrowing of the upper airway.[5]

The accumulation of visceral fat in the trunk and intra-abdominally can cause a decrease in lung compliance and volume, contributing to upper airway collapse.[20] The practical implication of this research is the need for the public, especially medical students, to know their body composition so that preventive measures can be taken to reduce the risk of OSA if high visceral fat levels are found. Efforts that can be made to reduce visceral fat are routine aerobic exercise for at least 150 minutes/week at moderate intensity according to WHO recommendations[21] and paying attention to intake according to balanced nutrition guidelines.[22]

CONCLUSION

Based on the research results and analysis, it can be concluded that there is a significant relationship between visceral fat and the risk level of OSA. The higher the visceral fat, the higher the risk level of OSA. Further research is needed using a quasi-experimental design to determine the effect of reducing visceral fat through diet and exercise on the risk of OSA.

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