SRIWIJAYA JOURNAL OF MEDICINE

The Impact of Body Fat Percentage towards the Attention Aspect of the Cognitive Function in Pre-Clinical University Students of Atma Jaya

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Abstrak

Pengaruh Persentase Lemak Tubuh terhadap Fungsi Kognitif Aspek Atensi pada Mahasiswa Preklinik FKIK Unika Atma Jaya. Pada 2016, Organisasi Kesehatan Dunia (WHO) memprediksikan 650 juta orang dewasa berusia 18 tahun ke atas mengalami obesitas. Banyak penelitian yang menunjukkan bahwa obesitas mempengaruhi fungsi otak dan mengganggu fungsi kognitif otak. Untuk mengetahui apakah persentase lemak tubuh berpengaruh terhadap aspek atensi fungsi kognitif pada mahasiswa. Penelitian ini merupakan penelitian secara potong lintang. Pengumpulan data dilakukan mulai Agustus 2020 hingga Maret 2021 dengan total 72 responden. Pengumpulan data dilakukan dengan menggunakan rumus persentase lemak tubuh *dari British Journal of Nutrition* untuk menilai persentase lemak tubuh dan *stroop test* untuk menguji atensi. *Kruskal-Wallis* dan *spearman* digunakan untuk menilai korelasi antara persentase lemak tubuh dan atensi. Hasil penelitian menunjukkan bahwa persentase lemak tubuh berpengaruh terhadap aspek atensi pada fungsi kognitif (p = 0,001, r = 0,71). Kesimpulannya adalah dari data 72 mahasiswa terbukti bahwa persentase lemak tubuh berpengaruh terhadap aspek atensi fungsi kognitif. Dampak dari tingginya persentase lemak tubuh adalah menurunkan aspek atensi pada fungsi kognitif.

Kata kunci: Atensi, Fungsi Kognitif, Mahasiswa, Obesitas, Persentase Lemak Tubuh

Abstract

In 2016, World Health Organization (WHO) predicts that 650 million adults aged 18 and more have obesity. Many research shows that obesity affects brain function and impairs the cognitive function of the brain. To understand whether body fat percentage has an impact on the attention aspect of the cognitive function in university students. This study is a cross-sectional study approach. The data was collected from August 2020 until March 2021 with a total of 72 respondents. The data was collected using the body fat percentage formula from the British Journal of Nutrition to assess body fat percentage and Stroop Test for attention. Kruskal-Wallis and spearman were used to assess the correlation between body fat percentage and attention. The result shows that body fat percentage affects the attention aspect of the cognitive function (p = 0.001, r = 0.71). In conclusion, based on 72 university students, it proves that body fat percentage has an impact on the attention aspect of the cognitive function. The impact that high body fat percentage does is lowering the attention aspect of the cognitive function.

Keywords: Attention, Body Fat Percentage, Cognitive Function, Obesity, University Student

1. Introduction

In 2016, the World Health Organization (WHO) estimated that 650 million adults aged 18 years or older were obese.[1] It is predicted that by 2030, 20% of adults in the world will be obese. According to the 2018 Basic Health Research (RISKESDAS), in Indonesia, the prevalence of obesity in young adults (>18 years) is 21.8%.[2-4] According to research from Goonasegarat et al., although Body Mass Index (BMI) is often used, it cannot distinguish between fat mass and muscle mass, so the use of body fat percentage is more specific in assessing between healthy and obese individuals.[5,6] The accumulation of fat mass in the body can cause various diseases such as hypertension, stroke, type 2 diabetes mellitus, and impaired cognitive function.[5-8]

Cognitive is the process of gaining knowledge and understanding through thought, experience, and bodily senses and includes aspects of knowledge, memory, action-taking, reasons for doing something, problem-solving, language, and attention.[9] Attention is an information processing aspect that can affect perception and is the initial process towards concentration and an important component of cognitive function because it can help the processing of daily activities to think more efficiently.[10]

Researches about the relationship between obesity and cognitive function have been done before.[11-20] Several studies have found that having obesity in adolescence and adulthood is associated with lower cognitive function.[15-18] A research on workers aged between 32 and 62 years was conducted by Cournot et al. in 2006, it was shown that obesity was associated with decreased cognitive function by the Digit Symbol Substitution Test (DSST).[16] In the study by Liang et al. it was found that adolescents with obesity had a lower Intelligence Quotient (IQ) value than adolescents with normal weight.[17] Intervention study by Staiano et al. showed an increase in cognitive function in obese adolescents who lost weight from obese to normal.[18] Contrary to several other studies, research by Gunstad et al. showed that the effect of obesity on cognitive function was only found in women and not in men.[19] A similar study was also conducted at Atma Jaya Medical School with no significant results between obese and normal subjects.[20]

Young adults tend to sacrifice sleep to do their tasks and fulfill their responsibility in college and the workplace.[1-2] For them, sleep is a luxury, not a necessity.[1] Sleep deprivation is waking up for more than 16-18 hours per day.[3] Sleep deprivation is known to cause various acute and chronic health problems, but not many people know that sleep deprivation also causes dehydration.[4]

More study is needed since there is still controversy between existing research and most of the research is examining cognitive function in general and not attention. Therefore, the researcher is interested in conducting this research. In this study, subjects with an age range of 18-21 years were used, where WHO determined that ages 15-24 years were young adults.[21] Body composition in this study was determined using a formula from the British Journal of Nutrition to determine the body fat percentage because the formula is easy to be used. The formula can be used only in the presence of the respondent's height and weight data. In contrast to previous studies, in this study, the cognitive function that will be assessed is attention using the Stroop Test. The attention aspect was chosen because attention is often used by students in learning so that the measurement of attention is under the individual target to be tested. Attention is a process towards concentration, so it is an important aspect in individuals who carry out daily activities and study.[10]

2. Methods

This was a cross-sectional analytic study with data taken from August 2020 to March 2021 with a total of 72 respondents with ages ranging from 18-21 years. The method of determining the respondent is by simple random sampling. DASS test is used to exclude respondents who are depressed and stressed. Then we use the data from the respondent's questionnaire to measure the percentage of body fat using a formula from the British Journal of Nutrition. The attention aspect of the cognitive function was tested using the Stroop Test and we used the formula from Zimmermann et al. to score the results. The data was then tested using the Kruskal-Wallis test and the Spearman to determine the degree of correlation.

The inclusion criteria in this study were 18-21 years old and willing to sign an informed consent, while the exclusion criteria for this study were having depression, anxiety, and stress disorders according to the Depression Anxiety Stress Scale (DASS) test and having a history of head trauma.

This research obtained ethical approval from the ethical review committee of the Faculty of Medicine and Health Sciences, Atma Jaya Catholic University of Indonesia on the 25th of May 2020 with the number 02/05/KEP-FKUAJ/2020. The researcher also asked for the approval of each respondent in the form of informed consent before filling out the research questionnaire.

3. Results

The characteristics of the study subjects are shown in table 1. The number of male and female participants was the same and the number of each class was the same. Most of the respondents have a normal fat category, 26 people (36.1%). Likewise, when divided into male and female respondents, most of the respondents had normal fat categories, 11 (30.6%) male respondents and 15 (41.7%) female respondents (Table 2).

Table 1. Respondents Characteristics

Variable	Results	
	n	Percentage (%)
Gender		
Male	36	50%
Female	36	50%
Total	72	100%
Class		
2017	24	33.3%
2018	24	33.3%
2019	24	33.3%
Total	72	100%

Table 2. Respondents Fat Percentage Characteristics

Variable	Results	
	n	Percentage (%)
Fat Percentage Category		
Athlete	12	16.7%
Fitness	23	31.9%
Normal	26	36.1%
Obese	11	15.3%
Total	72	100%
Male Fat Percentage Category		
Athlete	8	22.2%
Fitness	9	25%
Normal	11	30.6%
Obese	8	22.2%
Total	36	100%
Female Fat Percentage Category		
Athlete	4	11.1%
Fitness	14	38.9%
Normal	15	41.7%
Obese	3	8.3%
Total	36	100%

The average score for Stroop Test for males is 22.84 and 22.91 for females (Table 3).

Table 3. Average Stroop Test Score

Variable	Mean±SD	
	Male	Female
Stroop Test Score	22.84±1.83	22.91±1.71

The result shows a higher interference score in the higher fat percentage category with obesity has a score of 25.21. Kruskal-Wallis test shows a relation between body fat percentage and attention (p = 0.001) and the spearman correlation test shows a strong correlation between the two (r = 0.71) (Table 4).

Table 4. Correlation Between Body Fat Percentage and Attention Aspect of the Cognitive Function

Variable	STR (Mean±SD)	CC	P
FPC			
Athlete	21.03 ± 0.67	0.71	0.001
Fitness	22.03 ± 1.30		
Normal	23.49 ± 1.28		
Obese	25.21 ± 1.00		

STR: Stroop Test Results; FPC: Fat Percentage Category; CC: Coefficient Correlation

The result shows a higher interference score in higher fat percentage on each gender with the highest on obese category. Chi-Square Test shows that there is no relation in which gender affects attention (p = 0.546) (Table 5).

Table 5. Correlation Between Body Fat Percentage and Attention Aspect of the Cognitive Function Based on Gender

Variable	STR (Mean±SD		P
	Male	Female	
FPC			
Athlete	21.18±0.77	20.74±0.29	0.546
Fitness	22.02±1.45	22.03±1.24	
Normal	23.01±1.35	23.83±1.16	
Obese	25.18±0.92	25.30±1.39	

STR: Stroop Test Results; FPC: Fat Percentage Category; CC: Coefficient Correlation

4. Discussion

The research took data from 72 respondents, 36 men and 36 women. In this study, it was found that the majority of students from the Medical and Health Sciences of Atma Jaya University have a normal fat percentage. 15.3% of respondents were categorized as obese. This figure is lower than research by RISKESDAS in 2018 that 21.8% of young adults in Indonesia were obese.[4] The difference in these results could be because the respondents taken in the study were students in the health sector who pay attention to and maintain a healthy body.

Results showed that there was a strong correlation between body fat percentage and attention (p = 0.001, r = 0.71). The research is in line with the research of Momtaz et al. where the results of the multiple linear regression analysis have significant results (p<0.001), what distinguishes it from previous studies is that this study uses body fat percentage so that it is more accurate.[15] Cournot et al. conducted a cross-sectional study in which gender, age, education level, and psychosocial factors were equalized. The results showed that the results of the study were in line that higher body mass index influenced the decline in cognitive function.[16] Liang et al. conducted a systematic review study and 8 out of 9 sources that were used showed that obesity in adolescents and children affects attention indicating that the research is also in line.[17] The study is also in line with the results of Staiano et al. where an intervention has been carried out on respondents, where respondents were tested before and after a weight loss program for 10 weeks and showed better results after experiencing weight loss, indicating that body mass index affects a person's cognitive function.[18] The most significant difference is this research uses body fat percentage which is a more accurate indicator than body mass index and also uses the Stroop Test where no expert is needed to interpret it.

The results of this study differ from those of Gunstad et al. which states that a higher body mass index does not have a significant effect on cognitive function (p = 0.26).[19] According to Gunstad et al., the research has

drawbacks where respondents are notified of research to be conducted so that some respondents deliberately go on a diet, while in this study the data were collected without any notification.[19] Other possibilities are due to the study of Gunstad et al. respondents have an age range of 6-19 while the age range of this study is 18-21, so it is possible that age can affect the results of the previous study. The study also contradicts research from Noviyanti Mellisa in 2015 where it was stated that there was no significant relationship between body mass index and cognitive function (p=0.74).[20] The difference from previous studies is that depression and stress have been examined using the DASS test to exclude respondents experiencing depression and stress. The DASS test was carried out because in previous studies it was written that the limitation of the study was that there was no depression test, which made it possible that students were experiencing depression and stress during the Stroop Test.

This study indicates that gender does not affect the results of the Stroop Test (p=0.546). The results of the interference score on the Stroop Test appear to be increasing in the category of higher body fat percentage with an average of 25.18 for men and 25.30 for women. These results are in line with research conducted by Cournot et al. which states that gender does not affect cognitive function.[16]

The results of this study differ from those of Gunstad et al. which shows that in male respondents there is no relationship between body fat percentage and cognitive function (p = 0.94) while in female respondents there is a relationship (p = 0.001).[19] This difference is probably due to a large number of underweight female respondents and affects research results. It is also stated in the research of Gunstad et al. that underweight female respondents had lower cognitive function results.[19]

In this study, the results may be influenced by several things. The first is body fat percentage data obtained using a formula and not the Bioelectrical Impedance Analysis tool, although the accuracy is almost the same as the BIA tool, there will always be inaccuracies. The second is cognitive function research using an online Stroop Test, where every time there is a connection breakdown, the test will be repeated and can make respondents familiar with the series of words that will be read. The third is the number of respondents in each category of fat between male and female respondents is not the same, such as obesity, male respondents amounted to 8 people and female respondents only 3 people. And lastly. there has been no previous study using the interference score formula from Zimmermann et al. which relates the percentage of body fat with the function of attention. Previous research using this formula is more widely used in research on the relationship between attention and age.[22]

5. Conclusions

There is a relationship between the body fat percentage with attention aspect of the cognitive function of pre-clinical students of the Atma Jaya Faculty of Medicine. (p = 0.001) and that gender did not affect the attention aspect of the cognitive function (p = 0.546).

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