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Correlation of Body Mass Index with Lumbar Flexibility in Obese Students at HKBP Nommensen University Medan

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ABSTRACT

The Body Mass Index (BMI) is a widely-used indicator to assess nutritional status in adults. An increase in BMI escalates the risk of diseases related to obesity. There has been a global rise in obesity, and numerous studies on the correlation between BMI and lumbar flexibility show significant relationships. Given the importance of lumbar flexibility in daily activities, this research explores the link between BMI and lumbar flexibility among obese students aged 18-21 at HKBP Nommensen University. An observational analytical study with a cross-sectional design was conducted on students from the Faculty of Medicine, spanning the batches from 2015 to 2018, excluding athletes and those with vertebral deformities or a history of chronic illness. Out of 50 male obese respondents at HKBP Nommensen University, Medan, the average lumbar flexibility was found to be 23.49 cm. A weak positive correlation was identified between BMI and lumbar flexibility with a Spearman correlation coefficient of 0.324. The results indicate that as BMI increases, lumbar flexibility also increases, although with a weak correlation strength. This contrasts with some previous studies, highlighting the unique nature of the sample population and the need for more comprehensive future research. For subsequent researchers, considering a larger sample size, different methodologies, or other factors influencing flexibility would be beneficial. although with a weak correlation strength. This contrasts with some previous studies, highlighting the unique nature of the sample population and the need for more comprehensive future research. For subsequent researchers, considering a larger sample size, different methodologies, or other factors influencing flexibility would be beneficial. although with a weak correlation strength. This contrasts with some previous studies, highlighting the unique nature of the sample population and the need for more comprehensive future research. For subsequent researchers, considering a larger sample size, different methodologies, or other factors influencing flexibility would be beneficial.

1. INTRODUCTION

Body Mass Index (BMI) is an indicator used to measure nutritional status in adults. [1]The calculation of BMI is obtained by dividing the weight in kilograms by the square of the height in meters (kg / m2). [2]An increase in the value of BMI will increase the risk of developing diseases associated with increased body fat or increased BMI such as obesity. [1][2]

The prevalence of obesity worldwide is increasing. Data by the National Examination Surveys (NHANES) show that the percentage of the American population with obesity (BMI>30) has increased from 14.5% (between 1976 and 1980) to 33.9% (between 2007 and 2008). [3] According to Basic Health Research (RISKESDAS) in 2013, the prevalence of adults aged > 18 years with over weight is 13.5% and obesity is 15.4-5%. [4] Whereas in the results of the 2016 National Health Indicator Survey (SIRKESNAS), the prevalence of obesity was 20.7% in people aged ≥18 years. [5]

Increasing the BMI value means having more body weightcan have an effect on reduced freedom of physical activity in the form of wide range of joint movement (flexibility). [6][7] The flexibility of the human body is influenced by several things, including the type of body tissue, nervous system, psychology, age, gender, body temperature, regular and long participation in sports. [8]

According to research conducted by Pratiwi, et al (2015) at the Faculty of Medicine, University of HKBP Nommensen, which examined the correlation of BMI with lumbar flexibility in students from class 2011-2014, there was a significant correlation between BMI and lumbar flexibility. [9] Research conducted by Rahardjo, et al (2016) which examined the relationship between obesity and the range of motion of the hip joint and lumbar flexion in young adults, found that obesity can reduce the ROM of hip flexion, hip adduction, and lumbar flexion. [10] Whereas in a study conducted by Afriwardi, et al (2015) in the Andalas University medical education department which examined the relationship between BMI and cardiorespiratory endurance, muscle strength and endurance and flexibility in male students concluded that there was no correlation between BMI and flexibility with trunk extension and shoulder lift test. [11]

Body Mass Index (BMI) is the most frequently used and practical indicator to measure the level of the overweight and obese population in adults. [1] BMI includes an estimate of body fat and is more accurate than just a measure of body weight. [12]BMI is defined as body weight in kilograms divided by height in meters squared (kg/m2) [2]. BMI is a measurement that is an indicator or describes the level of adiposity but is not a direct measurement of a person's total body fat. [3] BMI values can depend on age and sex, but BMI may not correspond to the same level of obesity in different populations. WHO states that for the Asia Pacific population at high risk of type 2 diabetes and cardiovascular disease, the BMI value used is lower than the BMI value for overweight (25kg/m2) [13]. The prevalence of obesity is getting higher. Currently it is estimated that the number of people worldwide with a BMI of 30 kg/m2 exceeds 250 million people, which is about 7% of the world's adult population. The highest rates of obesity in the world are in the Pacific Islands in Melanesian, Polynesian and Micronesian populations. [14]

Obesity is the result of a combination of causes and contributing factors.Increased consumption of fast food (fast food), low physical activity, genetic factors, influence of advertising, psychological factors, socioeconomic status, diet programs, age, and gender are factors that contribute to changes in energy balance and lead to the incidence of obesity . [15] These factors can also be simplified into two things, namely: eating too much and moving too little. Diet is now increasingly proven as a major contributor to obesity in particular and chronic health disorders in general [16]. The reduction in physical movement is none other than driven by the indulgence due to technological advances, starting from the house to the workplace or recreation area. Flexibility is operationally defined as the intrinsic property of body tissues, including muscle and connective tissue, that determines the range of motion attainable without injury to a joint or joint group. Flexibility is very specific for each joint. [17].

There are several factors that can affect a person's flexibility, including: Age, gender, physical exercise habits, and medical history [18]. The older a person gets, the less flexibility he has. This often happens because the elasticity of the connective tissue in the muscles will experience shortening [19]. Therefore, the elderly are usually prone to injury due to physical activity that is too strenuous and involves a lot of joint movement [20]. [21] Gender is another factor that affects flexibility. Women are generally more flexible than men, especially in the younger age group. Women also become more flexible during pregnancy. The increase in the concentration of the hormone relaxin is thought to be the main factor to explain this increased flexibility. It is thought that women have more elastin in their myofascia than men. [21] Someone who regularly does physical exercise, especially stretching the body will certainly have better body flexibility. [22] Some conditions, such as arthritis, can reduce flexibility because the tissue has lost elasticity or because of the pain itself. [21]

Based on the several studies above, researchers were interested in seeing a comparison of lumbar flexibility between the normal weight group and the obese group aged 18 to 21 years at HKBP Nommensen University.

2. METHODS

This study is an observational analytic study with a cross-sectional study design to compare lumbar flexibility in the normal weight and obese groups aged 18 to 21 years, students of the Faculty of Medicine, University of HKBP Nommensen by taking momentary measurements without any follow-up procedures. This research was conducted at HKBP Nommensen University in November 2018.

The samples in this study were students of the 2015, 2016, 2017 and 2018 batches of the Faculty of Medicine, University of HKBP Nommensen. Exclusion criteria in this study included being an athlete (sportsman), having a disability related to the vertebral bones (lordosis, scoliosis, kyphosis), having a history of chronic disease or pain in the lumbar region.The sampling technique in this study was a consecutive sampling technique with a sample size of 50 people.The independent variable in this study was BMI and the dependent variable in this study was lumbar flexibility.

The research was carried out using a workflow to collect data using questionnaires and direct measurements.In the questionnaire there are questions about sports activities, sports in the last 2 months, frequency of sports in a week, and types of sports that are most often done. The data collected were primary data from samples that had agreed to sign an informed consent and had filled out a questionnaire and were then measured by researchers and anatomy assistants who had previously received training in measurement methods at the Anatomy Laboratory of the Medical Faculty, University of HKBP Nommensen.

Measurements taken included measuring body weight and height using a stepping scale and height meter, which were used to calculate BMI. Furthermore, lumbar flexibility was measured by MST.

BMI is a measurement ratio of a person's height to a person's weight, measured by stepping scales, height meter, with the categories of underweight, normal, overweight and obesity. As for the Lumbar flexibility variable, it is the range of movement around the lumbar as measured by the Modified Schober Technique (MST) method

3. RESULTS AND DISCUSSION

This research was conducted on 50 male students at the University of HKBP Nommensen Medan who were included in the obesity category according to the Asia Pacific perspective classification. Description of weight, height, BMI and lumbar flexibility can be seen in the following table.

Table 1. Description of the respondents in terms of weight, height, BMI and MST

Parameter	n	Min	Max	Average	Median	Standard Deviation
Weight	50	64	142	89,22	85.50	15,82
Height	50	1.54	1.84	1.68	1.68	0.07
BMI	50	26	46	31,36	31.00	4.46
MST	50	21	26	23,49	23.50	1.26

The normality test for weight, height, BMI and MST data was carried out using the Shapiro-Wilk test. Based on table 1, it can be seen that the median value of the respondent's BMI is 31 kg/m2 with a minimum value26kg/m2 and the maximum value46kg/m2.

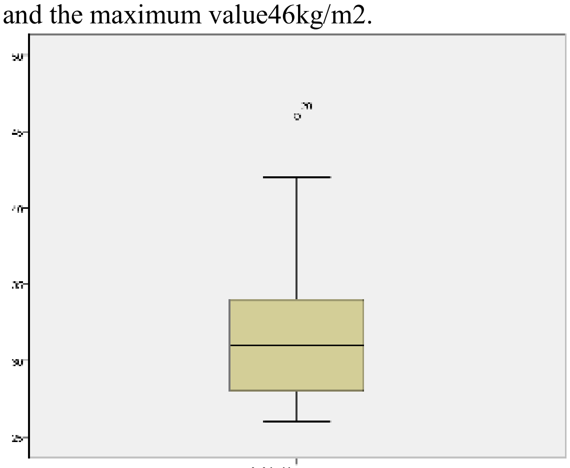

Figure 1. BMI data description

In Figure 1, it is found that the whisker is located slightly downwards with a median value of 31 kg/m2 which is included in level II obesity according to the Asia Pacific perspective classification and there is also one outlier value from the BMI data with a BMI value46kg/m2. This shows that the BMI data is not normally distributed.

Lumbar flexibility in this study was measured using the Modified Schober's Test method, namely by making a reference line in the lower back area that connects the two dimples of venus (venus dimples) formed by the upper back iliac spine in an upright position and taking the midline perpendicular to the line middle back. Then a mark is made above the midline of the back 10 cm and 5 cm below the midline of the back so that the distance between the two marks is 15 cm. Then in a bent position as much as possible, the distance between the two marks was measured again.

After testing the normality of the data with the Shapiro-Wilk test, it was found that the MST data were normally distributed. Based on table 1, the average MST value of the respondents in this study was 23.49 cm with a standard deviation of 1.26.

BMI Correlation with Lumbar Flexibility

In this study, it was found that BMI data were not normally distributed even after data transformation. So the correlation test used in this study is the Spearman correlation test.

Table 2. Correlation of BMI and Lumbar Flexibility

Variable	Lumbar Flexibility	
BMI	r	0.324
	p.s	0.011*
	n	50

*Spearman correlation test

Table 2 shows that there is a significant correlation between BMI and lumbar flexibility ($p = 0.011$) with a weak correlation strength ($r = 0.324$) and the direction of the positive correlation indicates that the greater the BMI value, the greater the MST value with a weak correlation strength.

Discussion

BMI measurements in this study were obtained using dataweight in kilograms divided by height in meters squared. Of the 50 respondents in this study, the BMI of 20 respondents (40%) was included in the category of obesity level 1 and 30 respondents (60%) were included in the category of obesity level 2 according to the classification of the Asia Pacific perspective. In this study there were also data on extreme BMI, namely 46 kg/m2, which was included in the category of obesity level 2. This could be related to factors that influence the increase in BMI, such as increased consumption of ready-to-eat food and decreased physical activity.[31]

Measurement of lumbar flexibility can be done using the MST method provided that an MST value of >20 cm indicates a good flexibility value and ≤20 cm indicates a poor level of flexibility.[17]The average value of lumbar flexibility with the MST method in this study is23.49 cm with a standard deviation of 1.26, so that the range of respondents' MST values in this study was 22.23 cm to 24.75 cm. This shows that the respondents in this study have good flexibility.

Based on table 2, the p-value obtained from the correlation analysis of BMI with MST is equal to0.011 which shows that there is a correlation between BMI and lumbar flexibility using the MST method. The Spearman correlation value of 0.324 indicates that the direction of the correlation is positive with a weak correlation. The direction of positive correlation indicates that the greater the BMI value, the greater the value of lumbar flexibility as measured by the MST method in HKBP Nommensen University Medan students who are obese.

This is supported by research conducted by Gileard, et al who tested the correlation of BMI with flexibility in obese people, obtaining a significant correlation with thoracolumbar back movement ($p = 0.002$) but with a negative correlation direction with moderate strength ($r = -0, 60$). However, this study also found a non-significant correlation between BMI and pelvic segment movement ($p = 0.326$) and hip joint movement (p= 0.880).[32]This can be caused by excessive fat distribution in certain areas which can inhibit the flexibility of the area, such as the thoracolumbar back joint.[32]

Many indicators can be considered in measuring flexibility. Body composition is also one of the factors that can affect flexibility, excess fat accumulation around the joints will cause mechanical resistance in joint movement, so that flexibility is reduced.[22]While the BMI value itself is not a direct measurement of a person's total body fat, so a sportsman/athlete can have a high BMI because he has higher muscle mass compared to body fat levels.[25]BMI values also cannot measure fat distribution in a joint area so that the same BMI fat distribution in different people can be different.

The distribution of fat in people who are obese is different for everyone. In accordance with the obesity category, a person with fat distribution in the abdominal and waist areas is called apple-shaped obesity and fat distribution in the hip and thigh area is called pear-shaped obesity. One's flexibility can be affected by the accumulation of fat tissue.[22]Lumbar flexibility can be affected by the accumulation of excess fatty tissue in the lumbar region. But in this study did not consider the accumulation of fat tissue in certain areas that can affect a person's flexibility.

Measurements with the MST method itself are used to measure the value of lumbar flexibility. This measurement is used to see the accumulation of fatty tissue in the lumbosacral area. So that a specific assessment of fat accumulation in the lumbosacral area such as abdominal circumference or waist circumference is more effectively associated with lumbar flexibility with the MST method. While other measurements for flexibility such as the sit and reach test are used to measure flexibility by assessing the accumulation of fat in the thigh and hip areas.

This is supported by a study conducted by Ward, who found no significant correlation between BMI and body flexibility (r= -0.27, p=0.15) but found a significant correlation with moderate correlation between body flexion and abdominal circumference (r = -0.49, p=0.01) and hip circumference (r= -0.39, p=0.03).[33]Through this research, it was found that the smaller the circumference of the abdomen and pelvis, the higher the flexibility of a person's body.

Flexibility is considered important for humans because it expresses the ability to perform movements in daily activities. Basically, flexibility, especially lumbar flexibility, is needed, because most human movements are centered on torso flexion.[16]

4. CONCLUSION

The maximum value of BMI is46kg/m2 minimum26kg/m2, and the median value31kg/m2. The average respondent's lumbar flexibility was 23.49 cm and a standard deviation value of 1.26 and included in the flexible category. There is a significant correlation between BMI and lumbar flexibility using the MST method, with a p-value of0.011. The correlation coefficient value of r=0.324 indicates that the direction of the correlation is positive with a weak correlation strength. The direction of positive correlation indicates that the greater the value of BMI, the greater the value of lumbar flexibility using the MST method.

REFERENCES

[1] WHO. Obesity and overweight [Internet]. WHO. 2018 [dikutip 23 Juli 2018]. Tersedia pada: http://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight
[2] Dorland WAN. Kamus kedokteran dorland. 31 ed. Jakarta: EGC; 2010.
[3] S. Flier J, Maratos-Flier E. Biology of obesity. In: Longo DL, Kasper DL, Jameson JL, Fauci AS, Hauser SL, Loscalzo J, editor. Harrison's principles of internal medicine. 18 ed. Mc Graw Hill; 2008.
[4] Badan Penelitian dan Pengembangan Kesehatan Kementrian Kesehatan R. RISKESDAS 2013. 2013.
[5] Badan Penelitian dan Pengembangan Kesehatan Kementrian Kesehatan R. SIRKESNAS 2016 [Internet]. 2016. Tersedia pada: http://labdata.litbang.depkes.go.id/riset-badan-litbangkes/menu-riskesnas/menu-rikus/422-sirk-2016
[6] Santosa Giriwijoyo HYS, Zafar Sidik D. Ilmu faal olahraga (fisiologi olahraga). Bandung: PT Remaja Rosdakarya Offset; 2013.

[7] Purnama A. Hubungan antara indeks massa tubuh dengan fleksibilitas lumbal pada laki-laki dewasa kelompok umur 19-20 tahun. Universitas Diponegoro; 2007.
[8] Reilly T. Sport Fitness and Sport Injuries. 1 ed. London: Faber and Faber Limited; 1988. 61-68 hal.
[9] Pratiwi E, Simaremare APR, Sinaga J. Korelasi indeks massa tubuh dengan fleksibilitas lumbal pada mahasiswa/i fakultas kedokteran Universitas HKBP Nommensen angkatan 2011-2014. Nommensen J Med. 2015;1:1–10.
[10] Sari A, Rahardjo B, Winarni TI, Susanto H. Hubungan Obesitas Dengan Range of Motion Sendi. J Kedokt Diponegoro. 2016;5(4):430–9.
[11] Lubis HM, Sulastri D. Hubungan indeks massa tubuh dengan ketahanan kardiorespirasi, ketahanan dan kekuatan otot dan fleksibilitas pada mahasiswa laki-laki jurusan pendidikan dokter Universitas Andalas angkatan 2013. J Kesehat Andalas. 2015;4(1):142–50.
[12] Bickley LS. Buku saku pemeriksaan fisik dan riwayat kesehatan bates. 5 ed. Jakarta: EGC; 2012. 45 hal.
[13] WHO. Global Database on Body Mass Index - World Health Organization [Internet]. WHO. [dikutip 30 Agustus 2018]. Tersedia pada: http://www.assessmentpsychology.com/icbmi.htm
[14] Sugondo S. Obesitas. In: Sudoyo AW, Setiyohadi B, Alwi I, Simadibrata K. M, Setiati S, editor. Bukuajar ilmu penyakit dalam. 5 ed. Jakarta: Internal Publishing; 2009. hal. 1973–83.
[15] Kurdanti W, Suryani I, Syamsiatun NH, Siwi LP, Adityanti MM, Mustikaningsih D, et al. Faktor-faktor yang mempengaruhi kejadian obesitas pada remaja. J Gizi Klin Indones. 2015;11(04):179–90.
[16] Arisman. Obesitas, diabetes mellitus, dan dislipidemia, buku ajar ilmu gizi. Jakarta: EGC; 2010.
[17] Pate R, Oria M, Pillsbury L, Youth C on FM and HO in, Board F and N, Medicine I of. Health-Related Fitness Measures for Youth: Flexibility. NCBI [Internet]. 10 Desember 2012 [dikutip 13 November 2018]; Tersedia pada: https://www.ncbi.nlm.nih.gov/books/NBK241323/#sec_0000116
[18] Kishner S. Lumbar spine anatomy [Internet]. Medscape. 2017. Tersedia pada: The bony processes
[19] Fauci AS, E B, Kasper DL, Hauser SL, Longo DL, Jameson JL. Back and neck pain. In: Harrison's principles of internal medicine. 17 ed. 2008. hal. 107–17.
[20] Moore KL, Dalley AF. Anatomi berorientasi klinis jilid 2. 5 ed. Jakarta: Erlangga; 2013. 2-3 hal.
[21] LE H, TW P, J H. Flexibility and exercise. AConcise Guide; 2008. 69-80 hal.
[22] Pulcheria M, Muliarta IM. Fleksibilitas mahasiswa Universitas Udayana yang berlatih Tai Chi lebih baik daripada yang tidak berlatih Tai Chi. E-Jurnal Med. 2016;5(6):1–6.
[23] Cameron MH, Monroe L. Physical rehabilitation for the physical therapist assistant. United State: Elsevier; 2011.