Poltekita: Jurnal Ilmu Kesehatan
http://jurnal.poltekkespalu.ac.id/index.php/JIK

Vol.17 No.2 August 2023: Hal. 487-492
p-ISSN: 1907-459X e-ISSN: 2527-7170

Original Article

The Effect of Physical Activity on the Muscle Strength of Obese People' Backs

Wendra[1*], Elly Noer Rochmah[2], Wisnu Fadhlurrohman[3]

[1]Department of Anatomy, Faculty of Medicine, Universitas Jenderal Achmad Yani, Cimahi, West Java, Indonesia
[2]Department of Pediatric, Faculty of Medicine, Universitas Jenderal Achmad Yani, Cimahi, West Java, Indonesia
[3]Bachelor of Medicine Program, Faculty of Medicine, Universitas Jenderal Achmad Yani, Cimahi, West Java, Indonesia

(Correspondence author's email, wendrarasyad@gmail.com)

ABSTRACT

In the last decade, the number of obese young adults has been increasing. Faculty of Medicine students tend to have low activity due to the busy learning schedule. Low activity is one of the risk factors for obesity and muscle strength, one of which is the back muscles that play a role in maintaining posture and supporting the body. This study aims to determine the level of physical activity and back muscle strength, as well as to examine the differences in back muscle strength between students at the Unjani Medical Faculty who suffer from obesity and low and high levels of physical activity. This study employs a cross-sectional design for its analysis. The ASAQ (Adolescent Sedentary Activity Questionnaire), the BMI (Body Mass Index) formula, and a back dynamometer are measuring instruments used to assess physical activity levels. Using a doctor's scale and a calibrated microtome, height and weight measurements were taken. To determine differences in muscle strength between study groups, the Mann-Whitney test (dk = 95%) was utilized. The results demonstrated that 33% of respondents had low levels of physical activity, with the majority of respondents being male (30.3%). As many as 28.1% of male respondents had low levels of back muscle strength and were inactive. There was a statistically significant difference (p 0.05) between the two groups in terms of back muscle strength, as determined by statistical tests. The results showed that obesity had an effect on reducing the back muscle strength of respondents.

Keywords: Obesity, Physical Activity, Back Muscle Strength

https://doi.org/10.33860/jik.v17i2.2522

INTRODUCTION

Obesity in the adolescent age group has become a world health problem in recent decades[1]. The World Health Organization (WHO), defines obesity as abnormal fat accumulation or excess fat accumulation due to an imbalance between energy intake and energy used [2]. Measurement of the level of obesity in Indonesians is based on the Body Mass Index (BMI) value for Asia-Pacific countries [3]. A person is said to be obese if the BMI is 25.0 kg/m^2 [4]. RISKESDAS data in 2007, 2013, and 2018 show that obesity sufferers in Indonesia tend to increase, namely 10.5%, 14.8%, and 21.8% respectively. Likewise, the prevalence of obese people in West Java Province tends to increase, namely 15.2% in 2013 and 23% in 2018 [5].

Faculty of Medicine students have busy activities, causing them to rarely do sufficient physical activity, such as exercising [6]. Research by Zulhamidah et al, in 2018 stated that most (41.7%) YARSI medical faculty students had low physical activity. This will certainly increase the risk of obesity [7]. KEMENKES RI defines Sedentary lifestyle or low physical activity as all activities outside of sleep, with very little calorie expenditure characteristics, namely <1.5 (METs) [8]. One method of

assessment is using ASAQ (Adolescent Sedentary Activity Questionnaire).

One of the many problems caused by obesity is a loss of muscle strength due to stress on the musculoskeletal system [9,10]. Chooi et al. found similar results, concluding that obesity negatively affects virtually all physiological systems of the body and poses a serious threat to public health, one of which is a wide variety of musculoskeletal problems [11]. Musculoskeletal diseases, like osteoarthritis, can make it hard to walk. When other factors are taken into account, this makes the chance of all-cause death and cardiovascular events much higher [12,13]. This shows that idle behavior can make MetS worse for people who have problems with their muscles and joints.

Back muscles have the main function of supporting the trunk, maintaining body posture and assisting the movement of the trunk, limbs, shoulders and neck used in human activities. Based on anatomy, the back muscles consist of superficial, intermedius, and profundus muscle groups. In obesity, there is not only an increase in intermuscular fat tissue but also impaired glucose intake by muscle cells due to insulin resistance in muscle cells. Glucose is needed as an energy source for muscle contraction so that the decrease in intake causes a decrease in muscle strength including back muscles. Decreased back muscle strength will cause health problems such as muscle strain, back pain, and impaired mobility. In chronic pain can also cause psychological disorders in the form of anxiety and stress [14,15]. Hence, engaging in physical activity is imperative in order to mitigate the potential health issues arising from diminished strength in the muscles of the back. Haider et al. (2019) conducted a study which yielded findings suggesting that engagement in physical activity has the potential to enhance muscle strength and overall physical performance[16].

Obesity has received much attention in relation to long-term heart and circulatory diseases and conditions, as well as diabetes. However, musculoskeletal complications due to obesity are rarely discussed or studied in depth. Therefore, this research will discuss the relationship between obesity, back muscle strength, and physical activity. The aim of this research is to determine the effect of physical activity level on the back muscle strength of Unjani Medical Faculty students who suffer from obesity. Determining obesity's nutritional status does not include body fat percentage. Measuring muscle mass needs to be considered to see the relationship between decreased muscle strength and muscle mass, as well as other factors that influence muscle strength.

METHOD

This research is an analytic study with a cross sectional approach. The inclusion criteria in this study were active students of the undergraduate stage of the Faculty of Medicine, Unjani, 2019-2021 with BMI criteria of 25 kg/m^2, age 18-24 years, and willing to take part in the study and fill out an informed consent sheet. Exclusion criteria include a history of steroid drug consumption, a history of surgery, fracture, or trauma to the back area, there is an anatomical abnormality of the spine based on a doctor's diagnosis. A total of 64 students who met the research criteria were sampled and divided into 2 groups, namely obese students with low physical activity (n = 33) and obese students with high activity (n = 31) taken by purposive sampling technique.

The level of physical activity was measured using the Adolescent Sedentary Activity Questionnaire (ASAQ) and categorized as low if physical activity was <5 hours/day and high if ≥5 hours/day [15]. Obesity was determined based on the BMI formula [4]. Back muscle strength was measured using a back dynamometer with 3 repetitions and the measurement results taken were the highest value and categorized as excellent, good, moderate, poor, and very poor based on male and female reference values [17,18].

Bivariate data analysis using the Mann-Whitney test (dk = 95%). The Mann-Whitney (or Wilcoxon-Mann-Whitney) test is occasionally employed in clinical trials to assess the comparative effectiveness of two treatments. The use of nonparametric tests is frequently advocated as a viable alternative to the t-test when the underlying data does not conform to a normal distribution [19].

Research Procedure

The study began with the measurement of TB and BW to assess the BMI of the research subject, if BMI≥ 25 and other research criteria were met, the subject was taken as a research sample. The sample then filled out the ASAQ questionnaire to get data on the level of physical activity. Based on BMI and ASAQ data,

respondents were grouped into 2 groups, namely obese with low physical activity and obese with high physical activity. Each group member measured back muscle strength using a back dynamometer for 3 repetitions and the highest value was taken. Data on the value of back muscle strength of the two research groups were analyzed with the Mann Whitney test because the data were not normally distributed. The test is to see the difference between the two groups. Data collection has paid attention to the ethical aspects of research.

RESULTS

Characteristics of Respondents' Physical Activity Level Based on Gender

From the analysis of the ASAQ questionnaire scores completed by 64 respondents, 33% of respondents had low physical activity levels. When viewed by gender, the number of female respondents had a low level of activity more (69.7%) than men (30.3%), as shown in table 3.

Table 3 Characteristics of Respondents' Physical Activity Level Based on Gender (n=64).

Gender	Physical Activity Level				Total	
	High		Low			
	n	%	n	%	n	%
Male	19	61.29	10	30.3	29	45.31
Female	12	38.71	23	69.7	35	54.69
Total	31	100	33	100	64	100

Physical activity plays a role in the process of burning calories in the body and if combined with calorie reduction will have an impact on calorie deficits so that it can lose weight. Research by Faiq et al. (2018) states that most (41.7%) YARSI medical faculty students have low physical activity[7]. This will increase the risk of obesity. The percentage of pre-obese and obese patients in the study of respondents was quite high at 33.2%. Research by Liando et al. (2021), explained that adolescents, especially in women, spend more time playing gadgets, watching TV than doing physical activity[20].

Overview of Respondents' Back Muscle Strength

The results showed that most respondents (43.75%) had poor back muscle strength, and there were even students in the very poor category (6.25%) as shown in Table 4.

Table 4 Overview of Back Muscle Strength in Undergraduate Students of FK Unjani who suffer from Obesity (n = 64).

Back Muscle Strength (kg)	F	Percentage
Very good	1	1,56
Good	8	12,50
Moderate	23	35,94
Less	28	43,75
Very less	4	6,25
Total	64	100,00

In addition, the results showed that 1.56% of respondents had excellent back muscle strength, 12.50% of respondents had good back muscle strength, as many as 35.94% had moderate back muscle strength.

Obesity characterized by BMI ≥25 is one of the factors causing impaired function of the musculoskeletal system with an increase in intramyocellular fat and accompanied by causing insulin resistance in muscle cells and blocking glucose intake which is a source of energy for muscle contraction. This is supported by the research of Susilawati et al (2019) which states a significant relationship between body fat percentage and back muscle strength [21].

Overview of Back Muscle Strength Based on Gender

Based on table 5, it can be seen that the number of female respondents who have a level of back muscle strength of less than very less is less (21.9%) than male respondents (28.1%).

Table 5. Overview of Back Muscle Strength Based on Gender (n=64).

Back Muscle Strength	Gender				Total	
	Male		Female			
	n	%	n	%	n	%
Very good	0	0.0%	1	1.6%	1	1.6%
Good	2	3.1%	6	9.4%	8	12.5%
Moderate	9	14.1%	14	21.9%	23	35.9%
Less	15	23.4%	13	20.3%	28	43.8%
Very less	3	4.7%	1	1.6%	4	6.3%
Total	29	45.3%	35	54.7%	64	100

Male respondents tended to have a lower level of back muscle strength (23.4%) when compared to female responses (20.3%). Likewise, for the level of back muscle strength less once men (4.7%) more than women (1.6%). However, research by Torik et al, stated that there was no significant difference between the back muscle strength of young men and women [22].

Overview of Back Muscle Strength Based on Level of Physical Activity

Table 6 shows that the percentage of respondents who have a very low level of back muscle strength occurs in respondents with low physical activity (6%).

Table 6. Back Muscle Strength by Physical Activity Level (n=64).

Back Muscle Strength	Level Physical Activity					
	High		Low		Total	
	n	%	n	%	n	%
Very good	0	0%	1	2%	1	2%
Good	6	9%	2	3%	8	13%
Moderate	10	16%	13	20%	23	36%
Less	15	23%	13	20%	28	44%
Very less	0	0%	4	6%	4	6%
Total	31	48%	33	52%	64	100%

Lack of physical activity affects muscle strength, which is one of the components of a person's physical fitness. A person with BMI≥25 has a risk of decreased muscle strength due to the accumulation of fat in the muscles. The more trained the muscle, the greater the muscle strength (23–25).

DISCUSSION

To see the relationship between the effect of physical activity level on back muscle strength in both research groups, a mann-whitney statistical test was conducted. Before the test was carried out, the data normality test was carried out and it was found that the data was not normally distributed. The results of the mann-whitney test showed that there was a significant difference in back muscle strength ($p<0.05$) between the group of respondents with low physical activity and the group of students with high physical activity.

Table 7. Mann-whitney Test Results

Level Physical Activity	Mean	Mann-Whitney	p-Value
High	31	39,82	0,002
		284,50	0,002
Low	33	25,62	

The function of the back muscles is to support the trunk and maintain body posture, as well as the movement of the trunk, helping the muscles of the limbs, shoulders, and neck move. The imbalance of energy intake and use causes blood sugar levels to increase and results in insulin resistance in skeletal muscle cells and reduces the ability of glucose intake to skeletal muscle cells. The glucose in skeletal muscle cells will undergo glycogenesis to produce glycogen which is an energy source for muscle contraction. So that the lack of glycogen in muscle cells causes a decrease in muscle strength, especially back muscles. In addition, excess sugar in the blood will be converted in the form of fat which is deposited as visceral fat and ectopic fat, such as in the intermyocellular skeletal muscle which can cause an inflammatory response and reduce muscle mass. Overall, it will cause muscle disorders in the form of sarcopenia which is characterized by impaired muscle function such as muscle strain, pain, and impaired mobility. Chronic pain can also cause psychological disorders such as anxiety and stress[11,12].

CONCLUSION

Based on the research results, it can be concluded that 33% of respondents have low levels of physical activity, and this is mostly experienced by male respondents at 30.3%. Most of the male respondents (28.1%) had low levels of back muscle strength, and this generally occurs in respondents with low physical activity. There is a significant difference in back muscle strength ($p<0.05$) between students at the Unjani Faculty of Medicine who suffer from obesity with low physical activity and those with high physical activity. The conclusion obtained is that obesity has a negative impact on back muscle strength. For further research, researchers suggest determining nutritional status, apart from BMI, by also considering body fat percentage. Measuring muscle mass is also recommended to see the relationship between decreased muscle strength and muscle mass, as well as age, BMR, and hormonal factors.

ACKNOWLEDGMENTS

The author expresses gratitude to the Head of the Physiology Laboratory at FK Unjani and the staff members who have provided support for the research. Additionally, appreciation is extended to all individuals who have contributed to the progress of this study.

CONFLICTS OF INTEREST

The authors declare no conflict of interest

REFERENCE

1. Sawamura LS, Souza GG de, Santos JDG dos, Suano-Souza FI, Gessullo ADV, Sarni ROS. Albuminuria and glomerular filtration rate in obese children and adolescents. Brazilian J Nephrol. 2018;41:193–9.
2. World Health Organization. World Health Organization Obesity and Overweight. 2011.
3. Kementerian Kesehatan RI. Epidemi Obesitas. Jurnal Kesehatan. 2018.
4. Rath D, Amlinger L, Rath A, Lundgren M. The CRISPR-Cas immune system: Biology, mechanisms and applications. Biochimie. 2015;117:119–28.
5. Riskesdas. Laporan Riskesdas Provinsi Jawa Barat. 2018.
6. Syauqy A. Hubungan indeks massa tubuh dengan kebugaran jasmani mahasiswa prodi kedokteran UNJA. JAMBI Med JOURNAL" J Kedokt dan Kesehatan". 2017;5(1).
7. Faiq AR, Zulhamidah Y, Widayanti E. Gambaran sedentary behaviour dan indeks massa tubuh mahasiswa Fakultas Kedokteran Universitas YARSI di masa pendidikan tahun pertama dan kedua. Maj Sainstekes. 2018;5(2).
8. Direktorat P2PTM Kemenkes RI. Yuk, mengenal apa it kegiatan Sedentari? 2019.
9. Sizoo D, de Heide LJM, Emous M, van Zutphen T, Navis G, van Beek AP. Measuring muscle mass and strength in obesity: a review of various methods. Obes Surg. 2021;31:384–93.
10. Kemenkes. Dengan Melakukan Latihan Fisik Dapat Meningkatkan Kekuatan dan Daya Tahan Otot. Direktorat P2PTM. 2022.
11. Chooi YC, Ding C, Magkos F. The epidemiology of obesity. Metabolism. 2019;92:6–10.
12. Collins KH, Herzog W, MacDonald GZ, Reimer RA, Rios JL, Smith IC, et al. Obesity, metabolic syndrome, and musculoskeletal disease: Common inflammatory pathways suggest a central role for loss of muscle integrity. Front Physiol. 2018;9:112.
13. Hawker GA, Croxford R, Bierman AS, Harvey PJ, Ravi B, Stanaitis I, et al. All-cause mortality and serious cardiovascular events in people with hip and knee osteoarthritis: A population based cohort study. PLoS One. 2014;9(3):e91286.
14. Ramadas DR. Karakteristik Kekuatan Otot, Kelenturan Tubuh, Komposisi Tubuh Dan Indeks Massa Tubuh Siswa Smk Negeri 5 Denpasar Tahun Ajaran 2014/2015. Intisari Sains Medis. 2016;5(1):36–42.
15. Valenzuela PL, Maffiuletti NA, Tringali G, De Col A, Sartorio A. Obesity-associated poor muscle quality: prevalence and association with age, sex, and body mass index. BMC Musculoskelet Disord. 2020;21(1):1–8.
16. Haider S, Grabovac I, Dorner TE. Effects of physical activity interventions in frail and prefrail community-dwelling people on frailty status, muscle strength, physical performance and muscle mass—a narrative review. Wien Klin Wochenschr. 2019;131:244–54.
17. FKIP U. Petunjuk Pengoperasian Back and Leg Dynamometer. Universitas Lambung Mangkurat; 2017.
18. Lubis MY, Hermawan D, Febriani U, Farich A. Hubungan antara faktor Keturunan, Jenis Kelamin dan tingkat sosial ekonomi orang tua dengan kejadian obesitas pada mahasiswa di Universitas Malahayati tahun 2020. Hum Care J. 2020;5(4):891–900.
19. Hickey GL, Dunning J, Seifert B, Sodeck G, Carr MJ, Burger HU, et al. Statistical and data reporting guidelines for the European Journal of Cardio-Thoracic Surgery and the Interactive CardioVascular and Thoracic Surgery. Vol. 48, European journal of cardio-thoracic surgery. Oxford University Press; 2015. p. 180–93.
20. Liando LE, Amisi MD, Sanggelorang Y. Gambaran aktivitas fisik mahasiswa semester IV fakultas kesehatan masyarakat unsrat saat pembatasan sosial masa pandemi Covid-19. KESMAS J Kesehat Masy Univ Sam Ratulangi. 2021;10(1).
21. Susilawati I, Primayanti I, Yundarwati S. Pengaruh Latihan Penguatan Otot Punggung (Back Exercise) Untuk

Mencegah Nyeri Punggung (Back Pain) Pada Dosen Dan Karyawan Ikip Mataram. JISIP (Jurnal Ilmu Sos dan Pendidikan). 2019;3(1).
22. Torik T, Tahap RN. Hubungan Berat Badan terhadap Kekuatan Otot Punggung (Kasus: pada Lab. Sistem Kerja & Ergonomi). SINERGI. 2013;17(3):300–6.
23. Dewi KIM, Widiastuti IAE, Wedayani AAAN. Hubungan Antara Indeks Massa Tubuh Dengan Kekuatan Otot Pada Mahasiswa Fakultas Kedokteran Universitas Mataram. J Kedokt. 2020;9(1):63–72.
24. Listiarini A, Widjasena B, Wahyuni I. Hubungan Kekuatan Otot Punggung Dengan Keluhan Nyeri Punggung Pada Porter Di Stasiun Tawang Semarang. J Kesehat Masy. 2016;4(4):636–44.
25. Suhada PD, Widyastuti N, Candra A, Syauqy A. Korelasi Aktivitas Fisik dan Persen Lemak Tubuh dengan Indikator Sarkopenia. 2021.