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RESEARCH ARTICLES

Physical Activity Relate to Cardiovascular Resilience in Grade X and XI Students of SMA 01 Muhammadiyah Medan in 2022

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Abstract: Physical activity is a form of any physical movement that requires the expenditure of energy produced by skeletal muscles, such as work, play or recreational activities. Cardiovascular resilience is the ability of the lungs, heart and blood vessels to deliver oxygen and nutrients to cells to meet the needs of activity. The purpose of this study is to determine the relationship between physical activity and cardiovascular resilience in students of grades X and XI of SMA 01 Muhammadiyah Medan. The research method used is an analytical method with *a cross sectional approach.* The number of samples used was 118 students. Physical activity was measured using the *International Physical Activity Questionnaire* (IPAQ) and cardiovascular endurance was measured using *the Harvard Step Test*. This study had 118 respondents with students who did physical activity, the majority of whom were 81 (68.6%) students. For cardiovascular endurance, the majority is lacking, around 82 (69.5%) students. Meanwhile, for the *chi-square test, a* p-value of 0.023 *was obtained* , so that there was a significant relationship between physical activity and cardiovascular endurance in SMA 01 Muhammadiyah Medan students. There is a significant relationship between physical activity and cardiovascular resilience in students of SMA 01 Muhammadiyah Medan.

Keywords: Physical Activity, Cardiovascular Resilience, SMA 01 Muhammadiyah

INTRODUCTION

Physical activity is a form of all physical movements that will require the expenditure of energy produced by skeletal muscles, such as activities carried out during household chores, work and other activities. Not being able to do physical activity is the highest cause of chronic diseases that cause death. According to the WHO, being overweight and lack of physical activity and

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lack of exercise can cause a 30% risk of cancer. It found some association between an unbalanced diet and physical activity or lack of physical exercise. Lack of physical activity can lead to a lot of energy being stored as fat. The prevalence in Indonesia in physical activity is still very lacking.[1]

The physical activity of people in Indonesia, which is classified as less, tends to continue to increase, with the percentage of physical activity less for the province of Bali at 26% in 2018. Body mass index (BMI) is also related to a person's physical health.[2]

Daily routine activities must at least have physical strength and cardiovascular endurance to support the needs of these routine activities. Cardiovascular resilience includes the ability of the lungs, heart, and blood vessels to take up, spread, and use oxygen to tissues where the causative factors include age, body mass index, physical activity, and exercise intensity.[3]

The Faculty of Sports Sciences at Yogyakarta State University said that there were 12.72% of students of the class of 2009 who had very poor cardiovascular endurance, 20% poor cardiovascular endurance, 40% moderate cardiovascular endurance, 14.55% good cardiovascular endurance, and 12.72% very good cardiovascular endurance. This means that among the 55 samples, 27.27% had cardiovascular endurance that tended to be good.[3]

The development of technology at this time has changed the lifestyle of the community without exception the lifestyle for children. A significant change is the lack of activity carried out by children resulting in low physical fitness. Nowadays many children only tend to play *online* games rather than do sports together with their friends. Lack of physical activity as a result of *online* gaming can lead to obesity or lack of physical fitness.[4]

Endurance is a person's physical ability to do work for a relatively long time. As for cardiovascular resilience, it is the ability of the lungs, heart and blood vessels to deliver oxygen and nutrients to cells to meet the needs of physical activity that lasts for a long time. This cardiovascular endurance has several important components in the human physiological profile which involves aerobic and anaerobic endurance. Cardiovascular depends on the combination of blood vessels, heart, and lungs. Very strenuous activities require the production of oxygen-rich blood to allow the muscles to carry out constant strenuous activity.[5] The researcher is interested in researching whether there is a relationship between physical activity and cardiovascular resilience in students in grades X and XI of SMA 01 Muhammadiyah Medan. So it is based on the researcher's desire to find out the cardiovascular resilience of female students in doing physical activities.

METHOD

The research was conducted at SMA 01 Muhammadiyah Medan in March-April 2023. The study used an observational analytical design with *a cross sectional*

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design. Students of grades X and XI of SMA 01 Muhammadiyah Medan are the subjects of this study. The inclusion criteria include students in grades X and XI of SMA 01 Muhammadiyah Medan, aged 15-17 years, regular physical activity and sports. Exclusion criteria included subjects who did not follow the entire activity procedure, subjects suffering from heart disease and asthma, subjects who smoked for more than 10 years and subjects who had injuries or fractures to the extremities. The number of samples obtained amounted to 118 people using *the consecutive sampling method.*

Instrumen penelitian terdiri dari kuesioner *Internasional Physical Activity Questionnaire* (IPAQ) untuk mengukur aktivitas fisik dan *Harvard Step Test* untuk mengukur ketahanan kardiovaskular.

Data tersebut dianalisis dan disusun dengan bantuan SPSS versi 26. Data dianalisis secara univariat dan bivariat.

RESULT

Univariate Analysis

The following are the characteristics of the respondents from 118 students of SMA 01 Muhammadiyah Medan who are the subjects of this study and univariate analysis is needed to describe or explain the results of the research from each variable.

Table 1. Gender

Gender	Frequency (n)	Percentage (%)
Man	55	46.6
Woman	63	53.4
Total	**118**	**100**

The distribution of research subjects by gender shows that of the total 118 students of SMA 01 Muhammadiyah Medan in this study, the majority of 63 (53.4%) students are female, while 55 (46.6%) other students are male.

Table 2. Age

Age	Frequency (n)	Percentage (%)
15 y.o	54	45.8
16 y.o	64	54.2
Total	**118**	**100**

The distribution of research subjects by age shows that of the total 118 students of SMA 01 Muhammadiyah Medan who were the subjects of this study, the majority of 64 (53.4%) students were 16 years old, while 54 (45.8%) students were 15 years old.

Table 3. Body Mass Index

Body Mass Index	Frequency (n)	Percentage (%)
Normal	118	100
Total	**118**	**100**

Based on the table above, it can be seen that 118 students have a normal body mass index.

Table 4. Physical Activity

Physical Activity	Frequency (n)	Percentage (%)
Light	37	31.4
Moderate	81	68.6
Total	**118**	**100**

Based on the table above, it can be seen that of the 118 students, 81 (68.6%)

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students did moderate activities, while 37 (31.4%) students did light physical activities. Thus, it can be stated that the majority of the students of SMA 01 Muhammadiyah Medan who are the subjects of this study do moderate activities.

Table 5. Cardiovascular Endurance

Ketahanan Cardiovascular	Frekuensi (n)	Persentase (%)
Poor	82	69.5
Sufficient	36	30.5
Total	**118**	**100**

Based on the table above, it can be seen that of the 118 students, 82 (69.5%) students have poor cardiovascular endurance, while the other 36 (30.5%) students have sufficient cardiovascular endurance. Thus, it can be stated that the majority of students of SMA 01 Muhammadiyah Medan who are the subjects of this study have poor cardiovascular endurance.

Table 6. Bivariate Analysis

Physical Activity	Cardiovascular Endurance		Total	*Odd Ratio*	*P-Value*
	Poor	Sufficient			
Light	31	6	37	3.039	0.023
Moderate	51	30	81		
Total	**82**	**36**	**118**		

Based on the table above, it can be seen that students who have light and moderate activity, both are dominated by students who have less cardiovascular endurance. Then based on the results of the statistical test using *the chi-square test*, a p-value *of 0.023 (p≤α: 0.05) was obtained* , meaning that in this study it can be concluded that there is a significant relationship between physical activity and cardiovascular resilience in students of SMA 01 Muhammadiyah Medan. In addition, an *odd ratio* of 3,039 was obtained, which means that students who engage in light activities will be 3,039 times more likely to have a risk of having less cardiovascular endurance.

DISCUSSION

In the results of my research on the students of SMA 01 Muhammadiyah Medan with a total of 118 respondents and their characteristics such as male gender which amounted to 55 people and female 63 people. The results of the research conducted by Kadek S Prima, Dewi S et al. (2022) are in line with my research where there are 59 more women than 34 men.[6] Meanwhile, the research conducted by Ni Komang Ayu Mega juliyanty et al. (2020) is different from my research, where there are 37 more men compared to 35 women.[2] According to Ni Kadek Febriyanti et al. (2015) it is also different from my research, where there are 64 more men compared to 53 women.[7] The physical activity of adolescents, both boys and girls, is almost the same, but after puberty, adolescent boys are more likely to be more active in physical activity both in daily activities and in exercise compared to women.[7]

My research from 118 respondents was in the age range of 15-16 years. In a

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previous study conducted by Ni Komang Ayu Mega Juliyanty *et al*. (2020) There is an age range of 18-22 years.[2] Based on the research by Made Billy Dwiki Saputra *et al.* (2022) has an age range of 19-22 years.[3] Menurut Kadek S Prima Dewi S *et al*. (2022) rentang usia 17-19 tahun.[6] As a person gets older, they tend to lose muscle mass and facilitate the accumulation of fat in the body. Due to an increase in subcutaneous fat in men aged 8 to 12 years while in women 16 years old.[7]

My research from 118 respondents for the Body Mass Index in this study was normal. Based on previous research conducted by Ni Komang Ayu Mega Juliyanty *et al*. (2022) There are 10 people with a thin body mass index, 45 normal people, *7 overweight people and 10 obese* people .[2] According to Kadek S Prima Dewi S *et al*. (2022) has an *underweight body mass index* of 24 people, normal 49 people and *overweight* 20 people.[6] According to Ni Kadek Febriyanti *et al.* (2015) there was an *undeweight body mass index* of 17 people, normal 23 people, *overweight* 27 people, obesity I 21 people and obesity II 19 people.[7] Low physical activity performed by adolescents will cause energy accumulation by the body in the form of fat. If this happens continuously, it will cause an increase in body mass index. This increase will be a major risk factor for chronic diseases such as heart disease, diabetes, stroke, bone and muscle disorders.[7]

In 118 respondents, 81 (68.6%) students performed moderate physical activity and 37 (31.4%) students performed moderate physical activity. Based on research conducted by Ni Komang Ayu Mega Juliyanty et al. (2022), there were 52 students who did light physical activity (72.2%), moderate physical activity 18 (25.0%) and 2 (2.8%) heavy physical activity.[2] Meanwhile, in the study of Made Billy Dwiki Saputra et al. (2022), the Baswara Prada Medical Assistance Team performed 15 (29.4) light physical activity, 18 (35.3) moderate physical activity and 18 (35.3).[3] According to Kadek S Prima, Dewi S et al. (2022), there were 42 adolescents who did moderate physical activity (45.5%) and 51 (54.8%) with heavy physical activity.[6] This shows that most students have met the recommendations of moderate physical activity recommended by the *World Health Organization* (WHO) which requires at least 60 minutes of moderate to vigorous physical activity per day for children and adolescents.[8] The physical activity done by students is essential to maintain their physical and mental health. Some of the benefits of physical activity include improving heart health, reducing the risk of obesity, improving sleep quality, and improving overall physical fitness. However, the type and intensity of physical activity carried out must be adjusted to the physical condition and age of the student so as not to pose a risk of injury.[9]

Furthermore, in this study, it was found that 118 respondents had deficient cardiovascular endurance, 82 (69.5%) and 36 (30.5%) had sufficient cardiovascular

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endurance. Based on research conducted by Ni Komang Ayu Mega Juliyanty *et al*. (2022) students who have cardiovascular resilience are very lacking 67 (93.1%), cardiovascular resilience is less than 3 (4.2%), cardiovascular resilience is good 1 (1.4%) and cardiovascular resilience is good 1 (1.4%) out of a total of 72 respondents.[2] Meanwhile, what was obtained by Made Billy Dwiki Saputra *et al.*(2022) there was 18 (35.3%) less cardiovascular resistance, 18 (35.3%) moderate cardiovascular endurance and 15 (29.4%) good cardiovascular resistance out of a total of 51 respondents.[3] According to Kadek S Prima Dewi *et al.* (2022) adolescents with very poor cardiovascular endurance were 31 (33.3%), poor cardiovascular endurance 28 (30.1%) and moderate cardiovascular endurance 34 (36.6%) out of a total of 93 respondents.[6] Lack of cardiovascular resilience in adolescents can result in a variety of health problems and interfere with daily activities. Therefore, it is crucial for adolescents to improve their cardiovascular resilience through regular physical activity and a healthy diet. By improving cardiovascular resilience, adolescents can have better health and a lower risk of developing cardiovascular disease later in life. Physical activity recommended to improve cardiovascular endurance is aerobic activity, such as running, cycling or swimming, which is done regularly and increases in intensity gradually. By improving cardiovascular endurance, students will have more energy and endurance to perform strenuous physical activities and improve physical and mental health.[7]

The Relationship between Physical Activity and Cardiovascular Resilience in Students of SMA 01 Muhammadiyah Medan

Based on the results of the research that I have conducted, it shows that there is a significant relationship between physical activity and cardiovascular resilience in SMA 01 Muhammadiyah Medan students in 2022 with 118 student respondents, this is evidenced by testing using the Chi-Square test which obtained a significance value (p-value) of 0.023 ($p < 0.05$)

Based on the results of previous research conducted by Ni Komang Ayu Mega Juliyanty *et al.* (2022) which used 72 student respondents from the Faculty of Medicine and Health Sciences, Warmadewa University showed that there was a significant relationship between physical activity and cardiovascular resilience with a p value of 0.001 ($p<0.05$).[2] Meanwhile, research conducted by Made Billy Dwiki Saputra *et al*. (2022) in male students of the Baswara Prada Media Assistance Team class of 2018 and 2019 with 51 respondents showed a p value of 0.000, meaning that there is a significant relationship between physical activity and cardiovascular endurance.[3] According to Kadek S Prima Dewi S *et al*. (2022) in adolescents in Denpasar where the results showed a relationship between physical activity and

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cardiovascular resilience with a p value of 0.005.[6]

Adequate physical activity can increase the contraction of the heart muscle, increase lung capacity, and increase the supply of oxygen to the body's tissues. Regular physical activity and appropriate intensity can also improve blood circulation, lower blood pressure, and lower cholesterol levels in the blood. All of these effects can contribute to increased cardiovascular endurance in adolescents. However, while there is a significant relationship between physical activity and cardiovascular endurance, other factors such as diet, smoking, and genetic factors can also affect a person's cardiovascular health. Therefore, it is important to pay attention to these factors and maintain a healthy lifestyle across the board to improve overall cardiovascular health.[7]

Physical activity will affect fitness levels related to heart function. The heart muscle in a person who does good physical activity or exercise will experience hypertrophy so that the heart muscle in that person will become strong. The increase in the strength of the heart muscle will affect the quality of the heart pump. This will cause the heart to not work hard to pump blood to fulfill the energy supply to the muscles because the heart muscle is stronger. In the capillary blood vessels, the muscle also has an increase in quantity, so that the diffusion of oxygen in the muscle is easier, so it has the ability to transport more oxygen than a person who does not carry out physical activity. Heart and lung endurance is important for life and reduced risk of cardiovascular disease.[10]

CONCLUSION

Based on research conducted on students in grades X and XI of SMA 01 Muhammadiyah Medan in 2022, the following conclusions were obtained: The majority of students do moderate physical activity with a total of 81 students (68.6%). Meanwhile, 37 students (31.4) did light physical activity. The majority of students have less cardiovascular endurance, which is a total of 82 students (69.5%). Meanwhile, 36 students (30.5%) have sufficient cardiovascular endurance. There is a significant relationship between physical activity and cardiovascular resilience in students of SMA 01 Muhammadiyah Medan in 2022.

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REFERENCES

1. Wungow L, Berhimpong M, Telew A. Tingkat Aktivitas Fisik Mahasiswa Program Studi Ilmu Kesehatan Masyarakat Universitas Negeri Manado Saat Masa Pandemi

E-ISSN: 2528-410X

Covid-19. J Kesehat Masy UNIMA. 2021;02(03):22-27.
2. Komang N, Mega A, Indonesiani SH, et al. Hubungan Tingkat Aktivitas Fisik dan Indeks Massa Tubuh Terhadap Daya Tahan Kardiorespirasi pada Mahasiswa Fakultas Kedokteran dan Ilmu Kesehatan Universitas Warmadewa. Aesculapius Medical Journal. 2022;2(3):143-149.
3. Billy M, Saputra D, Gita IGB, Putra P, Putu D, Udiyani C. Hubungan Aktivitas Fisik dan Daya Tahan Kardiovaskular Pada Mahasiswa Laki - Laki Tim Bantuan Medis Baswara Prada Angkatan 2018 dan 2019. Aesculapius Medical Journal. 2022;2(1):57-62.
4. Eko Nopiyanto Y, Pujianto D. Pelatihan Olahraga Permainan Srampangan untuk Meningkatkan Aktivitas Fisik dan Nilai Kerja Sama bagi Anak-anak. Journal Pengabdi Masyarakat. 2022;4(1):198. doi:10.20527/btjpm.v4i1.4808
5. Dwi N, Rum P, Dari D. Cardiovaskular Endurance Of UNM Hockey Athletes Reviewed From Giving Honey. Jurnal Ilara. 2022;13(1):22-29.
6. Dewi S KSP, Widnyana M, Wahyuni N, Narta Dewi AANT. Hubungan Indeks Massa Tubuh (Imt) Dan Aktivitas Fisik Dengan Daya Tahan Kardiovaskuler Pada Remaja Di Denpasar. Maj Ilm Fisioter Indones. 2022;10(1):38. doi:10.24843/mifi.2022.v10.i01.p08.
7. Febriyanti NK, Adiputra IN, Sutadarma IWG. Hubungan Indeks Massa Tubuh dan Aktivitas Fisik Pada Mahasiswa Fakultas Kedokteran Universitas Udayana. J Med Udayana. 2015;8(3):31-36.
8. Word Health Organization. (2022). Physical Activity. Available from: https://www.who.int/news-room/fact-sheets/detail/physical-activity.
9. Centers for Disease Control and Prevention. (2022). Physical Activity Basic. Available from: https://www.cdc.gov/physicalactivity/basics/
10. Damayanti YA. Peran Aktivitas Fisik bagi Kinerja Jantung dan Paru-Paru serta Relevansinya dengan Aterosklerosis. Jurnal Kesehatan Andalas. 2019;8(1):68-74.