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Differences In Lipid Profiles Based on Physical Activity Levels Among First-Year Students In a Medical Education Research Program

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Abstract: Regular physical activity with adequate intensity, according to WHO recommendations, can prevent various chronic diseases, such as heart disease, diabetes mellitus, cancer, and bone disease. Physical activity can improve lipid profil: triglycerides, total cholesterol, HDL cholesterol (HDL-C), and LDL cholesterol (LDL-C). The aim this study was to compare lipid profiles, which include levels of triglycerides, total cholesterol, HDL cholesterol (HDL-C), and LDL cholesterol (LDL-C) at different levels of physical activity: low, medium, and high levels of physical activity. This study was an observational analytic study using a cross-sectional study. The subjects of this study were 93 first year students of the Medical Study Program, Faculty of Medicine, University of Mataram. The level of physical activity was assessed using the International Physical Activity Questionnaire-Short Form (IPAQ-SF) questionnaire and the lipid profile levels were measured using the enzymatic calorimetric method. The Kruskal-Wallis test was performed to assess the comparison of triglyceride level between groups with low, medium and high activity levels, One-way ANOVA test for total cholesterol, LDL-C and HDL-C levels, and Post Hoc LSD for HDL-C. Of the 93 subjects, 36 (38.71%) had low levels of physical activity, 49 (52.69%) moderate physical activity, and only 8 (8.6%) had high levels of physical activity. There was a significant difference in HDL-C in the high-moderate physical activity level (p=0.006), high-low physical activity level (p=0.006), and medium-low physical activity level (p=0.022). Based on the results of this study, it can be concluded that there are significant differences in HDL-C at all levels of physical activity. Regular, measured physical activity of moderate to high intensity can increase HDL-C.

Keywords: Physical activity levels; Lipid profile; IPAQ-SF

Introduction

Getting enough physical activity is one of the important factors in maintaining a healthy body. The National Heart, Lung, and Blood Institute (NHLBI), United States of America (2016) defines physical activity as any movement of the body that causes muscles to work and requires more energy than at rest.

The World Health Organization (WHO) has identified a lack of physical activity as a risk factor for the fourth leading cause of death globally, accounting for 3.2 million deaths (WHO, 2017). In addition, physical inactivity is a risk factor for cardiovascular disease and various other chronic diseases, such as diabetes, cancer (colon and breast cancer), obesity, high blood pressure, bone and joint disease (osteoporosis and osteoarthritis), and depression (Warburton et al., 2006).

Doing regular physical activity can lower blood pressure and improve cholesterol levels (National Center for Chronic Disease Prevention and Health Promotion, 2015). Previous research has shown that blood lipid levels improve in people who engage in regular physical activity (da Silva, et al., 2016; Ofori & Angmoterh, 2019). The opposite fact is found in

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sedentary individuals. The researchers concluded that there was a relationship between the amount of sedentary time and metabolic risk, one of which was higher triglyceride levels in sedentary subjects (Healy, et al., 2008; Bankoski, et al., 2019) Likewise, sedentary individuals are 2.6 times more likely to have low levels HDL-C9 (Maciel, et al., 2022). Elevated levels of total and low-density lipoprotein cholesterol (LDL-C) and decreased levels of high-density lipoprotein cholesterol (HDL-C) are important risk factors for coronary heart disease (Castelli, 1998).

Physical activity carried out must pay attention to frequency, duration and intensity to get optimal benefits. Physical activity with moderate intensity with a frequency of 5 or more times a week can reduce triglyceride levels (Hicks, 2016). The purpose of this study was to compare lipid profiles, which include levels of triglycerides, total cholesterol, HDL cholesterol (HDL-C), and LDL cholesterol (LDL-C) at different levels of physical activity, namely low, moderate, and high levels of physical activity.

Method

This study was an observational analytical study using a cross-sectional study. The subjects of this study were first-year students of the Medical Education Research Program at the Faculty of Medicine, Mataram University. The number of subjects involved in this study were 93. Samples were taken using a non-probability sampling technique, namely consecutive sampling.

Data on subject characteristics, including: age, height, weight, body mass index, physical activity level, and lipid profile. Height was measured using a microtoir, and body weight and body mass index were obtained using a body composition monitor Omron HBF-375. The level of physical activity was assessed using the International Physical Activity Questionnaire-Short Form (IPAQ-SF) questionnaire. The IPAQ-SF questionnaire consists of seven open ended questions that ask participants' physical activity during the last seven days. The total value of physical activity is calculated in units of MET-minutes/week. Data from participants will be multiplied by a predetermined constant and then entered into a formula calculation that has been modified by the IPAQ Team Committee. Lipid profile levels were measured using a colorimetric enzymatic method.

The research data obtained were tested using the One-way ANOVA test for normally distributed data with the same variance and the Kruskal-Wallis test if the One-way ANOVA test requirements were not met, thus previously the normality test was carried out with the Kolmogorov-Smirnov, and the homogeneity test with Level Test. LSD Post hoc analysis of data processing results with significance (p) <0.05. Data processing was done using SPSS version 25

Result and Discussion

General Characteristics of Respondents

There were 93 respondents who filled out the IPAQ-SF questionnaire. The characteristics of the study subjects consisted of: age, height, weight, body mass index, level of physical activity in the form of IPAQ-SF scores, and lipid profiles, including: triglycerides, total cholesterol, HDL-C, and LDL-C. (Table 1).

Table 1. General Characteristics of Respondents

Characteristics	Average	Standard Deviation	Minimum	Maximum
Age (th)	18.28	0.68	17	20
Height (cm)	160.24	8.05	146	180.1
Weight (kg)	56.22	14.32	36.2	99.4
Body Mass Index (kg/m²)	21.73	4.57	15	37.3
IPAQ-SF score (MET-minutes/week)	1230.35	1288.93	60	7998
Triglycerides (mg/dL)	104.33	23.69	66	206
Cholesterol (mg/dL)	171.6	32.9	96	284
HDL-C (mg/dL)	33.14	8.62	14	74
LDL-C (mg/dL)	117.6	30.29	50	228

The results showed that the average age of the subjects was 18.3 years. The average body mass index describes the nutritional status of the subjects in the normal category (18-25 kg/m2). Lipid profile characteristics, respectively: the average triglyceride level was normal, (< 150 mg/dl), the total cholesterol level was within normal limits (< 200 mg/dl), and the LDL-C level was 117.6 mg/dl included in levels that are still normal (normal <130 mg/dl), while HDL-C levels with an average of 33.1 mg/dl are included in the low category (good category if levels are ≥ 60 mg/dl). The characteristics of the subjects were seen from their physical activity based on the average IPAQ-SF score, indicating that the average subject had a moderate activity level (600 – 3000 MET-minutes/week).

Distribution of Physical Activity Categories based on IPAQ-SF

Physical activity is grouped into 3 categories based on the amount of energy use in units of MET-

minutes/week, namely: high, medium and low activity level categories. The distribution of calculations using a formula based on answers to the IPAQ-SF questionnaire, the research subjects at most had moderate levels of physical activity, namely 49 people (52.69%), followed by subjects with low activity levels, as many as 36 people (38.71%), and the least were subjects with high activity levels, which were only 8 people (8.6%) (Table 2).

Table 2. Distribution of Physical Activity Categories of Research Subjects

Physical Activity Category	Total (N)	Percentage (%)
Tall	8	8.60
Currently	49	52.69
Low	36	38.71

Comparison of Lipid Profile Levels at Various Levels of Physical Activity

A one-way ANOVA test was performed to determine whether total cholesterol, HDL-C, and LDL-C levels differed between subjects with low, moderate, and high levels of physical activity, whereas the Kruskal-Wallis test for triglyceride levels. From the results of the Kruskal-Wallis test for triglyceride levels, it was found that there was no significant difference in triglyceride levels in the three groups of physical activity levels (p=0.533) (Table 3).

Table 3. Results of Analysis of Triglyceride Levels Based on Physical Activity Level (Kruskal-Wallis)

	Physical Activity Category	Total (N)	Mean Rank	p
Triglycerides	Low	36	50.90	
	Currently	49	44.78	0.533
	Tall	8	43.06	

The same results were obtained for total cholesterol and LDL-C levels with the One-way ANOVA test which showed that there were no significant differences in total cholesterol and LDL-C levels in the three groups of physical activity levels (light, moderate, heavy), with a value the respective significance of p = 0.271 and p = 0.754(Table 4 and Table 5).

Table 4. Results of Analysis of Total Cholesterol Levels based on Physical Activity Levels (One-way ANOVA)

	Sum of Squares	df	Mean Square	F	p
Between Group	2859.321	2	1429.661	1.324	0.271
In Group	97167.152	90	1079.635		
Total	100026.473	92			

Table 5. Results of Analysis of LDL-C Levels based on Physical Activity Levels (One-way ANOVA)

	Sum of Squares	df	Mean Square	F	p
Between Group	529.476	2	264.738	0.284	0.754
In Group	83928.997	90	932.544		
Total	84458.473	92			

In contrast to the results of the three parameters, the results of the One-way ANOVA test for HDL-C levels obtained a significance value of p = 0.008. This result means that there is at least a significant difference in HDL-C levels in the two groups (Table 6).

Table 6. Results of Analysis of HDL-C Levels based on Physical Activity Levels (One-way ANOVA)

	Sum of Squares	df	Mean Square	F	p
Between Group	701.081	2	350.540	5.147	0.008
In Group	6130.102	90	68.112		
Total	6831.183	92			

To find out in which group there was a difference in HDL-C levels, it was followed by Post Hoc LSD analysis. From the results of the analysis, it was found that in the high and medium physical activity level group, p = 0.006, in the high and low physical activity level group, p = 0.006, and in the moderate and low physical activity level group, p = 0.022. Of the three significance values (p), the difference in HDL cholesterol levels (HDL-C) was significantly different at all levels of physical activity (Table 7).

Table 7. Results of LSD Post Hoc Analysis of HDL-C Levels

Physical Activity	Average Difference	Minimum	IK 95% Maximum	p
Tall Vs Currently	5.15306	1.5539	8.7522	0.006
Tall Vs Low	-5.15306	-8.7522	-1.5539	0.006
Currently Vs Low	-7.50000	-13.9087	-1.0913	0.022

Subjects in this study were first-year students in the Medical Education Research Program with an average age of 18.3 years, the transitional age from adolescence to early adulthood. Learning activities that are quite dense cause a minimum of time to fulfill the physical activity recommended by WHO to maintain health, especially cardiovascular health, however, the average IPAQ-SF score of 1230.25 MET-minutes/week indicates that the subject's physical activity is included in the level of moderate activity.

Regular physical activity can be a preventive effort against various diseases, including cardiovascular

disease, diabetes mellitus, and cancer which are the cause of death for nearly three-fourths of deaths in the world. The World Health Organization (WHO) has recommended that adults aged 18-64 years engage in moderate-intensity aerobic physical activity, at least 150-300 minutes per week, or 75 minutes/week of vigorous intensity, or an equivalent combination of both, and Aerobics should be done for at least 10 minutes to produce health benefits (WHO, 2020).

Various studies conducted, both observational and experimental, show that doing regular and regular physical activity causes good changes in lipid profiles, especially increases in HDL-C and decreases in triglycerides, in addition to improving total cholesterol and LDL-C (low density lipoprotein) and VLDL (very low-density lipoprotein) levels (Halverstadt, et al., 2007).

The results of this study showed significant differences in high-density lipoprotein cholesterol (HDL-C) levels between subjects with low, moderate, and high activity levels. This result is in line with several previous similar studies. A study in Brazil involving more than 12,000 subjects concluded that individuals with moderate and high levels of physical activity (i.e., physical activity ≥ 150 minutes/week) were significantly associated with higher HDL-C levels and lower triglyceride levels relevant (da Silva, et al., 2016). The high risk of HDL cholesterol and triglyceride levels will decrease with an increase in the number of minutes of moderate to vigorous physical activity. The odds ratio for this risk decreases with an increase in the number of minutes of moderate to vigorous physical activity (LeBlanc & Janssen, 2010). Morelli, et al (2020) in his research involving 92 subjects with an age range of 14-17 years and dividing them into 3 groups, namely the group of subjects who were inactive, the group with moderate levels of physical activity, and the group with high levels of physical activity found that levels. The highest HDL-C was found in the group with a high level of physical activity and the lowest in the inactive/sedentary group. Sedentary individuals or those who do less physical activity than recommended by WHO have lower HDL-C levels than those who do physical activity according to WHO recommendations (p = 0.015) (Maciel et al, 2022). However, the subject's average HDL-C level was included in the less than normal category, namely 33.14 mg/dL (table 1), because the reference value for normal HDL-C is ≥ 40 mg/dL.

High density lipoprotein/HDL is a lipoprotein with a high protein concentration, which is around 50%, but the amount of cholesterol and phospholipids is smaller. When cholesterol crystals begin to build up on artery walls, HDL absorbs them, helping to prevent atherosclerosis. If a person has a high ratio of HDL to LDL, the risk of atherosclerosis is reduced/minimized (Guyton & Hall, 2016).

Conclusion

Based on the results of this study, it can be concluded that there are significant differences in HDL-C at all levels of physical activity. Regular moderate to vigorous physical activity increases HDL-C.

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