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THE CORRELATION OF FLUID INTAKE AND PHYSICAL ACTIVITY WITH ADOLESCENT CARDIORESPIRATORY FITNESS IN CIPADANG VILLAGE

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ABCTRACT

Cardiorespiratory fitness is the ability of the heart, lungs, and blood vessels to supply oxygen to the cells to sustain physical activity. A systematic review and meta-analysis indicate that adolescents with poor cardiorespiratory fitness are at higher risk of obesity and cardiometabolic diseases in the future. This type of research is an observational study with a cross-sectional design. The target population in this study were adolescents aged 12-15 years in Cipadang Village, Pesawaran Regency. The minimum sample size for this study using the Slovin Formula is 66 respondents. The type of data collected in this study is primary data. Data were collected in two ways, namely by direct measurement and interview. Cardiorespiratory fitness test was measured using 20 meters shuttle run test. Calculation of fluid intake through direct interviews with quantitative methods using 2x24h food recall questionnaire and physical activity using the 2x24h physical activity level (PAL) questionnaire. Data were analyzed using Spearman Test. There were a correlation between fluid intake ($p=0.016$, $r=0.422$) and physical activity ($p=0.001$, $r=0.648$) with VO_2max. The conclusion of this study is that there is a correlation between fluid intake and physical activity with the VO_2max. Therefore, adolescents are expected to be able to control daily fluid intake and routinely do physical activity to improve cardiorespiratory fitness to avoid obesity and cardiometabolic diseases in the future.

Keywords: adolescent fitness, fluid intake, physical activity

1. INTRODUCTION

Cardiorespiratory fitness is the ability of the heart, lungs, and blood vessels to supply oxygen to the cells to sustain physical activity. A systematic review and meta-analysis indicate that adolescents with poor cardiorespiratory fitness are at higher risk of obesity and cardiometabolic diseases in the future (1). One of the factors contributing to low cardiorespiratory fitness is insufficient physical activity. According to the Basic Health Research 2018, 33.5% of Indonesians engage in insufficient physical activity (2). Among adolescents, the rate is even higher, reaching 49.6%. This figure has increased from the Basic Health Research 2013 data, which reported that 26.1% of the population was physically inactive (3).

Several factors can influence an individual's fitness level, including fluid intake and physical activity. The human body is composed of water as one of the largest components in it besides the nutritional components. The body needs fluids to carry out several of its functions such as maintaining normal body temperature, transporting nutrients needed by all cells, removing unnecessary metabolic waste through the excretory system. To replenish body fluids lost due to breathing or physical activity, whether light, moderate, or heavy, a person must consume sufficient fluids, sources of fluids can come from food or drinks. The condition of losing more water in the body than fluid intake is often called dehydration (4).

The people will drink when they feel thirsty, even though the body's water needs are not only indicated by thirst and dryness in the throat. Both conditions are actually the final stage of signs of dehydration. Gender, age, nutritional status, physical activity, body temperature, and environmental temperature are some of the factors that

can influence dehydration (5). Dehydration has been associated with several aspects of health disorders. Health disorders caused by dehydration include impaired physical performance such as fatigue; impaired mental performance such as short-term memory and visual attention; increased risk of various chronic diseases such as urinary tract infections, kidney stones, diabetes heart disease, hyperglycemia, overweight; and can cause several deviant behaviors related to appetite, hyperactivity, emotional (6).

Adequate water intake in adolescents is very necessary to balance their activities because adolescents often do not care about the importance of fluid intake. The results of a study on boys aged 9-13 years in America showed that around 85% of children and adolescents did not meet the recommended daily fluid intake (7). A cross sectional study conducted on school children and adolescents aged 7-12 years in Spain showed data that boys were more active and tended to have lower levels of hydration status compared to girls (8). Another study conducted in Indonesia also found that 7 out of 10 children did not consume enough water, especially plain water and the average consumption of plain water was only 1,471 ml (9).

Physical activity is a movement carried out by the body that requires energy expenditure to improve fitness and health. Physical activity is grouped into light activity, moderate activity, and heavy activity. Measurement of physical activity can be done by measuring the amount of energy expended or needed in each minute of activity (10). The results of research on male adolescents in Bogor showed that providing physical activity interventions can significantly increase cardiorespiratory fitness (11). The results of other research in Pringsewu also showed that there was a significant correlation between physical activity and VO_2max (12).

Based on these findings, the researchers are interested in analyzing the correlation between fluid intake and physical activity with adolescent fitness in Cipadang Village, Pesawaran Regency.

2. METHOD

This type of research is an observational study with a cross-sectional design. The study was conducted in Cipadang Village, Pesawaran Regency, from April to September 2024. The target population in this study were adolescents aged 12-15 years in Cipadang Village, Pesawaran Regency in 2024. Subjects that fit the research needs were determined based on inclusion criteria and exclusion criteria. The inclusion criteria in this study were all adolescents aged 12-15 years and were willing to be respondents. While the exclusion criteria in this study were adolescents who had a history of illness so that they could not take part in the 20 meters shuttle run test (VO_2max).

The population of cases in this study were all adolescents in Cipadang Village, Pesawaran Regency. Based on the results of sample calculations using the Slovin Formula, the minimum number of samples that must be met is 66 adolescents. The type of data collected in this study is primary data. Data were collected in two ways, namely by direct measurement and interviews. Data collected during the implementation of the study included cardiorespiratory fitness, fluid intake, and physical activity. Cardiorespiratory fitness was measured using 20 meters shuttle run test. The submaximal exercise tests can be used to assess cardiorespiratory fitness of youth with a wide range of fitness levels (13). Calculation of fluid intake through direct interviews with quantitative

methods using food recall 2x24h questionnaire and physical activity was measured using the Physical Activity Level (PAL) 2x24h questionnaire.

Data collection was carried out by researchers with the help of 3 enumerators who had been given prior direction and training. The data were then tested statistically with a significance level of 95% ($p < 0.05$) using the Spearman test. This study was conducted after obtaining a research ethical clearance letter from the Ethics Committee of the Faculty of Medicine, University of Lampung with number 2153/UN26.18/ PP.05.02.00/2024.

3. RESULTS

The general description of the results of data collection related to age, fluid intake, physical activity level, and VO_2max of 66 respondents is presented in table 1.

Table 1. Distribution of Data on Adolescents in Cipadang Village, Pesawaran Regency

Variables	Mean±SD	Min - Max
Age (year)	12.82 ± 0.89	11.0 – 16.0
Fluid Intake (mL)	1478 ± 284	1445 – 2300
PAL	1.44 ± 0.12	1.25 – 1.81
VO_2max (ml/kg/min)	22.95 ± 3.99	19.2 – 37.1

The results table 1 about distribution of data on Adolescents showed that the mean and standard deviation of the age were 12.82 ± 0.89 years. The mean and standard deviation of the fluid intake were 1478 ± 284 mL, the mean and standard deviation of physical activity level were 1.44 ± 0.12. The mean and standard deviation of VO_2max were 22.95 ± 3.99 mL/kg/min.

Table 2. Normality test of VO_2max, fluid intake and physical activity in adolescents

Variabel	*Kolmogorov-Smirnov*		
	Statistic	df	Sig.
VO_2max	.223	66	.001
Fluid intake	.144	66	.002
PAL	.134	66	.005
VO_2max	.223	66	.001

Table 2 showed that based on the results of the normality test using the Kolmogorov-Smirnov test, the variables of fluid intake, physical activity, and VO_2max have $p<0.05$, so it shows that the data is not normally distributed. A bivariate analysis was carried out using the Spearman correlation test.

Table 3. Analysis of correlation between fluid intake and physical activity with VO_2max values in adolescents

Variables	VO_2max
Fluid Intake	r = 0.422 p = 0.016 n = 66
PAL	r = 0.648 p = 0.001 n = 66

The results of table 3 with statistical test analysis obtained $p<0.05$ which indicates that there was a correlation between fluid intake and VO_2max. The correlation value (r) is 0.422 which means it showed a positive correlation with sufficient correlation, this explains that the higher the fluid intake value, the higher the VO_2max. The results of other statistical test analysis obtained a $p<0.05$ which indicates that there was a correlation between physical activity level and VO_2max in adolescents. The correlation value (r) is 0.563 which means it shows a positive correlation with strong correlation, this explains that the higher the physical activity value, the higher the VO_2max.

4. DISCUSSION

Nowadays, adolescents have problems related to movement that result in changes in VO_2max endurance training (14). Physical activity is one of the factors that affect VO_2max (15). Maximum oxygen volume / VO_2max is the maximum amount of oxygen that can be taken by the body when a person is exercising. People with better fitness levels tend to have higher VO_2max compared to individuals who are less active or have poor fitness. This means that people who have high VO_2max can do more intense and durable physical activities.

The results of this study about correlation fluid intake with VO_2max are in line with the study on boys aged 9-13 years in America showed that around 85% of children and adolescents did not meet the recommended daily fluid intake (7). A cross sectional study conducted on school children and adolescents aged 7-12 years in Spain showed data that boys were more active and tended to have lower levels of hydration status compared to girls (8). Another study conducted in Indonesia also found that 7 out of 10 children did not consume enough water, especially plain water and the average consumption of plain water was only 1,471 mL (9). The other study on Pencak Silat adolescent athletes in the Special Sports Class of SMPN 1 Surakarta showed a negative correlation between hydration status and VO_2max capacity (16).

The results of this study about correlation physical activity with VO_2max are in line with the study on adolescents in Lithuania aged 11-14 years using the Youth Physical Activity Questionnaire (YPAQ) showed that adolescents of low physical activity were less physically capable and had poorer posture than adolescents in the moderate to vigorous intensity physical activities group (17). The another study on children and adolescents in Bosnia Herzegovina showed children and adolescents who had better cardiorespiratory fitness were more likely to have higher levels of physical activity and lower central adiposity (18). The other study in several countries in Europe showed the change in cardiorespiratory fitness were dependent to a different extent based on gender, on BMI, age, and participation in some physical activities (19).

Another study entitled comparison of the IPAQ-A (International Physical Activity Questionnaire) and Actigraph Accelerometers in relation to VO_2max among European adolescents: The HELENA study. Both methods were moderately correlated with estimated VO_2max. Within the HELENA-study, the IPAQ-A showed the modest comparability with the accelerometer data for assessing physical activity in each intensity level and was the highest for vigorous intensity (20). Meanwhile, the other study recommended health practitioners should be aware that encouraging greater physical activity (same dose) in inactive and underweight children and adolescents will result in greater gains in VO_2max compared with their active and overweight/obese counterparts (21). Lack of physical activity is known to have an impact on increasing the risk of obesity, but if someone does physical activity it is known to reduce the risk of cardiovascular disease so that it concludes that sedentary activity will trigger non-communicable disease.

The conclusion of this study includes a correlation between fluid intake and physical activity with physical fitness in adolescents. The suggestion in this study is that adolescents are expected to be able to

control daily fluid intake and routinely do physical activity to improve cardiorespiratory fitness to avoid obesity and cardiometabolic diseases in the future.

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