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Relationship between diet, body mass index and frequency of exercise per week on students' physical fitness levels

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Abstract

The purpose of this study was to determine, the relationship between body mass index and physical fitness, and the relationship between exercise frequency per week, physical fitness and the relationship between diet, body mass index and exercise frequency per week on the level of physical fitness of male elementary school students. This study was conducted on elementary school children aged 5-12 years and this study has a target completion starting from preparation, data collection and data processing. In this study, the Nusantara Student Fitness Test (TKPN) tool was used to collect data on the level of physical fitness and diet and exercise frequency per week using a research questionnaire. The results of the data analysis can be presented as follows, the first result is a relationship between diet and physical fitness of male elementary school students after being known using the Pearson product moment correlation with a significance value of 0.000 which shows an effect of 19.9%. Second, there is a relationship between Body Mass Index and physical fitness in male elementary school students after being known using the Pearson product moment correlation with a significance value of 0.000 showing an effect of 5.5%. Third, there is a relationship between the frequency of exercise per week and the physical fitness of male elementary school students after being known using the Pearson product moment correlation with a significance value of 0.004 which shows an influence of 9.8%. Based on these results, it can be concluded that there is a positive correlation, which means that there is an influence between diet, body mass index and frequency of exercise per week on the physical fitness of male elementary school students

Keywords: *Diet; Body Mass Index; Physical Fitness; Exercise Frequency*

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INTRODUCTION

Physical fitness is the basic physical condition of an individual to carry out daily activities. Low fitness levels are associated with cardiometabolic risk factors such as body fat percentage, obesity, or insulin resistance (Castro, 2022). The high level of muscle fitness (maximal strength and power, local muscle endurance) is associated with higher bone mineral density (García-Hermoso, 2019). The role of children's physical fitness as an indicator of health also extends to psychological and cognitive outcomes, with research reporting positive associations with health-related quality of life, executive function, relational memory, reduced risk of metabolic syndrome and cardiovascular disease, and academic performance (Blasquez Shigaki, 2020).

While physical fitness in youth is quite predictive of physical fitness in adulthood, identifying children with low levels of fitness and assigning them early fitness-enhancing interventions can be an important foundation for long-term health (Garcia-Hermoso, 2022). Therefore, children, especially those in elementary school, must have good physical fitness. Elementary school students seem to need special attention. It is because during that age is

considered an important phase for education and nutrition. From an educational perspective, this period is the perfect time to teach and foster healthy living norms. From a nutritional perspective, it is time to prepare for adolescence and growth (Bayu Hardiyono, 2018).

Good physical fitness is a valuable asset in a student's life. Optimal fitness levels do not just improve their quality of life, but have a positive impact on physical and mental performance (Oktaviani & Wibowo, 2021). According to (Afriwardi, 2011) "Fitness is a condition when the body still has remaining energy to carry out light activities with a recreational or relaxing nature, physical activities that require endurance, strength and flexibility. Physical fitness is very necessary for students when carrying out activities inside and outside school so that they can carry out these activities with enthusiasm. According to (Bandi, 2011; Penedo and Dahn, 2005; Ahn and Fedewa, 2011; Biddle and Asare, 2011), physical education is a period of education that prioritizes physical activity to create comprehensive changes in a person's quality emotionally, physically and mentally. Therefore, physical education will build a strong physical body in activities. As we know the importance of physical fitness in maintaining health, there is no doubt that the higher the fitness level, the better the physical fitness. Good physical fitness will support work in daily life." According to (Dwijayanti, 2015), physical fitness is a condition that reflects the body's ability to work or carry out daily activities effectively without causing fatigue and having energy reserves to carry out urgent tasks. With good physical fitness, a person can carry out daily activities for longer than someone with poor physical fitness.

Based on the above phenomenon, it is important to examine the factors that have an impact on the physical fitness of male students when they enter elementary school age. One of them is diet, body mass index, and frequency of exercise per week. Eating patterns are the amount, quantity, variety, proportion, or combination of foods and drinks in the diet, as well as the frequency of consumption of these foods (United States Department, 2022). A growing body of literature addresses the associations of physical activity, physical fitness, and body fatness with the risk of metabolic syndrome and its components in children and especially adolescents (Platat et al., 2006; McMurray et al., 2008; Rubin et al., 2008; Thomas and Williams, 2008; Christodoulos et al., 2012). Identification of diets can be useful for investigating the relationship between diet and disease, especially when more than one dietary component (nutrient or food) appears to be involved, as in diabetes (Fathonah & Sarwi, 2020: 27). This evaluation can be analyzed in two ways: a priori, diets are determined based on nutritional guidelines and recommendations, or a posteriori, when data from dietary surveys

are collected through specific statistical analysis (American Diabetes Association Standards, 2017). Diet is considered an important behavior and has an impact on condition and nutritional status. This comes from the quantity and quality of food and drinks consumed which will also have an impact on nutrition and health conditions. Optimal nutrition is useful in helping the growth and physical development and intelligence of babies, children and others (RI Minister of Health Regulation No. 14, 2014). A balanced diet and good physical fitness are the keys to healthy aging, and the two are closely related. Research shows that diet is the main factor that influences muscle mass (Jang BY & Bu SY, 2019) and muscle function. Healthy eating habits can contribute to increased skeletal muscle mass and help maintain good function (Granic A, 2019). Better overall food quality may be associated with improved physical fitness (Jeong GW, 2019). Several studies have explored the relationship between dietary nutrition and physical fitness (Aparicio-Ugarriza R, 2019), including protein, dietary fiber, vitamin D and several antioxidants (Fanelli Kuczmarski, 2018). So there is a significant relationship in a positive direction between diet and physical fitness scale (Benito Simamora, 2023). However, in terms of diet, Lubna (2023) found that there was no relationship between the number of types of food and physical fitness.

Apart from diet, body weight or BMI (Body Mass Index) can be related to physical fitness. BMI is assessed as a basis for deciding whether overweight is based on the Quatelet Index (body weight in kilograms divided by the square of height in meters (kg/m2)). The reflection of BMI refers to the age and gender of the child, because boys and girls do not have the same body fat as adults. BMI in children will be adjusted to age, length and weight. Recently, the CDC has published a publication on the BMI curve. BMI can be plotted based on the CDC growth curve for children aged between 2-20 years. BMI is the youngest attempt to estimate obesity and correlate height with fat mass in the body. Then it is also important to carry out an analysis of obesity sufferers at risk of developing medical complications. BMI is good at detecting excess body fat, is simple and can be implemented on large research populations. The measurement requires two things, namely weight and height, carried out accurately by the individual along with training. The problem is that other measurements are needed if they are to be implemented individually. One of the weaknesses of BMI is that it cannot identify the weight of fat and the weight of muscle or bone. BMI is also unable to analyze the distribution of fat in the body. This has resulted in a number of research results revealing that the standard cut-off point in assessing obesity based on BMI does not fully indicate an equal risk of health problems for all races or ethnic groups.

METHOD

This research was carried out on elementary school students aged 5-12 years and this research has a completion target starting from preparation, data collection and data processing carried out from April 20 - May 10 2024. This research uses quantitative research or numerical descriptions that focus on attitudes. or opinions from a collection of populations that analyze the sample, according to Creswell (2014), this type of research approach provides testing of objective theory and determines the correlation between variables. Referring to Sugiyono (2020:23), quantitative methods are a type of research method that is carried out based on the philosophical view of positivism, providing testing on samples using research instruments, data analysis has statistical properties that test the truth of the hypothesis formulation raised. The method used is correlational.

According to Gay and Airasian (2012), correlational research describes existing conditions, which are very different from the conditions usually described in survey or observational studies. Correlation analysis is considered a statistical technique which aims to determine the degree of correlation between two variables (Zawawi, 2012: 46), researchers will use a questionnaire as an instrument to survey the relationship between diet, BMI and frequency of exercise per week on the physical fitness condition of male school students. Surahman, et al (2016: 8) state that a population is the totality of something whose characteristics are studied. In this study, the population was male elementary school students aged 5 - 12 years.

Sugiyono (2017:81) the sample is part of the number and type of the population. If the population is large, and it is not possible for researchers to test the entire population, due to limitations in terms of funds, energy or time, researchers can carry out testing on samples in that population. The sample took male elementary school students who had been divided into clusters. The research instrument carried out was a non-test instrument in the form of a questionnaire. Experiments were carried out on instrument expert validators and external research sample teachers.

RESULTS

This research was carried out on April 20 2024. This research was carried out with 54 children who were the research samples using the Cluster Random sampling technique. The data in this study consist of eating patterns obtained from filling out a questionnaire that has been validated by experts. Body Mass Index data was obtained through measuring height and weight, exercise frequency was obtained from research questionnaire filling data

and physical fitness was obtained from the Nusantara Student Fitness Test (TKPN) measurement test. This Tels was prepared by the Assistant Deputy for Sports Management, Education, Deputy for Sports Cultivation, Ministry of Youth and Sports of the Republic of Indonesia in 2022, which consists of 5 series of test items, namely: Body Mass Index (BMI), Sit and Reach, Sit Up 60 Seconds, Squat Thrust 30 Seconds and Pacer Test. In this study the test used was the Pacer Test. Following are the test results:

1. Validity test

Validity tests were carried out on 4 variables, namely: Diet, Body Mass Index and Frequency of Exercise Per Week on Physical Fitness Level.

Table 2. Validity Test Results of Variable X2

Variable	Indicator	r count	r table	Result
X2	X2.1	1.000	0.2681	Valid

Table 3. Validity Test Results of Variable Y

Variable	Indicator	r count	r table	Result
Y	Y1	0.757	0.2681	Valid

Based on data processing using SPSS 18, a validity test was then carried out on 4 variables as illustrated in the table above, Eating Pattern, Body Mass Index and Frequency of Exercise Per Week on Physical Fitness Level. where each variable produces r count > r table (0.2681), then it can be concluded that each statement given from the 4 variables above is valid.

2. Reliability test

Reliability testing functions to test the consistency of measuring instruments that use questionnaires.

Table 4. Reliability test results

Reliability Statistics	
Cronbach's Alpha	N of Items
0,761	46

Based on data processing using SPSS 18, a reliability test was carried out for 4 variables as depicted in the table above, indicating that the variables were Dietary Pattern, Body Mass Index, Frequency of Exercise Per Week, and Level of Physical Fitness. where for each variable there is

a Cronbach Alpha value of (0.761) > than (0.6), it can be concluded that each statement item from the 4 variables with a total of 46 statement items/questions on the variables above is reliable/reliable and the indicators used can be trusted as measuring instrument.

3. Normality test

The normality test is used to see whether the confounding variables are normally distributed or vice versa.

Picture 5. Normality test results

One-Sample Kolmogorov-Smirnov Test

		Unstandardized Residual
N		54
Normal Parameters[a,b]	Mean	,0000000
	Std. Deviation	,18694273
Most Extreme Differences	Absolute	,098
	Positive	,098
	Negative	-,061
Test Statistic		,098
Asymp. Sig. (2-tailed)		,200[c,d]

a. Test distribution is Normal.

b. Calculated from data.

c. Lilliefors Significance Correction.

d. This is a lower bound of the true significance.

Based on the table above, the results of the normality test using the Kolmogorov-Smirnov test. Obtained a significance value (2-tailed) of (0.200), which means Sig (2-tailed) = 0.200 > 0.05, so it can be concluded that the data is normally distributed and the normality assumption is met.

4. Linearity test

Picture 4.2 Linearity test results of X1 and Y

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
PHYSICAL FITNESS * DIET	Between Groups	(Combined)	13,000	27	,481	,596	,906
		Linearity	,252	1	,252	,311	,582
		Deviation from Linearity	12,748	26	,490	,607	,895
	Within Groups		21,000	26	,808		
	Total		34,000	53			

Picture 4.2 Linearity test results of X2 and Y

ANOVA Table

			Sum of Squares	Df	Mean Square	F	Sig.
PHYSICAL FITNESS * EXERCISE FREQUENCY	Between Groups	(Combined)	1,680	21	,080	1,236	,288
		Linearity	,003	1	,003	,047	,830
		Deviation from Linearity	1,677	20	,084	1,296	,250
	Within Groups		2,071	32	,065		
	Total		3,751	53			

Picture 4.2 Linearity test results of X3 and Y

ANOVA Table

			Sum of Squares	Df	Mean Square	F	Sig.
PHYSICAL FITNESS * IMT	Between Groups	(Combined)	,092	3	,031	,418	,741
		Linearity	,031	1	,031	,426	,517
		Deviation from Linearity	,061	2	,030	,414	,663
	Within Groups		3,659	50	,073		
	Total		3,751	53			

Based on the results of the linearity test as in the table above, it can be seen that sig. Both deviations have a value of 0.895, 0.663 0.250 > 0.050, so it can be concluded that there is a linear relationship between variable x (Dietary Pattern, Body Mass Index, Frequency of Exercise Per Week) and variable Y (Physical Fitness Level). Meanwhile, both linearity decisions have a calculated F value of 0.607, 0.414, 1.296 < F Table (deviation from linearity; within groups) which has a result of 2.58 so it can be concluded that there is a linear relationship between the x variables (Eating Pattern, Body Mass Index, Frequency Sports Per Week) on variable Y (Physical Fitness Level).

5. Hypothesis Test Results (T Test & F Test)

The t statistical test is generally a sign of how far the influence of the independent variable itself (individually) can explain and explain the dependent variable. In this study, a t test was carried out by comparing the t statistical test to test whether there was a significant

relationship between the independent variable and the dependent variable partially (individually). If the calculated t value is smaller than the t table or significantly greater than 0.05 then the hypothesis is rejected (the regression coefficient is not significant), this indicates that the independent variable does not have a significant relationship with the dependent variable and vice versa (Wulandari, 2000).

Table 4.6. Hypothesis Test Results (T Test)

Coefficients[a]

Model	Unstandardized Coefficients		Standardized	t	Sig.
	B	Std. Error	Beta		
(Constant) DIET	1,410	,105		13,423	,000
IMT_X2	-,194	,035	-,610	-5,617	,000
EXERCISE FREQUENCY	-,055	,012	-,459	-4,564	,000
	,098	,033	,326	3,008	,004

a. Dependent Variable: PHYSICAL FITNESS

Based on the table above, it is calculated from: high significance (α) = 5% or 0.05 Degrees of freedom = n (number of variables n) – k (number of variables l X & variables l Y) = 54 – 4 = 50. If you look in t table l ulrultan kel-50 dipelrolel h t table l = 2.00856 Seluntil, the calculated t value and significance of each l cell variable are obtained as follows:

a. Variable X1 has a value of -5.617 (t count) > 2.008 (t table) with a significance level of 0.000 < 0.005. This means that H_0 is rejected and Ha is accepted, or it means that diet has a positive and significant influence on physical fitness.
b. The variable X2 has a value of -4.564 (t count) > 2.008 (t table) with a significance level of 0.000 < 0.005. This means, H_0 is rejected and Ha is accepted, or it means that body mass index has a positive and significant influence on physical fitness.
c. Variable X3 has a value of 3.008 (t count) > 2.008 (t table) with a significance level of 0.004 < 0.005. This means that H_0 is rejected and Ha is accepted, or it means that the frequency of exercise has a positive and significant influence on physical fitness.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,257	3	,086	16,500	,000[b]
	Residual	,260	50	,005		
	Total	,517	53			

Based on the table above, it is calculated from: F table = F, k (number of variables X & variables Y – 1; n (number of respondents) – k) = (4-1; 54-3) = (3; 51). If we look at the f table for the numerator df: 3 which is in 51st place, we get f table = 2.79. So, the calculated f count and significance < 0.05 for each variable can be concluded that diet, body mass index and frequency of exercise simultaneously influence physical fitness

DISCUSSION

This research aims to determine the relationship between diet, body mass index and frequency of exercise per week on the physical fitness level of male elementary school students. Based on the results of research conducted by researchers, there is a significant relationship between diet and the level of physical fitness of elementary school male students as evidenced by X1 (diet) has a value of -5.617 (t count) > 2.008 (t table) with a significance level of 0.000 < 0.005. This means that H0 is rejected and Ha is accepted, or means that diet has a positive and significant influence on physical fitness. The results of data processing in SPSS 18 also show that diet has a 19.9% effect on physical fitness. Based on the data above, diet as the highest percentage that influences physical fitness is certainly inseparable from efforts or behavior that regulate the quantity and type of food that are useful in maintaining nutrition, health, and the status of anticipating the potential for disease to enter (Ministry of Health of the Republic of Indonesia, 2009). Especially for elementary school age children, managing their diet to create physical fitness, there are several components that need to be considered: 1) Type of food, for example staple foods (corn, sago, rice, tubers and flour), food from animal side dishes, vegetable side dishes, vegetables and fruit (Sulistyoningsih, 2011); 2) Frequency of eating, namely morning, afternoon, evening and intermittently (Ministry of Health, 2013); and 3) Number of meals, which means the amount of food consumed (Willy, 2011). The results of this research showed that only 1 out of 54 elementary school boys received "Frequent Points", namely that they had a balanced food intake. Meanwhile, others have not been able to fulfill a balanced diet to create good physical fitness. Several studies have explored the relationship between food nutrition and physical fitness (Aparicio-Ugarriza R, 2019), including protein, dietary fiber, vitamin D and several antioxidants (Fanelli Kuczmarski, 2018) which, when eaten

by growing children, can create good physical fitness. both in the present and continuing in the future. Therefore, the role of parents is very much needed in fulfilling a balanced nutritional intake. Meanwhile, not only diet, body weight can be related to physical fitness. Being overweight or underweight is one of the main health risks in modern society because of its association with various non-communicable diseases (Pi-Sunyer, 2002). The results of this research show that X2 (Body Mass Index) has a value of -4.564 (t count) > 2.008 (t table) with a high significance of 0.004 < 0.005. This means, H_0 is rejected and Ha is accepted, or it means that body mass has a positive and significant influence on physical fitness. The results of data processing in SPSS 18 also show that BMI has an effect of 5.5%. Although it only has such an effect on physical fitness, unbalanced body weight in children is also associated with psychological problems including low self-esteem, lower achievement in school, and overall quality of life (Lobstein, 2015). Which, if allowed to continue, will hamper the child's physical and even psychological condition in the future. Normally, calculating body mass index for children aged 9 – 18 years is by dividing body weight (Kg) by height (m2) which if the results are in the range of 16.5 – 21.3 with normal nutrition at -2SD to +1SD (according to age) indicates that the BMI is normal (TKPN, 2022). This research shows that as many as 14 or 25.9% of male elementary school students are malnourished. This requires preventive efforts to prevent the situation from getting worse. In other cases, this means, H_0 is rejected and H_a is accepted, or it means that the frequency of exercise has a positive and significant influence on physical fitness. The results of data processing in SPSS 18 also show that the frequency of exercise has an effect of 9.8%. Sport, in this case, as resistance training, is also an effective method for increasing muscle strength, power and hypertrophy, which are fundamental components of physical fitness related to a person's quality of life (Grant W. Ralston, 2018). These exercise variables include exercise order, number of sets, repetitions, recovery period between sets, training intensity per muscle group, and total training volume. Steib et al. (2010) stated that the training variable that received limited consideration was the frequency of exercise in a week. Weekly training frequency (the number of training sessions carried out throughout the week) can influence various levels of physical fitness success. Exercise frequency is also defined in the literature as the number of exercise sessions undertaken during a certain period, usually described as weekly (Kraemer & Ratamess, 2004). Frequency is further characterized by the number of training sessions per week per muscle group or exercise (Schoenfeld et al., 2015).

Within the scope of elementary school age children, this research uses a pacer test to determine the ability of the heart and lungs to work optimally in children. The results showed that 31 out of 54 or 57.4% of male students in elementary schools had very low physical fitness after the pacer test was carried out. This is what parents should pay attention to, in inviting them to participate in physical activities/sports several times a week in order to create sustainable physical fitness that is good for their children in the future.

CONCLUSION

In this research, referring to the data analysis and hypothesis testing that has been carried out, the following conclusions are produced:

1. The Dietary Pattern variable has a negative regression result of -5.617 (t count) > 2.008 (t table) with a significance level of 0.000 < 0.005. This means that H_0 is rejected and H_a is accepted or has a meaning pattern that there is a positive and significant influence on the physical fitness of elementary school male students.
2. The Body Mass Index variable has a negative regression result of -4.564 (t count) > 2.008 (t table) with a significance level of 0.000 < 0.005. This means that H_0 is rejected and H_a is accepted, or it means that the body mass index has a positive and significant influence on physical fitness of male students.
3. The Sport Frequency variable has a positive regression result of 3.008 (t count) > 2.008 (t table) with a significance level of 0.004 < 0.005. This means, H_0 is rejected and H_a is accepted, or means that the frequency of exercise has a positive and significant influence on the physical fitness of elementary school male students.

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