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CORRELATION OF BODY MASS INDEX, PHYSICAL ACTIVITY, AND PHYSICAL FITNESS IN ELEMENTARY SCHOOL STUDENTS

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

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Abstract

The purpose of this study was to determine the conditions and the relationship between body mass index (BMI), physical activity, and physical fitness.

Materials and methods. This type of research was a cross-sectional study which was an observational study that analyzes data with predetermined variables and respondents. The number of respondents was 191 elementary school students in Kecamatan Ploso, Kabupaten Jombang, East Java, Indonesia. BMI was calculated by dividing weight in kilograms (kg) by height in meters squared (m^2), measurement of physical fitness used 20-meter Multi-Stage Fitness Test (MSFT) test, whilst physical activity test used a Physical Activity Questionnaire for Older Children (PAQ-C). The data analysis used the Pearson product-moment model using SPSS version 21.0 with a significance level of 5%.

Results. The correlation analysis results in this study indicate that there was a positive correlation between BMI and physical activity (r=0.176; p-value=0.015), BMI and physical fitness (r=0.151; p-value=0.037), and physical activity and physical fitness (r=0.142; p-value=0.049).

Conclusions. Based on the study results, it was showed that there was a positive correlation in each variable (body mass index, physical activity, and physical fitness).

Keywords: physical activity, physical fitness, body mass index, elementary school students.

Introduction

Physical activity is said to be an activity carried out by every human being described in daily life so as to produce a muscle reaction that can increase the energy expended including sports activities (Rejeki et al., 2021). When moving actively and regularly with a low to high intensity pattern used will have an impact on the body in removing calories in the body (Sugiharto et al., 2022). Each individual is different in the level of physical activity carried out because it is influenced by gender, nutrition and also socio-economic status, can benefit for physical and social health when children do physical activity and are well documented (Janssen & LeBlanc, 2010; Lubans et al., 2016), when children's active participation in physical activity can provide assistance to improve cognitive, emotional abilities, build strong muscles and bones and can be protected from several diseases and health (Hallal et al., 2006; Watson et al., 2017). Therefore physical activity is very important for elementary school children (Basuki et al., 2021).

Coronavirus Disease 2019 (COVID-19) pandemic and restrictions on gatherings have led to online classes and their impact on children's physical activity restrictions – with an increase in body weight and sedentary activities (Ługowska et al., 2022). The COVID-19 pandemic has also limited activities in schools, especially in the subjects of Physical Education, Sports and Health. The objective of Physical Education, Sport and Health subjects for elementary school children is not only to develop physical abilities, but also to develop intellectual, mental, social and emotional dimensions. However, this goal is certainly experiencing obstacles due to the COVID-19 pandemic in the world

(Basuki et al., 2019). So that it also has an impact on the cardiorespiratory condition of the child's fitness being less, obesity has increased in all age groups, overweight and low fitness are interrelated so that it has an impact on low physical activity (Dencker et al., 2006). When obesity in children later in life there is an increase it has a negative impact on health (Freedman et al., 2001). To lead a healthy life children must be able to increase movement activities to identify changes in overall fitness and get used to doing physical activity to show positive effects in home and family based activities (Brown et al., 2017).

Physical activity provides benefits for elementary school-aged children by increasing physical activity accompanied by healthy food, so that it can overcome health problems that have been developing in the community and show that physical activity as a tool to reduce obesity, as parents should also be able to know when at home that children's fitness must be maintained and keep moving so that the condition of the body can still carry out daily activities. When a children's fitness level decreases, it will result in a child being less mobile and obese, because good fitness is a picture of good physical activity, fitness and obesity are always related to gender (Li et al., 2008), so that every group including health can provide a description of an activity based on age and gender can reduce and be a solution to the problem of childhood obesity.

Physical activity is important for children who are more active and have better fitness than inactive ones (Aires et al., 2011; Boddy et al., 2012). Physical activity has a good impact on improving fitness and is integrated into physical activity. when children are active, the fitness condition will be better than children who are not active. Children who are involved in physical activity can help maintain their appearance (Muñoz-Vera et al., 2017). Each individual must have the motivation and desire to be active on a regular basis, but each individual must be able to maintain movement activities effectively because they will definitely face various things and challenges, each individual must have the skills, knowledge, motivation to overcome these challenges. The purpose of this study is how the condition of physical activity, body mass index and physical fitness to get a picture of the condition of children in elementary school.

Materiald and Methods

Study participants

A total of study pasticipants 191 elementary school students in Kecamatan Ploso, Kabupaten Jombang, East Java, Indonesia. This data collection has been approved by teachers, parents and students as the basis for the code of ethics in research and also respondents get directions before conducting the research orally, respondents fill out a willingness form to participate in this study and give sign a statement to be willing as a respondent.

Study organization

This type of research was a cross-sectional study which was an observational study that analyzes data with predetermined variables and respondents. Body mass index (BMI) was measured using standard norms by dividing the weight of the participant by his/her height in squared meters (Gerver & de Bruin, 2001; Raharjo et al., 2021; Andarianto et al., 2022; Sugiharto et al., 2022)and may not be appropriate for the Chinese population. More data among Chinese are needed to address this issue. We aimed to identify cut-offs for body mass index (BMI, measurement of physical fitness using 20-meter Multi-Stage Fitness Test (MSFT) test (Sugiharto et al., 2022; Paradisis et al., 2014)and may not be appropriate for the Chinese population. More data among Chinese are needed to address this issue. We aimed to identify cut-offs for body mass index (BMI, whilst physical activity test used a Physical Activity Questionnaire for Older Children (PAQ-C) (Kowalski et al., 1997; Kowalski et al., 2004; Moore et al., 2007).

Statistic analysis

Statistic analysis used descriptive statistics, namely the calculation of the mean, standard deviation to determine the results of BMI, physical fitness, physical activity, for BMI and fitness are calculated according to gender categories, after that used Pearson product-moment model to determine the correlation of each variable from BMI, physical activity, fitness physical analysis was performed with SPSS version 21.0, and the significant level 5%.

Results

The results of measurements made to research respondents regarding physical activity, physical fitness, body mass index (BMI) can be shown as follows in Table 1 below. Based on Table 1, it shows that regarding physical activity, physical fitness, BMI shows that the minimum value for physical activity is 10.00 a maximum of 46.00, the average is 31.09 and the standard deviation is 7.38. For the minimum physical fitness value 18.50 maximum 38.50, the average is 38.30 and the standard deviation is 38.0. For a minimum BMI value is 11.50, a maximum of 30.20, an average of 18.54 and a standard deviation of 3.59, based on the values obtained can be seen in Table 1.

Based on Table 2, which explains the characteristics of respondents with a total of 191 primary school student respondents with male and female gender regarding physical activity carried out in 1 week in a row that meets the very less, less, moderate, high, very high categories.

Based on the Table 2, it can be seen about the physical activity of elementary school student respondents based on gender with very less categories 4, less 14, moderate 42, high 26, very high 3. While for women with very less categories 4, less 17, moderate 51, high 24, very high 6. So based on these data it is known that physical activity for 1 week is on average in the moderate category, it can be seen from the calculation results, namely for male 42 students and female 51 students.

In Table 3 explains the physical fitness condition of elementary school students seen from 20-meter Multi-Stage Fitness Test (MSFT) test, so that it can be seen that the data about the categories are very less, less, moderate, good, very good, very very good. The data obtained from male and female respondents are as follows.

The Table 3 above shows that there were differences in the results of the respondents' physical fitness between men

and women, which can be seen based on the gender of men who get the number in the moderate category, namely the number of 35 respondents, while for the physical fitness of women it is in the less category with a total of 37 respondents.

Table 4 explains the condition of the body mass index of elementary school students as seen from the calculation of BMI (height and weight), so that it can be seen data about the categories of respondents, namely thin, normal, overweight, obesity. The data obtained from male and female respondents are as follows.

The Table 4 above shows that the body mass index of male respondents is in the thin category with a total of 56 respondents, while for female respondents it can be seen that it is in the normal category with a total of 50 respondents.

Based on the results of the Pearson correlation analysis (Figure 1), it shows that there is a positive correlation between BMI with physical activity (r=0.176; p-value=0.015), BMI with physical fitness (r=0.151; p-value=0.037), physical activity with physical fitness (r=0.142; p-value=0.049).

Table 1. Description of research variable data

Category	n	Min	Max	Mean	SD
Physical activity	191	10.00	46.00	31.09	7.38
Physical Fitness	191	18.50	38.50	38.30	38.0
BMI	191	11.50	30.20	18.54	3.59

Table 4. Characteristics of respondents BMI

Gender	Category	n	Min	Max	Mean	SD
Man	Underweight	56	12.10	18.40	15.96	1.87
	Normal weight	32	18.10	25.40	21.10	1.86
	Overweight	3	27.30	28.50	27.96	0.61
	Obesity	0	0.00	0.00	0.00	0.00
Woman	Underweight	47	11.50	23.90	16.29	2.53
	Normal weight	50	16.80	32.80	21.34	2.60
	Overweight	3	26.10	29.80	27.53	1.98
	Obesity	0	0.00	0.00	0.00	0.00

Discussion

The study conducted on respondents from elementary school students showed that the physical activity of boys and girls showed a moderate category so that conditions at school positively affected the fitness of boys, as seen from the results of the data obtained in the moderate category for girls in the category less even though the results are slightly different from male respondents. Another important factor impacting the risk of being overweight and obese is diet. It was evident that regular food consumption by female respondents shows a normal category so that the resulting

Table 2. Characteristics of physical activity respondents

Gender	Category	n	Min	Max	Mean	Std. Deviation
Man	Very less	4	14.30	16.80	15.6 7	1.10
	Less	14	18.00	24.00	20.57	2.24
	Moderate	42	24.00	34.00	29.35	2.35
	High	26	35.00	44.00	37.50	2.80
	Very high	3	46.00	46.80	46.43	0.40
Woman	Very less	4	13.20	17.50	15.37	1.93
	Less	17	15.00	24.00	20.35	2.62
	Moderate	51	25.00	34.00	30.09	2.80
	High	24	35.00	44.00	38.45	2.85
	Very high	6	45.00	46.00	45.50	0.54

Table 3. Characteristics of physical fitness respondents

Gender	Category	n	Min	Max	Mean	Std. Deviation
Man	Very less	16	27.50	38.30	31.24	4.16
	Less	6	36.20	38.50	37.76	1.13
	Moderate	35	34.80	39.80	38.87	0.82
	Good	0	0.00	0.00	0.00	0.00
	Very good	27	45.20	48.60	46.02	0.89
	Very very good	0	0.00	0.00	0.00	0.00
Woman	Very less	34	18.50	24.90	21.45	2.04
	Less	37	24.60	29.70	26.37	1.26
	Moderate	36	31.10	35.70	33.03	1.14
	Good	0	0.00	0.00	0.00	0.00
	Very good	0	0.00	0.00	0.00	0.00
	Very very good	0	0.00	0.00	0.00	0.00

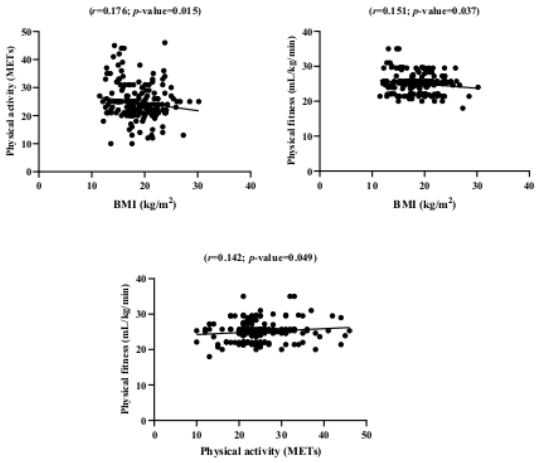

Fig. 1. Results of correlation analysis between body mass index, physical activity, and physical fitness. Pearson correlation coefficients (r) and p-values are shown in graph.

benefits increase in time for physical activity, while men enter the thin category due to irregular eating patterns and physical activity patterns because the portion of food intake that enters the body was not a lot, even though food was a source of energy to carry out activities. Although some variables show categories that were not good, at the level of a correlation, each variable illustrates that all variables influence each other or there was a correlation.

Elementary school was a place where children can gain knowledge about how to do physical activity which is an important element in a healthy lifestyle (Messing et al., 2019). High obesity rates and related diseases have made physical activity promotion a politically relevant topic. In order to form the basis for political decision making, evidence is required regarding the efficacy and effectiveness of interventions for physical activity promotion. In contrast to previous research, this systematic review of reviews targets three key settings (family and home, childcare, schoolIn addition, a less active lifestyle in moving should be reduced, including playing mobile phones and watching television, all of these activities are replaced by regular physical activity because regular physical activity can be associated with a healthy lifestyle. However, a small proportion of primary school age really understand how to carry out daily activities (Guthold et al., 2020).

Children's physical activity carried out with high intensity will have an impact on reducing the risk of being overweight and obese, and increasing the composition of physical fitness (Ng et al., 2019). This impact can be seen in Figure 1 showing that between physical activity and physical fitness there was a correlation with each other, so it can be said that every active physical activity carried out regularly and regularly will have an impact on a person's physical fitness level. Physical activity provides many benefits for children's health as a result of a physically active lifestyle. Also provides an increase in cardiorespiratory and muscle fitness, and also has a positive effect on body weight. According to Florido et al. (2017) explained that when active and increased in physical activity the possibility of a fat body condition will decrease.

Children are always involved in daily activities with physical activity will be able to maintain the condition and appearance of the body and also have an impact on the child's physical fitness, when everyone with a lifestyle that does not carry out moving activities will result in increased body fat conditions and have condition status. fat body, in contrast to an active lifestyle, because fat in the body has a negative correlation with energy expenditure (Fonseca et al., 2018). Energy activity, diet-induced thermogenesis, or a combination of all of these components. It thus contributes to positive energy balance and subsequent weight gain. Obesity, therefore, can be considered, among other aspects, the consequence of an energy imbalance; that is, energy intake greater than that spent in a certain period. In order to have stability of body weight and body composition it would be necessary for energy intake to correspond to energy expenditure. Regarding the comparison of energy expenditure between non-obese and obese individuals, the results point to a differentiated behavior of obese individuals. However, it has not yet been possible to identify which specific energy expenditure component contributes most to this differentiated behavior can (resting energy expenditure, energy expenditure during physical activity or food thermogenesisPhysical activity affects BMI values and body composition (Lakoski et al., 2011). We examined the nonmodifiable and modifiable determinants of CRF within a large healthy Caucasian population of men and women. The study included 20,239 patients presenting to Cooper Clinic (Dallas, Texas The most important thing is having a good BMI status and always being physically active. Students must have self-awareness for the importance of physical activity in daily activities so that it brings positive things and reduces obesity status and needs to be remembered that physical activity was a necessity as a lifestyle.

Conclusion

Based on the results of the study, it showed that the average student had a moderate level of physical activity and physical fitness, while the average student had a BMI with a normal weight category. However, based on the results of the analysis for each gender, on average, man had a BMI in the underweight category and women in the normal weight category. Meanwhile, the main finding of our study was the relationship between BMI and physical activity and physical fitness, and found a relationship between physical activity and physical fitness in a positive direction.

Conflict of interest

No conflict of interest to declare.

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ВЗАЄМОЗВ'ЯЗОК ІНДЕКСУ МАСИ ТІЛА, ФІЗИЧНОЇ АКТИВНОСТІ ТА ФІЗИЧНОЇ ПІДГОТОВЛЕНОСТІ В УЧНІВ ПОЧАТКОВОЇ ШКОЛИ

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 7 с., 4 табл., 1 рис., 30 джерел.

Метою цього дослідження було визначити умови та зв'язок між індексом маси тіла (ІМТ), фізичною активністю та фізичною підготовленістю.

Матеріали та методи. Цей тип дослідження був перехресним дослідженням, яке було спостережним дослідженням, у якому аналізують дані з попередньо визначеними змінними та респондентами. Кількість респондентів становила 191 учень початкової школи в окрузі Плосо, регентство Джомбанг, Східна Ява, Індонезія. ІМТ розраховували шляхом поділу ваги в кілограмах (кг) на квадрат зросту в метрах (м2), для вимірювання фізичної підготовленості використовували човниковий біг на 20 метрів, а для тестування фізичної активності використовували опитувальник із фізичної активності для дітей старшого віку (PAQ-C). Для аналізу даних використовували коефіцієнт кореляції Пірсона з використанням програмного забезпечення SPSS версія 21.0 за рівня значущості 5%.

Результати. Результати кореляційного аналізу в цьому дослідженні вказують на наявність позитивної кореляції між ІМТ та фізичною активністю (r=0,176; p-значення=0,015), ІМТ та фізичною підготовленістю (r=0,151; p-значення=0,037) та між фізичною активністю й фізичною підготовленістю (r=0,142; p-значення=0,049).

Висновки. На підставі результатів дослідження було показано наявність позитивної кореляції в кожній змінній (індекс маси тіла, фізична активність і фізична підготовленість).

Ключові слова: фізична активність, фізична підготовленість, індекс маси тіла, учні початкової школи.

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CORRELATION OF BODY MASS INDEX, PHYSICAL ACTIVITY, AND PHYSICAL FITNESS IN ELEMENTARY SCHOOL STUDENTS

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