e-ISSN: 2747-2051

Archives of the Medicine and Case Reports

[AMCR]

https://hmpublisher.com/index.php/amcr

The Relationship Between Physical Activity and Nutritional Status Based on Body Mass Index for Age Percentiles in Elementary School Children in Ciherang Village

Susy Olivia Lontoh[1], Yohanes Firmansyah[1], Ernawati Ernawati[2], Alexander Halim Santoso[3*], William Gilbert Satyanegara[4], Bryan Anna Wijaya[4], Fiona Valencia Setiawan[4], Nicholas Setia[4], Daniel Goh[4]

[1]Department of Physiology, Faculty of Medicine, Universitas Tarumanagara, Jakarta, Indonesia

[2]Department of Public Health and Family Medicine, Faculty of Medicine, Universitas Tarumanagara, Jakarta, Indonesia

[3]Department of Clinical Nutrition, Faculty of Medicine, Universitas Tarumanagara, Jakarta, Indonesia

[4]Faculty of Medicine, Universitas Tarumanagara, Jakarta, Indonesia

ARTICLE INFO

Keywords:
Body mass index
Children
Nutritional status
Physical activity

***Corresponding author:**
Alexander Halim Santoso

E-mail address:
alexanders@fk.untar.ac.id

All authors have reviewed and approved the final version of the manuscript.

https://doi.org/10.37275/amcr.v5i3.553

A B S T R A C T

Physical activity is crucial for children, and it is also useful in the prevention of obesity. In today's modern lifestyle, children are becoming more inactive, which puts them at risk of being overweight and obese. Studies have shown that physical activity and dietary changes can help reduce weight in obese children. Therefore, researchers are interested in studying the relationship between physical activity and nutritional status in children. This cross-sectional study was conducted in February-March 2024 at 5 Ciherang Elementary Schools. Children who meet the inclusion criteria will be asked questions about physical activity using the IPAQ questionnaire, followed by a measurement of body weight and height, and then nutritional status will be interpreted using the BMI per age chart from CDC. Two hundred forty-six children met the inclusion criteria, and it was found that there was no significant difference in the mean value of IPAQ between nutritional status groups based on BMI/Age (p-value = 0.844). In this study, it was found that there was no significant difference between physical activity duration and nutritional status in children.

1. Introduction

The increase in childhood obesity can be attributed to the lifestyle changes of children in society. Obesity is a persistent medical condition defined by a body mass index (BMI) over 25 kg/m^2. According to data from the World Health Organization (WHO), there were 39 million cases of obesity in children under the age of 5 in 2020 and 240 million cases of obesity in children and adolescents aged 5-19 in 2016. Obesity in children is influenced by various factors, including genetics, behavior, environment, and lifestyle. However, lifestyle is considered the primary contributor to obesity in children and adolescents.[1,2]

Physical activity is a method to both prevent and treat obesity. Physical activity in children can be divided into three types: aerobic exercise, muscle strength training, and bone strengthening activities. Insufficient levels of physical exercise have resulted in the loss of 5.3 million lives. Based on data from the World Health Organization (WHO), fewer than 20% of adults engage in regular physical activity. According to data from the Centers for Disease Control in America, a mere 37% of youngsters engage in 60 minutes of exercise daily, and only 29% of school students participate in sports classes daily. The CDC also found that 41% of school-aged children use electronic

devices to watch videos, while 32% spend more than three hours a day watching television. This is the reason why many governments worldwide promote physical activity among children and teenagers as a means to decrease obesity rates.[3–5]

There are many benefits to being physically active. Regular physical activity in children has been scientifically demonstrated to decrease the likelihood of developing cardiovascular disease, and type 2 diabetes and increase life expectancy in adulthood. In addition, physical activity plays a crucial role in weight management. Scientific evidence demonstrates that while food alone can decrease fat and non-fat levels, engaging in physical activity is necessary to preserve non-fat mass while fat levels stay lower. Physical activity in children not only aids in weight loss but also significantly impacts their motor, cognitive, and performance development.[3,6] This has piqued the curiosity of researchers who wish to investigate the influence of physical exercise on the body mass index of children enrolled in elementary schools in the Ciherang region.

2. Methods

Design of research and sample

This research employs a cross-sectional design and is an analytical observational study. This investigation was conducted in five elementary schools in Ciherang Village between February and March 2024. The study's demographic comprises elementary school pupils in fifth and sixth grades. Elementary school students in grades 5 and 6 from SDN A-E comprised the samples for this investigation. The study's inclusion criteria stipulated that participants must be at least ten years old. Students deemed uncooperative, encountered challenges in two-way communication, lacked comprehension of the Indonesian language, or were shunned by their parents were excluded from this research.

Protocol for research and variables

The research variables comprise two components: nutritional status determined by the calculation of BMI and plotted on the CDC growth chart and physical activity measured by The International Physical Activity Questionnaire (IPAQ). The body mass index (BMI) is computed using weight and height as its components and subsequently compared to the growth norms observed in age-appropriate healthy children and adolescents. The BMI percentile curve for age illustrates an individual's nutritional status in relation to the average population for that particular age group. The CDC curve provides the following interpretation of BMI percentiles: underweight is indicated by a BMI below the 5th percentile; a BMI indicates normal nutritional status between the 5th and 85th percentiles; overweight is denoted by a BMI between the 85th and 95th percentiles; and obesity is defined as a BMI 95th percentile or higher.

Physical activity intensity was assessed using the extended form of the International Physical Activity Questionnaire (IPAQ). The purpose of the IPAQ is to gather data about the physical activity participants participated in within the preceding week. The IPAQ comprises inquiries encompassing a wide range of physical activities, such as those performed for recreation, daily activity, mobilization (e.g., cycling or walking), domestic chores, and park visits. The IPAQ protocol entails the completion of a self-administered questionnaire.

Analytical statistics

This study presents descriptive statistics as proportional data (%) and centralised data distribution. The statistical analysis employed in this investigation was the Kruskall-Wallis test, operating under the assumption that the data distribution was asymmetrical, as confirmed by the Kolmogorov-Smirnov and Shapiro-Wilk tests. The investigation has established a type I error threshold of 5%.

3. Results and Discussion

This study comprised 246 research participants who met the specified inclusion criteria. Table 1 presents the respondents' demographic data, including their age, gender, physical activity level based on the International Physical Activity Questionnaire (IPAQ), and nutritional status based on the body mass index for age percentiles.

Table 1. The demographic characteristics of the individuals that participated in the research.

Variable	N (%)	Mean (SD)	Med (Min-Max)
Gender			
Male	116 (47,2)		
Female	130 (52,8)		
Age, years		11,83 (0,82)	12 (10-14)
School			
SDN A	64 (26,0)		
SDN B	39 (15,9)		
SDN C	65 (26,4)		
SDN D	46 (18,7)		
SDN E	32 (13,0)		
Body mass index for age percentiles			
< 5 Percentile	34 (13,8)		
5th to < 85th percentile	184 (74,8)		
85th to < 95th percentile	17 (6,9)		
≥ 95th percentile	11 (4,5)		
Physical activity, IPAQ Score		62,21 (16,45)	58 (37 – 107)

The association between physical activity and nutritional status, as determined by the body mass index for age percentiles, was evaluated using the Kruskal-Wallis statistical test due to the non-normal distribution of the data, as indicated by the Kolmogorov-Smirnov test. The Kruskall-Wallis statistical test showed that there was no significant variation in mean IPAQ scores among different nutritional status groups based on body mass index per age (BMI/Age) (p-value=0.844) (Table 2; Figure 1).

Table 2. Differences in mean total scores of the International Physical Activity Questionnaire (IPAQ) between nutritional status groups based on body mass index per age (BMI/Age).

Parameter		N	International Physical Activity Questionnaire (IPAQ)		p-value
			Med (Min-Max)	Mean rank	
Nutritional status (Body Mass Index for Age Percentiles)	Underweight (< 5 percentile)	34	57,5 (38 – 97)	114,75	0,844
	Normal weight (5th to < 85th percentile)	184	59 (37 – 107)	124,65	
	Overweight (85th to < 95th percentile)	17	67 (40 – 88)	131,50	
	Obesity (≥ 95th percentile)	11	56 (47 – 77)	119,00	

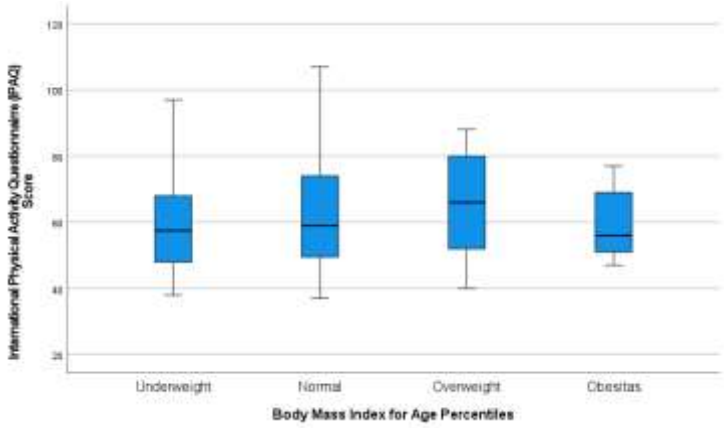

Figure 1. Relationship between physical activity and body mass index for age percentiles.

The rise of social media and computers has led to a decline in physical activity among children and adolescents. The use of social media and computers contributes to a sedentary lifestyle among youngsters, increasing their risk of obesity and other non-communicable diseases. Engaging in children's activities, suitable for both boys and girls, provides an enjoyable opportunity to socialize, forge new friendships, and acquire knowledge. Sports activities in schools can help children develop their skills and foster a sense of enjoyment in competition. However, it is important to acknowledge that these activities can also lead to feelings of frustration, embarrassment, and physical harm for children. Therefore, it is crucial to prioritize enjoyment over structure, as this allows children to enhance their skills and experience joy through achievement.[5,7]

Physical activity has been employed to prevent and treat obesity, a condition linked to an elevated body mass index. These findings are supported by the evidence that physical activity can decrease the body's leptin resistance, boost adiponectin levels, increase insulin sensitivity, enhance endothelial function, and decrease arterial stiffness. In addition, exercise can decrease both total and visceral fat, enhance the fat-free index, boost resting energy expenditure, lower LDL cholesterol and triglyceride levels, increase HDL cholesterol levels, and avoid problems associated with cardiovascular disease. In addition, the combination of appropriate physical activity and a nutritious diet is highly useful in treating and preventing obesity in children.[3,8]

Physical activity in children can be divided into three main types: aerobic exercise, muscle strength training, and bone-strengthening activities. Aerobic exercise should be children's primary form of physical activity, encompassing activities such as walking, jogging, swimming, dancing, cycling, and jumping rope. This activity has been scientifically proven to impact various aspects of the body, including body composition, cholesterol levels, blood pressure, blood sugar, muscle strength, motor abilities, and bone health. In addition to cardiovascular activity, engaging in muscular building exercises such as tree climbing, rope climbing, or climbing in designated parks is crucial. Gymnastics activities are beneficial for children in locations where equipment is not available. Lastly, bone density can be improved by leaping, skipping rope, and participating in tennis, basketball, and gymnastics.[5,9,10]

No notable variations in average IPAQ scores were seen among different nutritional status by BMI/Age in this study. This can be explained that children thought that they already doing their routine physical activity by attending school sports class. It is important to highlight that sports classes have a limited impact on physical activity, as they often involve mainly mild or moderate-intensity exercise.

This is supported by research conducted by Deborah et al. on adolescents enrolled in schools in Brazil. There were no inactive children, but 44% of teenagers were classified as inactive, while just 24% were considered active. This study uses the Baecke questionnaire assessment to evaluate physical activity levels in employment, sports, and leisure activities. The findings indicated that the average value was 6.18 ± 0.86. Additionally, the results demonstrated that these adolescents engaged in lower physical activity levels, as seen by the sample mean value of 7.86.[11]

A study conducted by Carlos et al. examined the effects of physical activity during recess on the body mass index (BMI), energy expenditure, and physical health of 359 schoolchildren. This investigation revealed substantial disparities in physical activity and energy expenditure (p-value<0.01), heart and lung health (p-value<0.001), and physical health (p-value=0.001). However, no significant difference was observed in BMI (p-value = 0.571). The limited impact of physical activity on BMI observed in this study can be attributed to the high proportion of children with poor nutritional status and the reliance on self-reported data rather than objective measurements using accelerometers to assess physical activity.[12]

A study by Juliano et al. examined the relationship between body mass index (BMI) and physical health in 978 children aged 7-11 years. The results indicated that both boys and girls who were overweight or obese had significantly poorer physical health (p-value <0.01), cardiopulmonary fitness (p-value <0.01) and muscle strength/endurance (p-value <0.01). In this study, no statistically significant difference was observed between flexibility and BMI for both boys and girls. The p-value was 0.87 for males and 0.587 for girls.[13]

This study highlights the significance of consistent physical activity and maintaining a healthy diet to prevent children's behavioral, emotional, and psychosocial issues. Both school and home environments require interventions to promote healthy lifestyles among children. This implies that implementing measures to promote physical activity and closely monitoring diet can positively impact the emotional and social well-being of youngsters. Consequently, it is imperative to priorities health education that encompasses both diet and physical activity in the school curriculum and at home to promote children's healthy growth and development. The findings have significant implications for policymakers, educators, and parents when creating and executing initiatives that promote children's physical and emotional well-being. Furthermore, this study indicates the necessity for additional research to investigate efficacious strategies for enhancing physical activity and nutritional status among elementary school students.

This research is limited by the use of questionnaires filled out without further validation from teachers and parents, which may result in errors in data collection. Children may lack enough comprehension to question or provide a response that aligns with the researcher's expectations rather than the true answer. Research conducted exclusively in Ciherang Village may not comprehensively represent elementary school children as a whole. The outcomes may be influenced by specific environmental, social, economic, and cultural elements distinct to the village and hence cannot be extrapolated to the wider community. The cross-sectional study design hinders the capacity to establish causal links between physical activity, nutritional status, and behavioral, emotional, and psychosocial disorders. It is only possible to determine the link between variables simultaneously. Another constraint regarding measurement is that questionnaires to assess physical activity may be less precise than objective approaches such as employing an accelerometer or pedometer. This can result in imprecise assessments of children's levels of physical activity.

4. Conclusion

This study discovered no notable disparity between physical activity and nutritional health in youngsters. Nevertheless, it is important to note that children are not permitted to opt for a sedentary way of life since engaging in physical exercise offers advantages for maintaining a healthy body weight and promoting the kid's overall development. Additional endeavors are necessary from parents and schools to enhance physical activity in children to mitigate the risk of childhood obesity. The researchers aim to conduct additional investigations on physical activity by utilizing both self-reported data and objective measurements obtained through accelerometers. Researchers anticipate that future studies will conduct a more comprehensive evaluation of various illnesses, forms of physical activity, and duration of time to determine their impact on children's body mass index.

5. References

1. Hills AP, Andersen LB, Byrne NM. Physical activity and obesity in children. Br J Sports Med. 2011; 45(11): 866–70.
2. Vaamonde JG, Álvarez-Món MA. Obesity and overweight. Medicine (Spain). 2020; 13: 767–76.
3. Bülbül S. Exercise in the treatment of childhood obesity. Türk Pediatr Arşivi. 2019.
4. Pate RR, Hillman CH, Janz KF, Katzmarzyk PT, Powell KE, Torres A et al. Physical activity and health in children younger than 6 years: a systematic review. Med Sci Sport Exerc. 2019; 51(6): 1282–91.
5. Michel J, Bernier A, Thompson LA. Physical activity in children. JAMA Pediatr. 2022; 176(6): 622.
6. Mairbäurl H. Red blood cells in sports: Effects of exercise and training on oxygen supply by red blood cells. Front Physiol. 2013; 4: 1–13.
7. Aubert S, Brazo-Sayavera J, González SA, Janssen I, Manyanga T, Oyeyemi AL, et al. Global prevalence of physical activity for children and adolescents; inconsistencies, research gaps, and recommendations: a narrative review. Int J Behav Nutr Phys Act. 2021; 18(1): 81.
8. Headid III RJ, Park SY. The impacts of exercise on pediatric obesity. Clin Exp Pediatr. 2021; 64(5): 196–207.
9. Control CFD. Physical activity children. CDC. 2012.
10. CDC. Making physical activity a part of a child's life. CDC. 2016.
11. Luiz Fernani DCG, Tereza Artero Prado M, Massetti T, Dias da Silva T, Ciello de Menezes L Del, de Mello Monteiro CB. Analysis of physical activity level, the body mass index and skill in global motor teens. Clin Med Investig. 2017; 2(5).
12. Ayán-Pérez C, González-Devesa D, Diz-Gómez JC, Varela S. Influence of Body Mass Index, Physical Fitness, and Physical Activity on Energy Expenditure during Recess. Children. 2024; 11(1): 125.
13. Casonatto J, Fernandes RA, Batista MB, Cyrino ES, Coelho-e-Silva MJ, de Arruda M, et al. Association between health-related physical fitness and body mass index status in children. J Child Heal Care. 2016; 20(3): 294–303.