ATLANTIS PRESS
Advances in Health Science Research (AHSR), volume 7
2nd International Conference on Sports Sciences and Health 2018 (ICSSH 2018)

Relationship Between Body Mass Index (BMI) With Agility of Elementary School Students

Imam Hariadi
Dept. of Sport Sciences
Universitas Negeri Malang
Malang, Indonesia
imam.hariadi.fik@um.ac.id

Nurrul Riyad Fadhli
Dept. of Sport Sciences
Universitas Negeri Malang
Malang, Indonesia
nurrul.riyad.fik@um.ac.id

Dona Sandy Yudasmara
Dept of Sport Sciences
Universitas Negeri Malang
Malang, Indonesia
dona.sandy.fik@um.ac.id

Abstract-- The purpose of this study was to determine the relationship between BMI of male and female students with agility level. This study uses a cross-sectional method; the subject of the study is students of elementary school level second to sixth grade. The conclusion of this study is that there is no significant difference in BMI between boys and girls. Agility in boys is better than agility in girls and there is no significant relationship between BMI and the level of agility in elementary school children.

Key word: BMI, agility, children

I. INTRODUCTION

Physical development or also called biological growth (bio-logical growth) is one important aspect of individual development. Physical development includes changes in the body (such as: growth of the brain, nervous system, sensory organs, height and weight growth, etc.), and changes in the ways individuals use their bodies (such as the development of motor skills) and sexual development), as well as changes in physical abilities (such as decreased heart function, vision and so on) [8]. For school-age and adolescent children, optimal physical growth and development is very important. Because the child's physical growth / development will directly or indirectly affect daily behavior. Directly, the child's physical growth will determine the child's skill in moving. While indirectly, physical growth / development will affect the way children perceive themselves and others. This will be seen from the pattern of adjustment of children in general.

Agility is a component of physical conditions that need to be improved in the phase of children. It is the ability to change direction quickly. There are two terminologies that must be mastered in agility, namely speed and ability to change direction. Agility in language comes from the word agile which means always moving, unable to be quiet, not calm, not fixed. Someone who is said to be agile is a person who has the ability to change the direction and position of the body quickly and precisely when moving without losing balance and awareness of his body position [17]. Agility is also interpreted as the ability of a person to change position and direction as quickly as possible according to the situation at hand [18]. It is the ability to accelerate using concentric strength and the ability to reduce speed using eccentric strength [4]. The main factor that influences a person's speed is genetic factors. This type of fast twitch is a type of genetic carrier velocity muscle. Cognitive and speed in making decisions are also very influential on agility [3].

The main factors that influence agility are speed, strength, coordination and balance. These factors can be reduced again to a smaller factor. Factors suspected of influencing agility are body type. There are three types of body types, the first endomorph is that it looks from the outside in the form of fat and large body. The child with an endomorph type of fat is far more than muscle tissue, the second mesomorph that looks sturdy, strong, and more muscular. mesomorph is far less fat than muscle tissue The last ectomorph that looks tall, flat, weak, and like a muscular. Children who have ectomorph have no tissue that exceeds the other tissues so they look thin. Body type will affect speed and strength, because these two components can't be separated from the characteristics of muscle and anthropometry of a person. A person's body type is more commonly known as a body mass index unit. Body mass index (BMI) is defined as weight in kilograms divided by height in squared meters [19]. The number of BMI is influenced by several things, such as nutritional intake, diet, physical activity and many more factors that influence BMI. Determination of BMI also depends on age and sex, boys and girls have different body fat [5]. BMI in children changes according to age and according to the increase in height and weight. The Centers for Disease Control (CDC) publishes BMI curves. BMI can be plotted according to gender on the CDC growth curve for children aged 2-20 years [6].

The age of children is a very rapid growth age compared to other growth periods. The age of the children is divided into two, namely small children and big children. In school age small children are in first-grade to third grade qualifications. Whereas the big children in the fourth grade arrived with the 6th grade of elementary school. Annarino said that the domain that must be developed at the age of children is the affective domain, cognitive domain, motoric domain and physical domain [1]. The four domains are interrelated between one another. All domains must be increased simultaneously. The process of increasing the entire domain must be in accordance with the characteristics of the child. For physical and motorized domains, the baby recommends giving one-time training in one week [2]. The physical domain that needs to be improved in the children's phase is agility, balance, coordination and speed [2].

By knowing the BMI in children and the level of agility, it is expected that physical education teachers and early age

Copyright © 2019, the Authors. Published by Atlantis Press.
This is an open access article under the CC BY-NC license (http://creativecommons.org/licenses/by-nc/4.0/).

trainers can provide training material in accordance with the characteristics of students. In addition, it is also expected to provide alternative scouting to advance sports achievements in the future.

II. METHOD

This study was a correlational study conducted cross sectionally. The subjects in this study were all elementary school students in grades two to six in three elementary schools in Malang. the instrument to measure the level of agility is by shuttle run test. BMI measuring instruments use omron. In testing the hypothesis, the relationship between the Body Mass Index, sex with agility level was analyzed by Pearson correlation test.

III. RESULT AND DISCUSSION

A. *BMI (Body Mass Index)*

Elementary school children are in a transitional period, namely the transition of rapid growth from early childhood to a slower phase of development. The body size of a child has relatively little change during elementary school. In primary school age boys are relatively slower to grow compared to women. The data that the researchers collected showed that the difference in BMI between boys and girls did not have a significant difference. The following is the difference between BMI between boys and girls from second grade to sixth grade of elementary school in Malang.

TABLE I. BODY MASS INDEX OF ELEMENTARY SCHOOL CHILDREN

Gender		Grade 2	Grade 3	Grade 4	Grade 5	Grade 6
Men	Highest	9.50	12.10	12.10	11.20	11.90
	Lowest	21.30	29.40	24.90	27.80	25.10
	Average	15, 48	17.10	16.04	17.10	17.30
Female	Highest	11.40	11.20	12.00	12.80	12.00
	Lowest	24.10	27.90	24.20	28.1	27.00
	Average	15.50	16.30	16.60	17.00	18:00

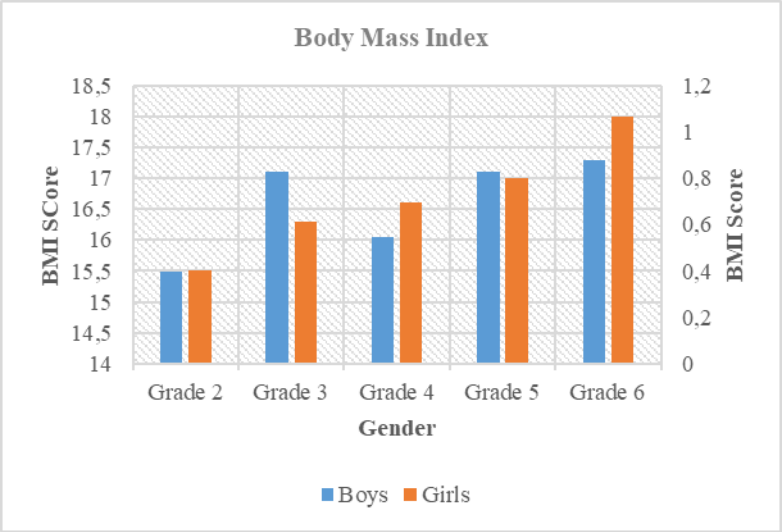

Fig. 1. Range of Body Mass Index (BMI) of Elementary School Students

The data these findings are less consistent with the findings of Tariola that mention girls are fatter and less active than boys [7]. From the results of these studies the difference in BMI between boys and girls does not have a striking difference. A higher level of BMI in girls is assumed because girls are not more active than boys. Girls who do a small number of steps each day, have a higher BMI than those who do a high number of steps each day [8]. the high and low BMI of a child is influenced by the characteristics of the father's BMI and maternal BMI [21]. To reduce the level of BMI, it is suggested to do enough physical activity every day [9]. The absence of a striking difference between boys and girls from research results is influenced by balanced physical activity. This research was conducted in an area that still has very wide open space and environmental activities that are dominated by agricultural activities in the rice fields. Physical activity outside of school between boys and girls is as much. So there is no difference between BMI between boys and girls.

B. *Agility*

Agility is the ability to change direction quickly. Agility is affected by skeletal muscle strength, coordination and flexibility. In the age of children, agility is a physical component that must be developed. The exercise design for improving the availability of children should be designed with various methods that are not boring, so that the participation of children to follow the material is higher. The following is the difference in agility between boys and girls from grade two to grade six in elementary school in Malang.

TABLE II. AGILITY ABILITY OF ELEMENTARY SCHOOL CHILDREN

Gender		Grade 2	Grade 3	Grade 4	Grade 5	Grade 6
Male	Highest	20.45	15.34	21.12	17.08	20.10
	Lowest	35.83	30.61	30.81	28.88	28.44
	Average	25 , 29	24.56	23.91	22.05	22.88
Female	Highest	21.92	23.01	21.13	17.85	20.00
	Lowest	37.54	34.32	29.28	30.33	28.00
	Average	28.01	26.55	24.62	23.62	24.00

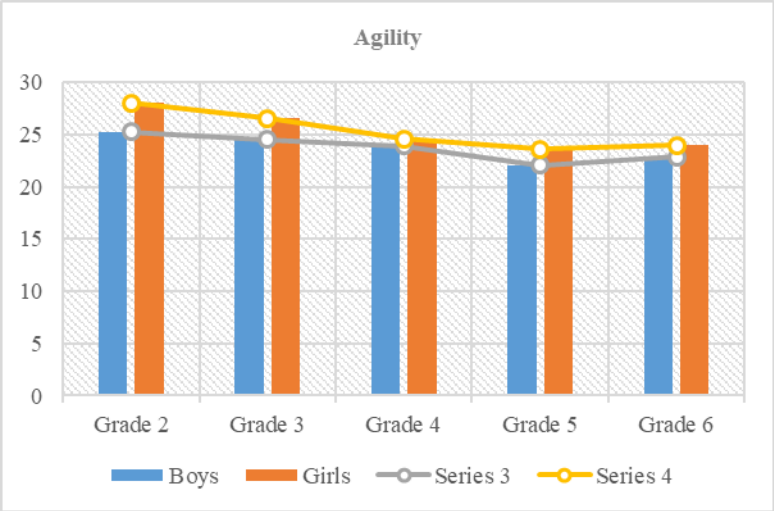

Fig. 2. Agility Ability of Elementary School Students

The level of agility between boys and girls from grade two to grade six shows that boys have a higher level of agility than girls. The level of agility in boys and girls experiences an increasing tendency from second to sixth grade. Agility increases because the factors that influence agility include strength of skeletal muscle. Skeletal muscle strength has increased in line with the increase in the age of the child. in the same age group, agility does not differ between genders but increases with age for both boys and girls [11].

C. Relationship Between BMI And Agility

Children with a larger standard BMI are less physically active, more sedentary, and have poorer motor skills compared to children with a lower standard BMI [12]. BMI is strongly influenced by physical activity of children. Genetics also contributes to child BMI, although this is less significant [13]. The following is the level of correlation between BMI and agility in boys and girls from second grade to sixth grade elementary school in Malang.

TABLE III. RELATIONSHIP BETWEEN BMI AND AGILITY

Gender	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6
Male	0.064	0.047	0.118	0.431	0.113
	Poor	Poor	Unacceptable	Acceptable	Unacceptable
Female	0.159 0.339	0.244	-0.045	0.020	0.132
	Poor	Unacceptable	Poor	Acceptable	Unacceptable

Of exposure the data can be concluded that the BMI does not have a close relationship with the level of agility in elementary school age children. In second grade and third grade children the relationship between BMI and agility is very insignificant, it happens both for men and women. In the fourth and sixth grades BMI and agility have a weak relationship, it occurs in boys and girls. In the fifth grade BMI and agility have moderate relationships. There is no relationship between fat content and fitness in children [10]. But the relationship between BMI and coordination motors has a harmonious relationship at the age of children [14]. Besides that the development of coordination motors can increase long-term health levels in children [15]. Agility also requires a good coordination motorbike. Efforts to increase the level of agility in children will also give a positive influence in the future, which of course with rules that must be adjusted to the conditions of children. Physical activity also has a high influence on children's fitness [16]. Child physical activity is one of the tasks of Physical Education (PE). PE plays a very important role in the physical fitness of children at the next level. One of the goals of PE is to improve physical fitness [1]. BMI is one indicator of children's physical fitness level. Elementary students are usually in the age range of around 6-12 years, the age range is commonly referred to as childhood and middle childhood, which is a phase between childhood and adolescence. Physically, children at elementary school age have their own characteristics that are different from the

physical conditions before and after. At this time, children's activities, including learning and mental activities are much influenced by their physical condition. Child's physical growth can have a significant influence on the overall development of the child's personality. So that as educators need to be understood the characteristics of students' physical development so that it has an impact on the implications for the implementation of education and learning. Nutritional intake also affects children's growth. At school age it must be divided into gender, considering their different needs. Boys do more physical activity so they need more calories than girls. At this age, girls usually experience menstruation so they need more protein, iron than before. Physical activity in children must also be considered, no more and no less. recommendations for physical activity for the age of children is 150 minutes with a duration of 30 minutes each training session [2].

CONCLUSIONS

The conclusion that can be formulated from the results of this study is that there is no significant difference between BMI boys and BMI girls. Agility between boys is better than the agility of girls. There is no significant relationship between BMI and agility in boys. There is no significant relationship between BMI and agility in girls.

ACKNOWLEDGMENT

We thank to the elementary schools who are willing to be tested for agility and measured by the BMI. Thanks also go to Sports Science Faculty of State Malang University who have provided support in conducting the research.

REFERENCES

[1] Annarino, AA, Cowell, CC, & Hazelton, HW (1980).*Curriculum theory and design in physical education*. Mosby.

[2] Balyi, I., Way, R., & Higgs, C. (2013).*Long-term athlete development*. Human Kinetics.

[3] Lloyd, RS, & Oliver, JL (2012). The youth physical development model: A new approach to long-term athletic development.*Strength & Conditioning Journal*,*34*(3), 61-72.

[4] Bompa, T., & Buzzichelli, C. (2015).*Periodization Training for Sports, 3E*. Human kinetics.

[5] Sjarif D. Obesity in children and the problem. In: Prihono P, Purnamawati S, Sjarif D, Hegar B, Gunardi H, Oswari H, et al, editors. Hot topics in II pediatrics Jakarta: Faculty of Medicine, University of Indonesia Dr. Ciptomangunkusumo Hospital; 2002.p. 219-34.

[6] Roberts SB, Vinken AG. Energy and substrate regulation in obesity. In: Walker W, Watkins J, editors. Nutrition in pediatrics basic science and clinical application. London: BCDecker Inc.Publisher; 1997.p. 181-95.

[7] Toriola, OM, & Monyeki, MA (2012). Health-related fitness, body composition and physical activity among adolescent status learners: the PAHL study: health and fitness.*African Journal for Physical Health Education, Recreation and Dance*,*18*(Issue-4_1), 795-811.

[8] Kantanista, A., Król-Zielińska, M., Borowiec, J., Glapa, A., Lisowski, P., & Bronikowski, M. (2015). Physical activity of female children and adolescents based on step counts: the recommendation and relation to BMI meetings.*Biomedical Human Kinetics*,*7*(1).

[9] Dagci, G., & Saygin, Ö. (2015). Investigation of physical activity levels and body compositions of adolescent boys and girls.*Studies on Ethno-Medicine*,*9*(3), 385-390.

[10] Johnson, Maria S., et al. "Aerobic fitness, not energy expenditure, influences subsequent increase in adiposity in black and white children."*Pediatrics*106.4 (2000): e50-e50.

[11] Cetin, E. (2013). Is There A Gender Difference For Agility In Children Age 7-12 Years?*International Journal of Academic Research*,*5*(4).

[12] Wrotniak, BH, Epstein, LH, Dorn, JM, Jones, KE, & Condilis, VA (2006). The relationship between motor proficiency and physical activity in children.*Pediatrics*,*118*(6), e1758-e1765.

[13] Danielzik, S., Langnäse, K., Mast, M., Spethmann, C., & Müller, MJ (2002). Impact of parental BMI on the manifestation of overweight 5-7 years old children.*European journal of nutrition*,*41*(3), 132-138.

[14] Lopes, VP, Stodden, DF, Bianchi, MM, Maia, JA, & Rodrigues, LP (2012). Correlation between BMI and motor coordination in children.*Journal of Science and Medicine in Sport*,*15*(1), 38-43.

[15] Cattuzzo, MT, dos Santos Henrique, R., Ré, AHN, de Oliveira, IS, Melo, BM, de Sousa Moura, M., ... & Stodden, D. (2016). Motor competence and health related to physical fitness in youth: A systematic review.*Journal of Science and Medicine in Sport*,*19*(2), 123-129.

[16] Dencker, M., Bugge, A., Hermansen, B., & Andersen, LB (2010). Objectively measured daily physical activity related to aerobic fitness in young children.*Journal of Sports Sciences*,*28*(2), 139-145.

[17] Harsono, M., & Sugiantoro, G. (1988). Exercise Physical Conditions.

[18] Suharno, HP (1993). Exercise Program Plan.Sports Directorate of the Directorate General of Cycle. Jakarta.

[19] Bandini, L., Flynn, A., & Scampini, R. (2011). Over nutrition. nutrition and metabolism.

[20] Seifert, K., Hoffnung, R. J., & Hoffnung, M. (2000). *Lifespan development*. Houghton Mifflin.

[21] Wanda, D., & Hartoyo, M. (2013). Hubungan Indeks Massa Tubuh Ayah Dan Ibu Dengan Kejadian Obesitas Pada Anak Usia Sekolah Di Sd Islam Al-Azhar 14 Kota Semarang. *Jurnal Keperawatan Anak*, *1*(1).