



The Role of Body Mass Index on the Young Athletes' Performance: Evidence from the IAAF Kids Athletic Ability Competition in Indonesia

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Abstract. Body mass index (BMI) is an important variable in child growth. However, there is a lack of evidence that has scientifically examined the effect of child growth to children's motoric development. This study aims to determine the correlation between children's growth by using BMI indicators with motoric development by using the kanga escape instrument and formula one from Kid's Athletics developed by the International Association of Athletic Federations (IAAF). The research sample in this study consisted of 23 young athletes aged 7-12 years old, with 13 male athletes and 10 female athletes. The research method used is correlational, using Pearson product-moment and Spearman correlation. The results of the correlation test showed that there were significant correlations between BMI and Kanga escape and formula one. The significance value of the correlation test results is 0.00 (sign <0.05). Based on the results of these studies, it can be concluded that there is a positive correlation between BMI with kanga escape and formula one. The results of this study provide a new perspective regarding the positive relationship between growth on the development of children's motor skills.

Keywords: growth, maturity, motor development, fundamental movement.

1 Introduction

The child's motoric development has an interesting phase and level to be observed (1). The motoric development movement skills of a child can be observed from the family environment since a toddler (2). As they get older, the role of parents in paying attention to a child's development will decrease (3). Furthermore, the role of the external or the surrounding environment will be more significant in motoric development (4). The school environment and social environment have a big role in improving and developing a child's motoric skills (5).

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The motoric developments that occur in the school environment are carried out by teacher, especially in physical education classes (6). Meanwhile, from the social environment, it can be obtained through children's playgrounds or training grounds (7). The training ground becomes an appropriate environment for a child's motoric development (8). When practicing, a child will be molded into an athlete, which will be trained from basic movements until he becomes a proficient or professional athlete (9). In the motor development of an athlete, followed by physical development as well (10). This physical development includes many things, generally weight and height (11).

Weight and height are two important components in measuring body mass index (BMI) (12). BMI is an indicator for measuring body mass to determine the level of composition of the human body (13). Levels of body composition consist of undernourishment, good nutrition, excess nutrition, and obesity (14). The level of this composition is determined based on quantitative data based on predetermined criteria (15). BMI is measured using a formula, namely by dividing body weight by height which has been converted to meters and squared. So, the BMI unit will appear, namely Kg/m^2 (16). By using BMI, the movement ability or performance of an athlete can be estimated (17).

An athlete's performance can be measured through a test. International Association of Athletic Federations (IAAF) has developed a new concept of athletics that focuses on the motor development needs of children (18). Kids' Athletics is a program from the IAAF designed based on situation analysis in athletics, children's training, and children's biological characteristics (19). Kid's athletics requires a number of children to carry out motion activities in each "motion post" (20). The goal of athletic kids is to introduce athletics to athletes that are fun (21). This program is not only intended for sports clubs, but also for schools and all institutions interested in children's motor development (22). In Indonesia, Kid's Athletics is contested in various championships, one of which is the National Student Sports Olympiad (O2SN) (23).

This study aims to determine the relationship between the athlete's body mass index and the movement components of Kid's Athletics. The intended motion component consists of a running component, namely Kanga Escape and a jumping component, namely Formula One. Based on the body mass index data, it is hoped that there will be a correlation with the motion components of Kid's Athletics.

2 Method

The Method section describes in detail how the study was conducted, including conceptual and operational definitions of the variables used in the study, Different types of studies will rely on different methodologies; however, a complete description of the methods used enables the reader to evaluate the appropriateness of your methods and the reliability and the validity of your results, It also permits experienced investigators to replicate the study, If your manuscript is an update of an ongoing or earlier study and the method has been published in detail elsewhere, you may refer the reader to that source and simply give a brief synopsis of the method in this section.

2.1 Study Sample

This study uses correlation as a type of research. This study was followed by 23 young athletes aged 7-12 years with 13 male athletes and 10 female athletes (Table 1). These samples were selected by using purposive sampling technique, which is a sampling technique by giving specific criteria to the sample.

Table 1. Research Sample

No	Sample	N	Age			
			Min	Max	Mean	SD
1	Male Athlete	13	7	12	9.46	1.33
2	Female Athlete	10	7	11	8.9	1.66

2.2 Study Organize

The children's growth was measured by using the BMI instrument. BMI measurement begins with measuring the athlete's height and weight. Height measurement is carried out using a portable stadiometer with units of centimeters and the level of accuracy is 0.1 cm. Measurement of body weight in kilograms was carried out using a calibrated digital scale with an accuracy of 0.1 kg. The data that has been collected is analyzed using the SPSS 26 statistical application.

2.3 Kanga Escape

The test instruments used are the motion components in Kid's Athletics, Kanga Escape and Formula One. The Kanga Escape and Formula One tests are adjusted according to the World Athletics competition regulations. Kanga escape, begins with the students standing at the starting line, after the signal to start the participants run 40 meters by circling the flagpole again. Then, jump over 4 hurdles with a distance of 6 meters between the hurdles (Figure 1). This test is measured using a time record via a stopwatch.

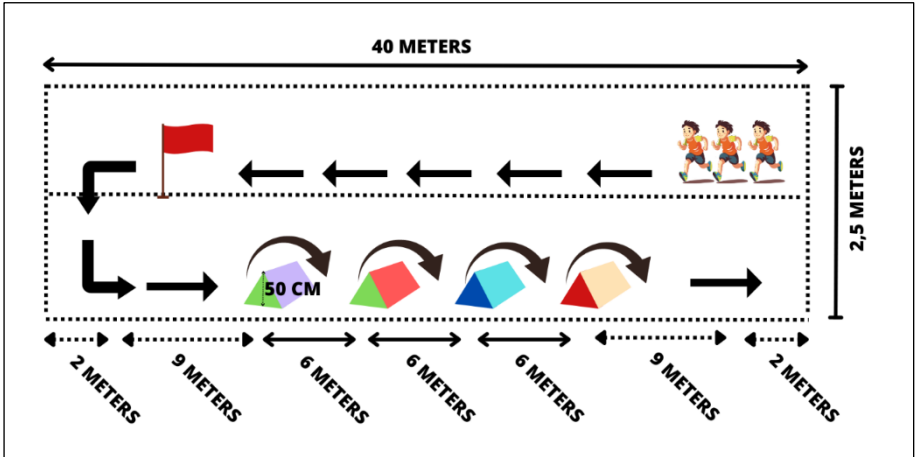


Figure 1. Kanga Escape

3.4 Formula One

Formula one, starting with a front roll on the mat, then around an area with an estimated distance of 80 meters and a track width of 1 meter. It consists of sprints, jumping hurdles, and slaloms or zig-zag runs (Figure 2). Time records are taken from start to finish, then these time records will be used as a reference in the assessment.

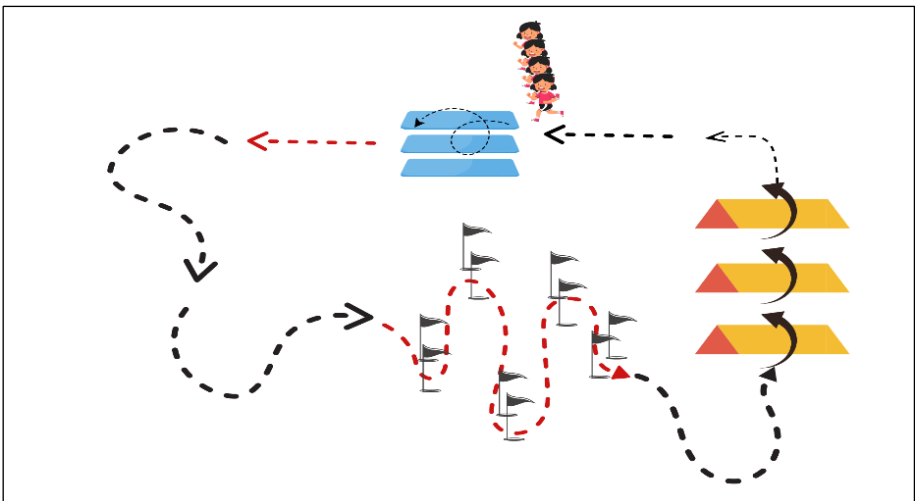


Figure 2. Formula One

3 Results

3.1 Normality Test

The normality test was carried out using the Kolmogorov Smirnov test in the SPSS 26 statistical application. The normality test on the BMI variable and the Formula One test showed that the data was normally distributed with a p-Value of more than 0.05 (sign > 0.05). However, in the Kanga Escape test variable, the p-value is less than 0.05 (sign > 0.05) or the distribution of the data is not normal (Table 2).

Table 2. Normality Test Results

No	Test Items	N	SD	Means	P-Value
1	Kanga Escape	23	1.60	17.57	0.015
2	Formula One	23	3.00	24.74	0.073*
3	BMI	23	2.65	19.71	0.15*

*sign > 0.05

3.2 Correlation Test

Correlation test is done by product moment correlation test or pearson correlation test. In addition, a Spearman correlation test was also carried out for the kanga escape variable. The Spearman correlation test was carried out because the p-Value of the kanga escape variable is not normally distributed. The results of the Pearson correlation test and the Spearman correlation showed that there was a significant correlation between BMI and the Kid's Athletics test component. The test results show that the p-value of Kanga Escape and Formula One is 0.00 (sign <0.05) (Table 3).

Table 3. Correlation Test Results

No	Test Items	p-Value
1	BMI-Kanga Escape	0.00*
2	BMI-Formula One	0.00*

*sign < 0.05

4 Discussion

Kanga Escape and formula one show the same correlation results, with a significance value of 0.00 which means there is a correlation between BMI and the two Kid's Athletic components. According to (24), BMI has a significant effect on physical activity, child's BMI status depends on parenting style. Based on the raw data collected by the researchers, there is an interesting phenomenon that occurs when ranking or evaluating the results of the kanga escape component test. The results of the assessment

of the female group showed that athletes who had more nutritional BMI status were able to dominate or get the best score in both components of the test.

This BMI status is measured based on the Regulation of the Minister of Health of the Republic of Indonesia Number 2 of 2020 concerning Child Anthropometric Standards (25). This phenomenon can be used as a new perspective that BMI status cannot be used as a reference for the motor quality of an athlete. In BMI, there is a component of body weight as one of the measurement variables. More body weight, can occur due to fat accumulation (26) and also due to good muscle composition (27). Therefore, a person's motor skills are not only measured in terms of BMI, but in terms of movement experience, muscle composition, and joint flexibility also need to be taken into consideration (28).

5 Conclusion

Body mass index (BMI) is an important thing that needs to be considered in the development of a child, especially an athlete. An athlete, it is recommended to maintain body composition or BMI status in the category of good or normal nutrition. This is because BMI has an influence on an athlete's motor skills, because by accumulating fat it will hinder joint motion and muscle work will not be optimal. However, it should be noted that in measuring an athlete's motor skills, BMI is not the only variable that can assess an athlete's motor skills. Other variables related to leg length, jump distance, jump height, arm span, and other anthropometric variables also need attention.

References

1. Farida A. Urgensi Perkembangan Motorik Kasar Pada Perkembangan Anak Usia Dini. *Jurnal Raudhah*. 2016;4(2):2338–2163.
2. Saripudin A. Analisis Tumbuh Kembang Anak Ditinjau Dari Aspek Perkembangan Motorik Kasar Anak Usia Dini. *Equalita: Jurnal Pusat Studi Gender dan Anak [Internet]*. 2019;1(1):114–30. Available from: <http://syekhnrjati.ac.id/jurnal/index.php/equalita/article/view/5161>
3. Meriem C, Khaoula M, Ghizlane C, Asmaa MA, Ahmed AOT. Early Childhood Development (0 - 6 Years Old) from Healthy to Pathologic: A Review of the Literature. *Open J Med Psychol*. 2020;09(03):100–22.
4. Belagavi D. Theories of growth and development in pediatrics : A review. *IP Journal of Paediatrics and Nursing Science*. 2019;2(3):63–6.
5. Candra O, Pranoto NW, Ropitasari R, Cahyono D, Sukmawati E, CS A. Peran Pendidikan Jasmani dalam Pengembangan Motorik Kasar pada Anak Usia Dini. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*. 2023;7(2):2538–46.
6. Kok M, Kal E, van Doodewaard C, Savelsbergh G, van der Kamp J. Tailoring explicit and implicit instruction methods to the verbal working memory capacity of students with special needs can benefit motor learning outcomes in physical education. *Learn Individ Differ*. 2021 Jul 1;89:102019.
7. Hasanah U. Pengembangan Kemampuan Fisik Motorik Melalui Permainan Tradisional Bagi Anak Usia Dini. *Jurnal Pendidikan Anak*. 2016;5(1):717–33.

8. Lloyd RS, Oliver JL, Faigenbaum AD, Howard R, De Ste Croix MBA, Williams CA, et al. Long-term athletic development- Part 1: A pathway for all youth. *J Strength Cond Res* [Internet]. 2015 May 7 [cited 2023 Jul 16];29(5):1439–50. Available from: https://journals.lww.com/nsca-jscr/Fulltext/2015/05000/Long_Term_Athletic_Development_Part_1_A_Pathway.36.aspx
9. Wang S. Methods of Physical Training in Physical Training. *Curriculum and Teaching Methodology*. 2023;6(5):111–6.
10. Airaksinen M, Taylor E, Gallen A, Ilén E, Saari A, Sankilampi U, et al. Charting infants' motor development at home using a wearable system: validation and comparison to physical growth charts. *EBioMedicine*. 2023 Jun 1;92:104591.
11. Ghaemmaghami P, Ayatollahi SMT, Alinejad V, Sharafi Z. Growth curves and their associated weight and height factors in children from birth to 4 years old in West Azerbaijan Province, northwest Iran. *Archives de Pédiatrie*. 2018 Aug 1;25(6):389–93.
12. Gandham A, Mesinovic J, Cervo MM, Glavas C, Jansons P, Ng CA, et al. Associations of body mass index, body fat percentage and sarcopenia components with bone health estimated by second-generation high-resolution peripheral quantitative computed tomography in older adults with obesity. *Exp Gerontol*. 2023 Aug 1;179:112227.
13. Berardi G, Kingham TP, Zhang W, Syn NL, Koh YX, Jaber B, et al. Impact of body mass index on perioperative outcomes of laparoscopic major hepatectomies. *Surgery*. 2023 Aug 1;174(2):259–67.
14. Rusdiana A, Wiriawan O, Ronald H, Hadi, Guntur, Komarudin, et al. Pedoman Pelaksanaan Tes Kebugaran Pelajar Nusantara. 1st ed. Jakarta: Kementerian Pemuda dan Olahraga Republik Indonesia; 2022. 1–34 p.
15. Freise J, Tavakol M, Gao Y, Klein O, Lee BK, Freise C, et al. The Effect of Enlarged Kidneys on Calculated Body Mass Index Categorization in Transplant Recipients With ADPKD. *Kidney Int Rep*. 2019 Apr 1;4(4):606–9.
16. Singh H, Esht V, Shaphe MA, Rathore N, Chahal A, Kashoo FZ. Relationship between body mass index and cardiorespiratory fitness to interpret health risks among sedentary university students from Northern India: A correlation study. *Clin Epidemiol Glob Health*. 2023 Mar 1;20:101254.
17. Bakhtiar S, Khairuddin, Afrian H. Pengaruh Strategi Pembelajaran Rangkaian Permainan, Indeks Massa Tubuh Terhadap Keterampilan Gerak Dasar Anak Usia Dini. *Jurnal Sporta Saintika*. 2019;4(2):778–83.
18. Çalık SU, Aydos L, Pekel HA. A study of effects of kids' athletics exercises on academic achievement and self-esteem. Vol. 6, *Universal Journal of Educational Research*. 2018.
19. Bradeško B. Otroška atletika (IAAF Kids' Athletics). / IAAF Kids' Athletics. *Sport: Revija Za Teoreticna in Prakticna Vprasanja Sporta*. 2015;63(1/2).
20. Putra RN, Bafirman B. Efek model kids' athletics memberikan nilai tambah dalam meningkatkan konsep diri siswa. *Jurnal SPORTIF : Jurnal Penelitian Pembelajaran*. 2020;6(1).
21. Septiria R, Subandowo M, Rohman U. Influence of With Pair Jump Rope Training and Ladder Drill Model on Kids Athletic Improvement. *Jp.jok (Jurnal Pendidikan Jasmani, Olahraga dan Kesehatan)*. 2020;4(1).
22. Petros B, Ploutarhos S, Vasilios B, Vasiliki M, Konstantinos T, Stamatia P, et al. The effect of IAAF Kids Athletics on the physical fitness and motivation of elementary

- school students in track and field. *Journal of Physical Education and Sport*. 2016;16(3):883–96.
23. Umaryono, Apendi P, Hartono FV, Sabarudin E, Handoko P, Purnomo YS. *Pedoman Olimpiade Olahraga Siswa Nasional: Jenjang SD/MI*. 1st ed. Meilani D, Asrul, Sunarko D, Khasanah UU, editors. Jakarta: Kementerian Pendidikan Kebudayaan Riset dan Teknologi; 2023. 1–150 p.
 24. Joshi BP, Mahajan SM, Tayade DN. Physical activity and its correlation with various measures of obesity among medical students and young faculty. *Clin Epidemiol Glob Health*. 2023 Sep 1;23:101363.
 25. Kesehatan K. Database Peraturan. 2020 [cited 2023 Aug 1]. Peraturan Menteri Kesehatan Nomor 2 Tahun 2020 tentang Standar Antropometri Anak. Available from: <https://peraturan.bpk.go.id/Home/Details/152505/permenkes-no-2-tahun-2020>
 26. Sidhu G, Samson R, Nedunchezian SH, Srivastav S, Dixit N, Le Jemtel TH. COVID 19 in-hospital mortality, body mass index and obesity related conditions. *J Diabetes Complications*. 2021 Dec 1;35(12):108054.
 27. Dewi GAANU, Santika IGPNA. Korelasi Berat Badan Dan Kekuatan Otot Tungkai Terhadap Kelincahan Tubuh Siswa Pencak Silat. *Jurnal Kejaora (Kesehatan Jasmani dan Olah Raga)*. 2020;5(1):14–9.
 28. Masanovic B, Gardasevic J, Bjelica D. Comparative study of anthropometric measurement and body composition between elite handball and volleyball players from the serbian national league. *International Journal of Morphology*. 2021;39(1):287–93.

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