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Anthropometric factors and nutritional intake associated with speed performance in athletic athletes at SKO Ragunan Jakarta

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ABSTRAK

Latar Belakang: *Atletik merupakan olahraga tertua yang sering kali disebut induk segala cabang olahraga karena unsur mendasar dari atletik adalah jalan, lari, lompat, lempar, dan bermain. Salah satu komponen penting dalam olahraga atletik adalah kecepatan. Dalam meningkatkan kecepatan, banyak faktor yang berpengaruh, seperti asupan, program latihan, dan lainnya.*
Tujuan: *Untuk menganalisis hubungan berat badan, tinggi badan, asupan zat gizi makro dan kalium, serta status hidrasi dengan kecepatan atlet atletik SKO Ragunan.*
Metode: *Studi cross-sectional. Sampel pada penelitian ini merupakan 41 atlet atletik remaja berusia 12-18 tahun di SKO Ragunan. Metode pengambilan sampel menggunakan total sampling dengan mengambil seluruh atlet atletik yang terdaftar di SKO Ragunan. Analisis data menggunakan uji pearson correlation.*
Hasil: *Hasil analisis univariat menunjukkan bahwa rata-rata berat dan tinggi badan atlet atletik sebesar 56,20 kg dan 165,99 cm. Selain itu, asupan energi, protein, dan lemak masuk ke dalam kategori baik; status hidrasi atlet juga masuk ke dalam kategori baik. Hasil tes kecepatan sebanyak 51,20% masuk ke dalam kategori baik. Rata-rata kecepatan atlet atletik SKO Ragunan adalah 6,15 m/detik. Hasil dari analisis bivariat ditemukan adanya hubungan yang signifikan antara berat badan ($p = 0.009$; $r = -0.367$), tinggi badan ($p = 0.002$; $r = -0.439$), dan asupan karbohidrat ($p = 0.031$; $r = 0.294$) dengan kecepatan atlet atletik di SKO Ragunan Jakarta.*
Kesimpulan: *Sebagian besar responden memiliki kecepatan baik sesuai dengan kebutuhan dan kemampuan utama seorang atlet atletik. Demi meningkatkan kecepatan dan performa atlet, diperlukan dukungan dari berbagai pihak dan faktor, seperti asupan dan waktu pemberian asupan, yang juga perlu menjadi perhatian.*

KATA KUNCI*: berat badan, kalium, status hidrasi, tinggi badan, zat gizi makro*

ABSTRACT

Background: *Athletics is the oldest sport, often called the mother of all sports, because its basic elements include walking, running, jumping, throwing, and playing. One key component in athletics is speed, which can be influenced by various factors such as nutrition, training programs, and others.*

Objectives*: To analyze the relationship between body weight, height, intake of macronutrients and potassium, and hydration status with the running speed of SKO Ragunan athletics athletes.*

Methods: *This research used a cross-sectional design with 41 adolescent athletes aged 12-18 years from SKO Ragunan. Total sampling was applied, involving all registered athletes, and data were analyzed using pearson correlation test.*

Results: *Univariate analysis showed that the athletes' average body weight and height were 56.2 kg and 165.99 cm. Energy, protein, fat intake, and hydration status were in the good category. The speed test showed 51.2% of athletes in the good category with an average speed of 6.15 m/s. Bivariate analysis revealed significant correlations between body weight ($p = 0.009$; $r = -0.367$), body height ($p = 0.002$; $r = -0.439$), and carbohydrate intake ($p = 0.031$; $r = 0.294$) with the speed of athletics athletes at SKO Ragunan Jakarta.*

Conclusions: *Most respondents in this study have good speed in line with the demands and abilities of athletic athletes. To improve speed and performance, support from various parties and attention to factors such as intake and its timing are needed.*

KEYWORDS*:* *body weight, height, hydration status, macronutrient, potassium, speed*

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INTRODUCTION

An athlete is a sports performer who receives special training regularly and strives to achieve accomplishments at regional, national, or even international levels (1). To achieve these accomplishments, athletes require more energy than ordinary people. This is aimed at producing energy, supporting growth, enhancing performance, and facilitating the recovery process after training or competition. Adolescent athletes fall into an age category that is effective and important in sports development. At this age, athletes need to receive training related to strength, speed, agility, and endurance (2). Sports development prepares and trains athletes according to their needs to get them ready for competition. One example of sports development is the Special School for Athletes (SKO). SKO Ragunan is one of the athlete schools in Indonesia. It was established as a platform to develop prospective athletes so they can achieve accomplishments at both national and international levels (3). SKO Ragunan offers various sports disciplines, such as games, measurable sports, extreme sports, and many others. Athletics, as a measurable sport, is considered the oldest and often called the mother of all sports due to its basic movements—walking, running, jumping, throwing, and playing (4). This diversity gives athletes more chances to win medals in various events (5). According to PBPASI (2023), the performance of Indonesian athletics athletes is fairly good, but youth athletes' performance over the past five years has been less than optimal. At the 2023 SEA Youth Athletics Championships, they won 7 gold, 4 silver, and 6 bronze medals, but results declined at the 2025 Singapore Open with only 6 gold, 2 silver, and 3 bronze. Athletic performance must be supported by talent and developed through training and biomotor abilities such as flexibility, strength (developed into strength-speed), coordination, and endurance (developed into endurance-speed).

Speed is one of the components of physical condition required in various sports disciplines and events, including athletics. Speed is defined as a person's ability to cover a certain distance in the shortest possible time (6). It is a crucial component in athletics, particularly in short-distance running or sprinting (5). Speed is influenced by various factors, such as age, gender, nutritional status, macronutrient intake, body type, health status, training intensity, and fatigue. These factors are interconnected in improving speed (7). In the

process of improving speed, athletes require proper nutritional intake. According to Saputra et al. (2017), athletics athletes in the All Indonesia Athletics Federation (PASI) Riau have not yet reached optimal performance, particularly in the men's 800-meter middle-distance run. The cause of this problem is that athletes are no longer able to increase their speed in the last 150 meters, resulting in a significant time gap between runners. In addition, according to Alfionita Saketa et al. (2022), the speed of athletics athletes often decreases in the first 200–400 meters. This issue may occur due to fatigue in the leg muscles and suboptimal breathing regulation.

Adequate macronutrient intake is essential for athletes, who need carbohydrate, protein, and fat to support daily activities and training. Food must also replace nutrients lost during physical activity. Nutritional management aims to balance energy intake and expenditure to maintain metabolic stability, support body functions, and ensure energy availability during rest, training, and competition. Previous research conducted by Putri 2023 (10) states that insufficient nutritional intake during exercise can cause calorie imbalance and affect nutritional status.

Besides macronutrients, micronutrients are also vital. Minerals play key roles in metabolism and physiology, including muscle contraction, nerve transmission, oxygen transport, enzyme activation, bone health, and acid-base balance. Important minerals for athletes include iron, calcium, sodium, and potassium. Potassium, a major electrolyte lost through sweat (11), is crucial for fluid balance, nerve and muscle function, energy metabolism, glycogen, and protein (6). According to Frank (2014) in (12), intense training and excessive sweating reduce potassium levels, and low intake may impair oxygen use and increase lactic acid buildup.

Nutritional status is a condition that results from the balance between nutrient intake from food and the nutritional needs required for the body's metabolic processes. Athletes with good nutritional status will naturally contribute positively to their performance. Nutritional status is related to an individual's strength, speed, endurance, agility, and appearance. It can be measured using the Body Mass Index (BMI), which is an indicator of body composition based on weight and height. In BMI calculations, body weight is an important factor, as the greater the athlete's body weight, the lower their performance tends to be (13). This is linked to the components of an athlete's body condition that play a role in optimizing performance both during training and competition.

One of the components of physical condition that can be measured in an athlete is hydration status. Hydration status is the condition that reflects the amount of fluid in a person's body. Each individual has different water intake needs depending on their activity level (14). Fluid balance in an athlete's body is certainly one of the factors that supports their performance. Proper hydration management allows for optimal regulation of the nervous system. Inadequate fluid consumption in athletes can lead to dehydration, which has negative effects on health and increases the physical workload. Athletes need to maintain proper hydration levels through regular fluid intake to ensure that their bodily functions run optimally (15).

Based on the speed test data obtained using the 30-meter sprint test method, there are athletes whose speed is still categorized as low. This has prompted the researcher to explore the factors that influence the speed of athletics athletes at SKO Ragunan. Thus, the objective of this study is to determine the association between anthropometric, macronutrient, potassium intake, and hydration status with speed performance among adolescent athletes.

MATERIALS AND METHODS

This research was conducted from December 2024 to June 2025. The research location will be at the SKO Ragunan field, Jl. Harsono RM, Gor Ragunan Complex, Pasar Minggu, RT 9/RW 7, South Jakarta. Based on preliminary studies conducted by the author before the main research, it was found that the speed of athletes at SKO Ragunan was not yet optimal. This was a strong reason for choosing the location, as it allowed us to identify factors that might affect the suboptimal speed of athletes. This study is an analytical observational research with a cross-sectional design. In this study, both dependent and independent variables were measured once to examine the relationship between macronutrient and potassium intake, body weight, height, and

hydration status with the athletes' speed. The dependent variable was athletic speed, while the independent variables included macronutrient and potassium intake, body weight, height, and hydration status. The Kolmogorov–Smirnov test was used to assess data normality, while associations between categorical variables were analyzed using the chi-square test. The population in this study consisted of all athletic athletes from grades 7-9 and 10-12 at SKO Ragunan Jakarta. The sample included athletic athletes who were active students in the 2024/2025 academic year and were present at the school during the research period.

The sample size in this study was determined using the Slovin formula, which is used to calculate the number of samples that can represent the characteristics of a population. The final result of this calculation was 41 respondents. This study involving human participants was conducted in accordance with ethical principles for research involving human subjects. Ethical approval was obtained from the Health Research Ethics Committee of Universitas Prima Indonesia with ethical clearance number 059/KEPK/UNPRI/IV/2025. The study involved adolescent athletic athletes from SKO Ragunan, and written informed consent was obtained from all participants and/or their guardians before data collection.

RESULTS AND DISCUSSIONS

Respondent Characteristics

The frequency distribution of respondent characteristics in this study is presented in **Table 1**. Respondent characteristics include age, gender, education level, and athlete sports category at SKO Ragunan.

Table 1. Categories and examples of beverages sold in school canteens

Characteristics	N	%
Age		
10-15 years	17	41.50
16-18 years	24	58.50
Sex		
Male	20	48.80
Female	21	51.20
Education Level		
JHS	11	26.80
SHS	30	73.20
Sports		
Long Distance	1	2.40
Middle Distance	7	17.10
Throw	5	12.20
Jump	5	12.20
Hight Jump	1	2.40
Hurdling	19	46.30
Middle and Long Distance	2	4.90
Middle Distance and Jump	1	2.40

In this study, the characteristics observed were age, gender, class, and athletic branch number (Table 1). This study was attended by 41 athletic athletes who were students in grades 7-9 (junior high school) and 10-12 (high school) at SKO Ragunan Jakarta. The total number of athletic athletes was 43, but 2 people were injured, so they could not participate in this study. The results above show that most of the athletic athletes studied were female (51.20%). As in the table above, the age of respondents in this study is 12-18 years, with the average age of athletes being 16-18, or called late adolescence (58.50%), which means that the distribution of athletes is mostly in grades 10-12 (73.20%). Athletic athletes at SKO Ragunan have several branch numbers, and the largest distribution of athletes is in the sprint/hurdle branch number (46.30%). The athletic branch numbers at SKO Ragunan are divided into 6, namely long distance, medium distance, throwing, jumping, high jump, and sprint/hurdling. Some athletes pursue 2 branch numbers, such as middle and long distances and middle and jump distances. The age of

adolescence, according to the Ministry of Health (2014), is 10-18 years, which is then grouped into 2 categories, early adolescence (10-15 years) and late adolescence (16-18 years). Athletics has a role as the mother of all sports because it contains various elements of movement, so there are many branch numbers in athletics (17).

According to (18), athletic events are divided into several categories, such as fast walking, sprinting, middle-distance running, long-distance running, throwing, and jumping. The speed of an athletic athlete is very important because it is the main ability in the race (Cania & Alnedral, 2019) (16). The dependent variable in this study is athletic speed. Athletic athletes at SKO Ragunan carry out speed physical tests every month, so that coaches can monitor the development of athletes' speed. The athletic speed tests that are often used at SKO Ragunan are the 20m, 30m, and 200m running tests. In this study, the speed test used was the 30-meter running test. Based on the tests carried out, it is divided into 2 categories, namely less and good. The category is based on the cutoff value of the median because the speed data is not normally distributed. Athletic athletes are said to have less speed if the results of the speed test are > 4.56 seconds and are said to be good if the speed test results are ≤ 4.56 seconds.

Table 2. Frequency Distribution of Speed

Speed	(n)	(%)
Poor	20	48.8
Good	21	51.2
Total	**41**	**100**

Based on the tests carried out, it is divided into 2 categories, namely poor and good (**Table 2**). The category is based on the cut-off value of the median because the speed data is not normally distributed. Athletic athletes are said to have less speed if the results of the speed test are > 4.56 seconds and are said to be good if the speed test results are ≤ 4.56 seconds. The athletes' speed was tested using a 30-meter sprint. Energy intake was obtained using the 2 x 24-hour food recall method and categorized as: below 1,526.64 kcal was considered low, while higher values were adequate. Carbohydrate, protein, and fat intakes were classified as poor if below 217.96 g, 58.16 g, and 56.8 g, respectively, and good if equal to or above those values. This classification is determined based on the average obtained from the preliminary study. Potassium intake was poor when below 4,700 mg/day and good when above it. Hydration status was determined by urine color, with values of 5–9 indicating dehydration and 1–4 indicating hydration.

Body Measurements

Table 3 presents the frequency distribution of the average body weight and height of student-athletes at SKO Ragunan. Understanding body weight and height is important because they relate to athletes' nutritional status, which is linked to speed performance.

Table 3. Frequency Distribution of Weight and Height

Variable	Mean ± SD	Minimum	Maximum
Weight	56.2 ± 11.23 kg	38.2 kg	102 kg
Height	165.99 ± 8.27 cm	150.7 cm	184.5 cm

Based on the research data, **Table 3** shows that the average body weight of athletic athletes at SKO Ragunan is 56.2 kg. According to (19), leg length and body weight are factors that play an important role in supporting the performance of an athletic athlete to achieve maximum speed when running. Teenage athletes are still in the growth phase, so their body weight tends to fluctuate. Generally, the body weight of adolescent athletes has increased, which is also influenced by an increase in the hormone testosterone. This

hormone can increase appetite and stimulate muscle protein synthesis, resulting in weight gain.

Based on the univariate test above, Table 3 shows that the average height of athletic athletes at SKO Ragunan is 165.99 cm. Similar to body weight, teenage athletes are still growing, so their height will certainly still increase. Variations in height and leg length can be one of the factors that influence the selection of certain athletic branches. Throwing athletes have a higher height, greater weight, and higher percentage of body fat compared to other athletes (20). If classified according to BMI for age, the average nutritional status of these athletes is in the normal category (90.2%). Nutritional status in this study was grouped into three categories: underweight (<-2SD), normal (-2.01SD – 1SD), and overweight (>1SD).

Macronutrient and Potassium

The frequency distribution of macronutrient and potassium intake is presented in Table 4. Macronutrient intake is assessed based on the mean intake of energy (kcal), protein, fat, and carbohydrates (in grams). In addition to macronutrients, potassium intake is a variable examined in this study because potassium is a crucial electrolyte associated with an athlete's speed, strength, and recovery.

Table 4. Frequency Distribution of Macronutrient and Potassium

Variable	Mean	n	%
Energy (kcal)	1820.90		
Less		6	14.60
Enough		35	85.40
Protein (g)	69.40		
Less		9	22.00
Enough		32	78.00
Fat (g)	80.20		
Less		5	12.20
Enough		36	87.80
Carbohydrate (g)	212.60		
Less		23	56.10
Enough		18	43.90
Potassium (mg)	1208.80		
Less		41	100

Based on the statistical test results shown in **Table 4** above, it can be seen that the intake of energy, protein, and fat of athletic athletes at SKO Ragunan is mostly in the sufficient category (E = 85.4%, P = 78%, L = 87.8%). As for the carbohydrate intake of athletes at SKO Ragunan, the majority fall into the less category (56.10%). The highest energy intake in this study was 2,443.15 kcal, and the lowest was 1,141.2 kcal. This is because athletes are free to take portions when eating in the dormitory, and athletes also consume snacks from outside whose content has not been regulated by the dormitory nutritionist. According to (21), the average energy intake is> 1,526.64 kcal, protein intake> 58.16 g, fat intake> 56.80 g, and carbohydrate intake> 217.96 gr.

The results of this study are supported by other research conducted by (22), which states that the macronutrient intake of adolescent athletes at SKO Ragunan is mostly in the sufficient category. Most athletes at SKO Ragunan eat the same food because the dormitory has provided it. The dormitory provides food with a 10 + 1 menu cycle, which of course has been adapted to the needs of athletes. The average energy requirement of SKO Ragunan athletes is 4,309.02. The results of this study are in line with the research of (21), which states that the intake of adolescent athletes at SKO Ragunan is still far from their needs.

Energy intake is the main nutrient that must be obtained by all athletes in supporting their performance. Energy intake also influences increasing or decreasing muscle mass. To increase speed, athletes need to meet energy intake according to their daily needs (23). Energy

intake data is obtained through the 2 x 24-hour food recall method. In addition, adequate protein intake is also needed to help increase strength, speed, endurance, and athlete performance (24). Fulfillment of fat and carbohydrate intake also plays an important role in meeting the energy needs of athletes. Based on the test results above, the potassium intake of all respondents fell into the deficient category. The average potassium intake of athletic athletes at SKO Ragunan is 1,208.82 mg. A person's potassium needs are said to be poor if <4,700 mg. This is also supported by (6), which states that the potassium intake of adolescent athletes in Purwakarta Regency falls into the deficient category with an average of 1,065.01 g. Potassium intake is very important for athletes because it can balance fluids and body electrolytes. Potassium intake is very important for athletes because it can balance body fluids and electrolytes. Food ingredients that are often consumed by athletes and contain high potassium are bananas. Athletes need potassium both before and after training and competition. Potassium can prevent fatigue and muscle injury (1).

Relationship of Variables with Athlete Speed

The results of the analysis of the relationship between variables in this study are in **Table 5**. The variables tested for the relationship with speed were body weight, height, hydration status, intake of macronutrients, and potassium.

Table 5. Frequency Distribution of Macronutrient and Potassium

Variables	Speed	
Weight	Correlation Coefficient	-0.37
	Sig. (1-tailed)	0.01
Height	Correlation Coefficient	-0.44
	Sig. (1-tailed)	0.00
Hydration Status	Correlation Coefficient	-0.19
	Sig. (1-tailed)	0.12
Energy	Correlation Coefficient	0.19
	Sig. (1-tailed)	0.12
Protein	Correlation Coefficient	0.24
	Sig. (1-tailed)	0.07
Fat	Correlation Coefficient	0.02
	Sig. (1-tailed)	0.46
Carbohydrate	Correlation Coefficient	0.29
	Sig. (1-tailed)	0.03
Potassium	Correlation Coefficient	0.17
	Sig. (1-tailed)	0.15

This study has several strengths. First, this study provides detailed data on both energy and sugar content of beverages sold in school canteens in Indonesia. This information offers important insight regarding the nutritional environment which school-aged children are routinely exposed to. Second, this study uses real-world data from vendor interviews and product labels enhances the practical relevance of the findings for policy and intervention development.

We also acknowledge several limitations in this study. The data were collected from only two public high schools in one urban city, which may limit the generalizability of the findings to other regions, including rural areas or private schools. In addition, the analysis focused exclusively on beverages and did not include foods, which also contribute substantially to students' overall dietary intake

CONCLUSION AND RECOMMENDATION

Based on the results of research on SKO Ragunan athletics, most athletes have speed that is included in the good category. The characteristics of athletes are dominated by the age of 16-18 years, female, in grades 10-12, and come from sprint or hurdle events. In general, the athletes' intake of energy, protein, and fat was good, but their intake of carbohydrates and potassium was still lacking. Athletes also had an average body weight of 56.2 kg and height of 165.99 cm with good hydration status.

This study also found a significant relationship between body weight, height, and carbohydrate intake with athletes' speed. Conversely, no significant relationship was found between speed and energy intake, protein, fat, potassium, or hydration status. The findings of this study highlight the importance of maintaining optimal body composition and adequate carbohydrate intake to support athletic speed performance. If the result is negative, the correlation coefficient is negative, and vice versa. Coaches and nutritionists at SKO Ragunan should pay greater attention to athletes' carbohydrate consumption and body weight management. Training and dietary programs should be adjusted to ensure sufficient carbohydrate intake and balanced nutrition to enhance energy availability during high-intensity activities. Although other nutrients and hydration status did not show a significant relationship, maintaining good overall nutritional and hydration practices remains essential for optimal athletic performance and long-term health.

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