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The Correlation between Nutritional and Hydration Status with Physical Fitness in Young Soccer Athletes

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ABSTRACTS

Introduction: Soccer is a sport that is required optimal physical fitness. Previous studies have shown that nutritional status and hydration status affect the physical fitness of athletes. Malnutrition will affect physical fitness to be low while dehydration can increase fatigue in athletes and affect performance. The aim of this study was to determine the correlation between nutritional status and hydration status with physical fitness in young soccer athletes.
Methods: This research is a cross-sectional study conducted on young soccer athletes from the Indonesian Football Association in Subang Regency (Persikas Subang). Subjects total of 28 people met the inclusion and exclusion criteria. Statistics were tested by using the Spearman correlation for the bivariate test.
Results: Most of the subjects (85.7%) were in the normal nutritional status category, 64.3% in the mild dehydration, and 71.4% in the moderate physical fitness. There was a significant correlation between nutritional status and physical fitness ($P<0.05$), but there was no significant correlation to hydration status. The results of the study concluded that nutritional status had a significant relationship with physical fitness.
Discussions: This suggested that young soccer players could be aware of their nutritional status and fluid intake.

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1. Introduction

Soccer is a popular sport all over the world. Soccer athletes are required to have optimal physical fitness in order to give maximum effort in matches such as running, holding the ball, passing and kicking. The duration of the game is quite long (90 minutes) coupled with additional time, which is very dependent on providing energy through aerobic metabolic pathways. The average work intensity can be measured from the percentage of maximum heart rate (HR-max). The 90 minutes span of a soccer match can approach the anaerobic threshold/maximal lactate steady state[(1)].

Several physiologic factors can affect an athlete's degree of fitness. Athletes who are in good physical fitness have less weariness, which allows them to think more clearly, creatively, and with greater focus. Cardiovascular fitness level is a type of fitness level that is often measured in soccer athletes. Previous research showed that 28% of young soccer athletes in Kebumen, Central Java had below average levels of cardiovascular fitness. Factors that affect the athlete's fitness level include athlete's nutritional intake, fluid intake, hydration status, physical activity and athlete's VO2Max [(2,3)] .

An athlete's nutritional status summarizes the results of their dietary intake during a specific time period. Nutritional status can also determine the body composition of an athlete. Previous research has shown that the body composition of young soccer athletes is related to their level of fitness when competing. Athletes who have an ideal body composition have a better fitness level efficiency. Other research shows that 9.5% of young soccer athletes category of undernourished status and 4.7% obese category [(4,5)].

The athlete's fluid intake has a significant impact on their level of hydration. The habit of an athlete consuming less fluid can contribute to inadequate fluid intake. One of the athletes most at risk this condition is a soccer player. Previous research has shown that there is a significant relationship between hydration status and soccer athletes' fluid intake[(6)]. Hydration status affects Heart Rate Variability (HRV). Dehydrated athletes will experience a decrease in HRV, which can reduce parasympathetic activity and increase sympathetic activity or both. Sympathetic nerves function to increase heart rate[(7)].

Research related to the relationship between nutritional status and hydration status with the level of physical fitness in young soccer athletes is still limited in Indonesia. Young soccer athletes who are still in their teenage phase still need attention for their growth. In addition, body composition and food intake will also be related to the athlete's condition in the future. Therefore, the purpose of this study to determine the correlation between nutritional status and hydration status with physical fitness in young soccer athletes, especially soccer athletes aged less than 15 years.

2. Materials and Methods

This cross-sectional study was conducted in November 2022 at the Subang Regency Indonesian Football Association (Persikas Subang). The population of this study were male soccer athletes and covered by the study was the youth category (≤ 15 years). The 28 people who met criteria in this study were youth soccer athletes, actively practicing, aged ≤ 15 years and willing to participate in the study by signing an informed consent. The exclusion criteria included injured or sick athletes during the study.

This study was initiated by explaining the research and signing the informed consent. This research was conducted when the subject did a routine exercise schedule. Body weight and height measurements were used to collect data on nutritional status. Digital scales were

used to determine body weight, and a microtoise was conducted to determine height. The nutritional status used is Body Mass Index per Age (BMI/A) with indicators according to the Minister of Health Regulation of 2020 for ages 5 years to 18 years[8]: severe thinness (< -3 SD), thinness (-3 SD to < -2 SD), normal (-2 SD to +1 SD), Overweight (+1 SD to +2 SD), and Obesity (> + 2 SD).

Hydration status was measured by comparing the standard urine color on the PURI card. The level of physical fitness was measured using the 20m Multistage Fitness Test (Beep Test) method. Univariate analysis was used to analyze the subject's characteristics, nutritional status and hydration status. Spearman-test bivariate analysis was used to analyze the correlation between nutritional status and hydration status on the subject's level of physical fitness. This study approved by ethics committee of Muhammadiyah University Prof. Dr. HAMKA number:03/22.10/02080.

3. Results and Discussion

3.1. Characteristics of Subjects

The subject is a male soccer player who plays in the under-15 years (U-15) category. Most of the subjects were 15 years old (67.9%) and were currently studying at junior high school (75%) during the research. Subject characteristics are listed in Table 1.

Table 1. Characteristics of subjects

No	Variables	Amount (n)	Percentage (%)
1	Age		
	- 14 years	9	32.1
	- 15 years	19	67.9
2	School degree		
	- Junior high school	21	75.0
	- Senior high school	7	25.0
3	Nutritional status		
	- Thinness	1	3.6
	- Normal	24	85.7
	- Obesity	3	10.7
4	Hydration status		
	- Good Hydration	9	32.1
	- Mild Dehydration	18	64.3
	- Dehydration	1	3.6
5	Physical fitness		
	- Low	5	17.9
	- Moderate	20	71.4
	- Good	3	10.7

According to the study's findings, the majority of the subjects (85.7%) had normal nutritional status, but there were also some individuals with obese and thinness conditions (10.7% and 2.6%, respectively). The majority of the subjects (64.3%) had mild dehydration, while 3.6% had dehydration. The majority of the subjects (71.4%) classified into the moderate physical fitness category, and as many as 17.9% of the subjects were in the low physical fitness

category. Only 10.7% of the distribution of subjects had good physical fitness. This result shows that most of the subjects do not have good physical fitness, even though soccer is a sport that requires optimal individual physical fitness.

3.2. Nutritional Status and Physical Fitness

Nutritional status is an indicator of the adequacy of nutritional intake athletes. The nutritional status should be monitored as it affects their ability to train efficiently, speed, strength, power, and their risk of injury[9]. Table 2 shows the results of a significant correlation between nutritional status and physical fitness ($p<0.05$). All obesity category subjects have low physical fitness. Meanwhile, in the normal nutritional status category, 7.1% of the subjects had low physical fitness. These results indicate that abnormal nutritional status is associated with a low level of physical fitness. These results are in line with previous research on soccer athletes from the Semarang Indonesian Football Association (PSIS), which showed 22.1% of subjects had obese and 14.4% of subjects had underweight[10].

Table 2. Correlation between nutritional and hydration status with physical fitness

No	Variables	Physical fitness						*P-value*
		Low		Moderate		Good		
		n	%	n	%	n	%	
1	Nutritional status							
	- Thinness	0	0.0	1	3.6	0	0.0	*0.002
	- Normal	2	7.1	19	67.9	3	10.7	
	- Obesity	3	10.7	0	0.0	0	0.0	
2	Hydration status							
	- Good Hydration	0	0.0	7	25.0	2	7.1	0.09
	- Mild Dehydration	5	17.9	12	42.9	1	3.6	
	- Dehydration	0	0.0	1	3.6	0	0.0	

**Significant p≤0.05*

Underweight nutritional status or obesity can affect the use of energy metabolism in athletes. This causes energy efficiency is not optimal and can affect the performance of athletes. Soccer athletes are required to be able to move agile and fast. soccer athletes who have obese will decrease their performance because obesity will cause a person to be less able to move agile and fast. In addition, someone with obesity is also prone to fatigue because the burden on vital organs such as the heart and lungs is greater. If the heart and lungs cannot meet their requirements, tissue oxygenation decreases and hypoxia can occur[10].

The results of this study are also in line with previous research which showed that there was a significant relationship between the nutritional status of soccer athletes and their level of fitness. Obesity will lead to greater energy requirements for the aerobic system to carry out and sustain body movements. Therefore, being obese will generally lead to much earlier fatigue. Whereas someone who has an underweight will experience a decrease in strength, flexibility and agility as well as a decrease in cardiovascular endurance[11].

3.3. Hydration Status and Physical Fitness

Hydration status is a condition that describes the balance of fluids in the body. Hydration status is very dependent on a person's total fluid consumption in a certain period. The results of the study in table 2 show that there is no significant correlation between hydration status and the subject's physical fitness. However, from the distribution of subjects in the mild dehydration category, 17.9% of subjects had low physical fitness. This indicates that a tend to be low hydration status which is related to low of physical fitness. This result is in line with previous studies showing that 68.8% of youth soccer athletes were included in the mild dehydration category and more than 80% of subjects reported consuming insufficient fluids before and during exercise[12].

Athletes should intake enough fluids before, during, and after exercise to maintain hydration and support performance. However, as physical activity and temperature increase, the requirement for fluids will also increase. Soccer is an activity-intensive sport since players might go up to 10 kilometers throughout a game. The higher the activity, the more heat generated by energy metabolism will also increase. The body's fluids will assume their function as heat regulators (thermoregulator). The recommended fluid intake for young men aged 14-18 years is 3.3 liters/day. However, the consumption of these fluids has not been able to replace fluids lost through sweat during training or competition. Consumption of insufficient fluids will increase the risk of dehydration in athletes. During training, athletes should not depend on thirst but make proper drinking arrangements before, during, and after exercise to maintain body fluid balance and sports performance [12–14].

According to the findings in previous research, athletes do not drink enough before, during, or after training, which may possibly be a result of a lack fluid intake during training or competition. Athletes should make appropriate hydration arrangements before training for fulfil their fluid consumption. Before training, athletes can consume various types of drinks, including water, fruit or vegetable juices, milk, and sports drinks. Fluid consumption during exercise mostly comes from water. Only a few consume carbohydrate and electrolyte drinks[12].

4. Conclusions

This study shows that the most of the subjects have normal nutritional status, mild hydration, and moderate levels of physical fitness. Nutritional status and physical fitness were significantly correlated. This result suggests that young soccer players should be conscious of the performance-affecting effects of their hydration and nutritional status. Optimal nutritional and hydration status will support the performance of young athletes in the future.

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