

Research Article

The effect of caffeine consumption on some factors of physical fitness and skills of young footballers

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Abstract

Background: Caffeine is a supplement that is not yet fully effective in specific football training styles. The purpose of this study was to determine the effect of caffeine consumption on some of the physical fitness and skill factors of young footballers.

Materials and Methods: The research method is quasi-experimental and the participants of this study were 30 football players aged 16-18 years who were randomly selected and randomly assigned to one of the three groups of caffeine consumption, placebo use and control (30 = n). The variables of lower limb strength, agility, speed, maximum oxygen consumption and pass, shoot and dribble football skills were considered as dependent variables in pre-test and post-test of all participants. Data were classified by descriptive indices of mean and standard deviation and data analysis was performed using repeated measures analysis of variance test using SPSS-23 software at a significance level of $P < 0.05$.

Results: The results of statistical test showed that between the average lower limb strength ($\text{sig} = 0.001$), maximum oxygen consumption ($\text{sig} = 0.001$), speed ($\text{sig} = 0.001$) and agility ($\text{sig} = 0.002$) There is a statistically significant difference in the caffeine group with the other two groups from the pre-test to the post-test, but there is no statistically significant difference between the control and placebo groups. The results also showed that there was a statistically significant difference between the mean performance of shot, pass and dribble football in the caffeine group with the other two groups from the pre-test to post-test ($\text{sig} = 0.001$), but between the control and placebo groups. There is no statistically significant difference.

Conclusion: Based on the results of the present study, caffeine consumption can have a positive effect on the physical fitness and technical skills of young footballers. Therefore, football coaches are advised to use caffeinated beverages before training to improve their footballers' physical and skill factors.

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1. Introduction

Today, according to the available evidence, football is the most popular and most watched sport in the international arena, a phenomenon that has affected many social, political and economic issues of many countries and many countries in the world consider it their national sport. According to the statistics of the International Football Federation (FIFA), one out of every six people in the world has played football and one out of every three people is interested in football (1). Proper nutrition is important for success in a football game and can affect a player's ability to practice, play and recover after an activity. Also, dietary components such as vitamins, minerals, and supplements can be included in an athlete's diet through a varied diet and affect the body's neuromuscular and metabolic function (2). Foods and food ingredients that can improve a person's capacity to perform an exercise task have been defined as energizing aids (3). Most athletes use athletic assistance to improve the quality and quantity of their training and, in fact, to help them perform in competitive situations. Under certain circumstances, strength training aids may have positive effects on athletic performance, body composition, and strength (4,5). On the other hand, physical fitness is one of the most important parts of training in sports, which is necessary and a pioneer in achieving optimal sports performance. The main goal of physical fitness is to increase the practical capabilities of athletes and develop their capabilities to the highest level (6). In the present study, the factors of physical fitness were the score that was recorded for lower limb strength, cardiovascular endurance, speed and agility for young footballers. Technical skills in football, along with psychological skills and physical dimensions, are key factors influencing

performance and performance in order to achieve appropriate results (7). Caffeine is one of the most widely used nutritional and ergogenic supplements used by athletes. Caffeine is a behavior-dependent active drug and is an example of the most widely used nutritional energy supplements in the world (8, 9). Fatty acid excretion, increased calcium release from the sarcoplasmic reticulum and improved skeletal muscle contractility, increased catecholamine secretion, increased energy production through increased neuromuscular transmission, and improved maximal muscle activity and decreased performance perception; Apply(10, 11). Caffeine produces a variety of physiological effects, including effects on the cerebral vascular system, blood pressure, respiratory function, gastrointestinal activity, urine volume, and exercise performance (12). Regarding the effect of caffeine on athletic performance, three main and possible mechanisms have been suggested. Caffeine increases cyclic adenosine monophosphate and consequently increases lipolysis, mobilization of intracellular calcium from the sarcoplasmic reticulum and competitive antagonist of adenosine receptors in the central nervous system (13, 14). Caffeine increases the oxidation of fatty acids and stores muscle glycogen. This practice can improve performance, especially during endurance activity (13). Because of these characteristics, athletes in various disciplines consume caffeine to increase performance. Although the effects of caffeine consumption on endurance performance have been well studied (15, 16), less research has been done on caffeine energy and its effect on other factors of physical fitness and skill of athletes.

In this study, football technical skills were the score that young futsal players received from the Moore Christian test series (dribble, pass and shoot). Vergayon et al. Examined the effect of carbohydrate supplementation alone and in combination with caffeine on kicking performance in 13 male tennis players. Caffeine consumption was given as 5 mg per kilogram of body weight one hour before training and 0.75 mg of caffeine was consumed for the additional two hours after that. The results showed that adding caffeine to carbohydrates had no effect beyond carbohydrates only on skill performance and the 70-meter shuttle test (17). Horneri et al. Examined the effect of caffeine on 12 top tennis players and found that caffeine consumption speeds up service compared to placebo (18). On the other hand, Lorino et al. Examined the effect of caffeine consumption on agility and showed that caffeine consumption did not have a significant effect on agility and anaerobic power in active men (19). Spradley et al. Also showed that caffeine supplementation (300 mg) before exercise significantly improved the selective reaction time in male athletes and had a lower effect on muscular endurance (20). Frati et al. In a study entitled the effect of acute caffeine consumption on muscle strength and endurance of amateur male football players showed that muscle strength and endurance in the experimental group increased significantly but did not see a significant change in the placebo group (21).

In their study, Lara et al. Showed the effects of caffeinated beverages on the performance of female soccer players and showed that consuming caffeinated beverages compared to placebo resulted in increased in-situ jumps and the average maximum sprint and, in general Participants in the energy supplement group ran faster than the placebo group (22). Haghghi et al. Also studied the effect of caffeine consumption on some indicators of skill and physical fitness of the best table tennis players and concluded that caffeine consumption has no effect on skill and physical indicators in table tennis (23). Due to the discrepancies in the results of the above studies and the lack of appropriate conclusions regarding the use and non-use of caffeine-containing supplements on young footballers, this study aims to examine the effects of caffeine supplementation on physical and skill indicators.

2. Materials and Methods

Methods of research and subjects: The method of this research is semi-experimental due to the use of human samples and lack of control of all disturbing factors and is applied research in terms of purpose. The statistical population of the present study was all football players in the age group of 16-18 years old in Tehran who were active in the provincial league in the 2017-17 season. Statistical samples included 30 footballers who participated in the study in an accessible and voluntary manner. Participants were randomly assigned to one of three groups: caffeine consumption, placebo use, and control.

Inclusion criteria include 16-16 years old age, membership in a sports club and issuance of playing cards for the current season of football history for at least 3 years under the supervision of a coach and exclusion criteria include not participating in training for more than 3 sessions, reluctance He continued to work with the researcher and was injured during the training protocol.

Exercise protocol

The study participants each participated in the study three times, one day apart, in three groups of caffeine users, placebo users and control.

The required information was collected by field method. After explaining the method and purpose of the research, participants completed a written consent form to participate in the research and a medical history questionnaire. Using a physical activity readiness questionnaire (which included 7 key questions) and a general practitioner examination, it was found that all participants were in good health and had no particular problem performing the activity (24). Participants were advised to avoid foods high in caffeine for 24 hours before the tests and to maintain a normal diet throughout the study. A few days before the tests, two candidates performed the tests on a trial basis, according to which the approximate time of the tests was determined. Participants in all test sessions first warmed up and stretched for 5 minutes, then participated in shoot, dribble, and pass football tests, respectively, and finally performed cardiovascular speed, agility, strength, and endurance tests. brought. At the end of the sessions, cooling was done for 5 minutes.

However, in sessions that included caffeine consumption (5 mg per kilogram of body weight) and placebo, participants came to the training site 45 minutes earlier and after consuming caffeine or placebo (starch powder) which was prepared as a capsule, along with Half a cup of water, 45 minutes in order to maximize the concentration of caffeine in the blood, sit in a chair without activity. It should be noted that the rest interval between skill tests was 3 to 5 minutes and between repetitions of tests was 2 to 3 minutes It took 48 hours for the participants to return to the gym, during which time the athletes stopped doing strenuous physical activity and caffeine consumption. It should be noted that all measurements and tests were performed under the same conditions in terms of temperature, humidity and time.

measurements:

Test the front foot of the device

In order to evaluate the maximum strength of the lower limb, a front wire device was used and the maximum lower limb strength was calculated based on the formula of one repetition (25). Maximum strength is 1RM (maximum weight that a person can have one repetition) (maximum repetition = shifted weight / (0.25 / × number of repetitions) -1).

YUT 2 Recovery Test (YIRT2)

To measure aerobic power, the Yuio 2 periodic recovery field test was used. This test involves running 2 consecutive distances of 20 meters in the form of going back and forth to the starting point, where the start and end time of the round trip is determined by the sound of the horn. Behind the starting line, the cone is 5 meters away, where the participant has 10 seconds to run 2 5-meter distances with a soft run after each round for recovery.

The test start speed will be 13 km / h, which will be increasingly increased. The test ends when the participant is unable to reach the line twice when he hears the beep. In order to ensure the maximum effort of the participants in performing the Yoyo 2 test, the heart rate at the end of the test was measured with a heart rate monitor (Polar model F7 made in Finland) (6)

35m Speed Test (40 Yards Speed)

This test measures the linear speed of athletes and is suitable for athletes who perform various sports activities at a very high speed. Test method: Using two cones at a distance of 35 meters, the test site was determined. The athlete is standing in the starting position, the starting position is maintained for 2-3 seconds, the timer starts working from the moment the sole of the foot begins to move. When the timer was held the athlete's foot was on the finish line.

Illinois Agility Test

This test is used to measure agility in running and different routes. The length of the ground is 10 meters and its width is 5 meters, the participant runs the route as fast as possible. Then touch the marked line and quickly move backwards on the new path. Here, in a zigzag motion, it moves side by side with the cones and returns to its original position. After going around the last cone, move back and forth again in the specified direction, and after touching the marked line, walk the straight path of about 10 meters again with a speed to the end. How to score in this test is how long it takes the participant to walk this route (6).

Moore-Christine dribble skill test

Equipment needed: 12 45 cm cones, chronometer, several balls, a circle with a diameter of 18 meters, one person who records the results, one person to return the balls, a scrapbook, a pencil or a pen. Draw a circle with a diameter of 18.5 meters. 12 cones with a distance of 4.5 meters are arranged on the circle. Then draw a 90 cm long starting line outside the circle. By announcing the start, the participant starts moving the ball from the starting point and passes through the cones with maximum speed and then returns to the starting point. The participant has performed this test twice, but each performance must be different from the previous one, so that in the first turn it moves clockwise and in the second turn counterclockwise. The final score of the test is calculated from the average time of 2 runs (26)

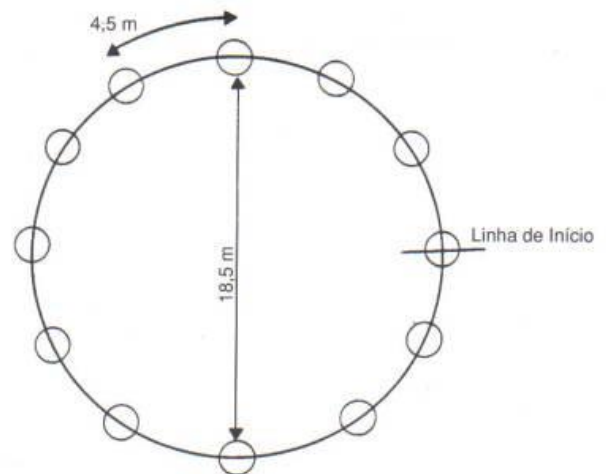


Figure 1: How to organize the Moore-Christine dribble test

Moore-Christine Pass Skills Test

Materials needed: cone, gate approximately one meter wide and half a meter high. In the skill of guarding two cones at a distance of approximately 1 meter using a rope approximately 135 cm will be created as a horizontal beam and two cones with an angle of 45 degrees to the gate line and another cone with a 90 degree angle at a distance of 15 meters. They will be at the gate. People send 4 passes from each cone and a total of 12 passes to the goal. This test is repeated twice from each area and one point is awarded for each correct pass that hits the cone. The final score will be the total score of 12 assists (26).

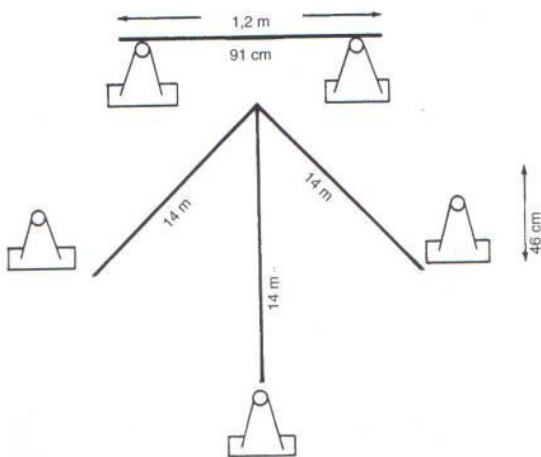


Figure 2: How to organize the Moore-Christine Pass test

Moore-Christine Shot Skills Test

Equipment needed: a few balls, enough space, two ropes, a football gate. In shooting skill, the execution method is as follows: with two strings, we separate the door rope from each vertical pole to the middle of the goal by 120 cm. From a distance of 14.5 meters to the gate, a line is drawn on the ground, which is the firing point. The subject is placed behind the starting line to shoot the ball into the goal. To prepare, each person is given the opportunity for 4 test shots. He then has the opportunity to repeat the test in 4 stages and 4 shots in each stage (16 shots in total). The scoring method is that 10 points are awarded to shots that hit the target and 4 points are awarded to shots that hit the target. For example, if a participant wants to shoot to the right and above the goal and the shot hits the same place as the arrow, he gets 10 points. If the ball is hit to the right but below the goal, 4 points will be awarded. Balls thrown on the ground are not awarded points and the final score is 16 shots (26).

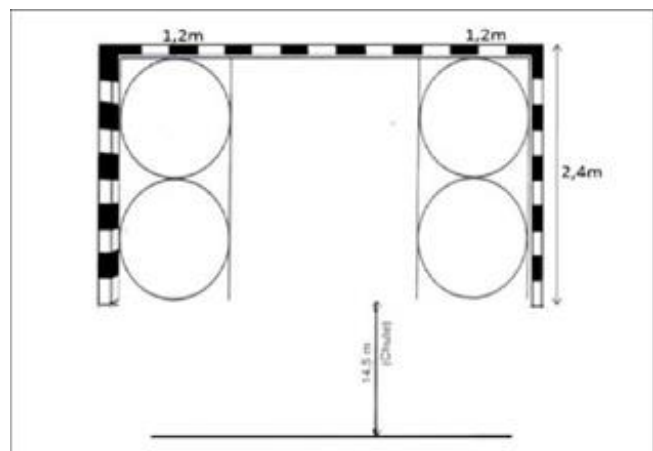


Figure 3: How to organize the Moore-Christine shot test

In inferential statistics, Kolmogorov-Smirnov test was used to evaluate

the normality of information distribution, and Levin test was used to check the homogeneity of variances. In order to test the research hypotheses, repeated measures analysis of variance test was used to evaluate the differences between groups and after the differences were significant, Bonferroni post hoc test was used to compare the two groups. In all tests, a significance level of $p = 0.05$ was considered. All statistical operations were performed using SPSS software version number 23.

3. Results

Frequency, mean and standard deviation of participants' body measurements are presented in Table 1. According to the information presented in the table, the participants have a similar average age. Also, the experimental group is 1 cm taller and weighs 2 kg more than the other two groups.

Findings related to the mean and standard deviation of participants' performance in all stages of the research are presented in Table 2. As shown in the table, the participants of all three groups in the pre-test stage are not significantly different from each other. In the post-test phase, the experimental group showed significant progress in all four subscales, but no difference was observed in the other two groups.

Findings related to the mean and standard deviation of participants' performance in all stages of the research are presented in Table 3. As shown in the table, the participants in the control group had poorer but minor performance in the pre-test stage in shooting and passing skills, and in the post-test stage the experimental group improved more than the other two groups. The Kolmogorov-Smirnov test was used to determine the normality of data distribution. According to this test, the distribution is normal when the value of P is greater than the critical number at the level of 0.05. The results of this test showed that the distribution of all measured data was normal. The results of this test are presented in Table 4.

Table 1: describes the descriptive demographic information of testers in three groups

Variable / Group	Experimental	placebo	Control
Abundance	10	10	10
Age (years)	17 ± 1	17.7±1.1	17.5±1.5
Height (cm)	173.8±2	172±3	172.2±2
Weight (kg)	68 ± 2.7	66±4.1	65±3.4

Table 2: Distribution of performance of physical fitness variables in different groups

Variable group		power	VO2max	Speed	Agility
		Mean ± standard deviation	Mean ± standard deviation	Mean ± standard deviation	Mean ± standard deviation
Experimental	pre-test	44.3±3	46.4±2.4	5.5±0.1	17.5±2
	Post-test	53±2.7	51.4±2.6	4.8±0.2	16±0.9
placebo	pre-test	42.8±4.5	45±1.9	5.5±0.1	19±1.7
	Post-test	45.1±2.8	46.2±2.2	5.4±0.1	18.8±1.7
Control	pre-test	42.6±4.9	45.9±1.3	5.3±0.2	18.2±1.7
	Post-test	45.1±2.8	46.8±2.8	5.3±0.1	18±2.2

Table 3: Information on the football skill performance of participants in different groups

Variable group		shoot	Pass	Dribble
		Mean ± standard deviation	Mean ± standard deviation	Mean ± standard deviation
Experimental	pre-test	152±12	4.2±1.3	18±2.2
	Post-test	176±5	7.3±1.7	14.8±1
placebo	pre-test	152±10	4.2±1.3	19±1.8
	Post-test	148±10	4.5±1.2	18.6±1.9
Control	pre-test	152±8	4.7±1.1	18.2±2
	Post-test			

Table 4: Summary of Kolmogorov Smirnov test results for research variables

Indicator	the level	the power	VO2max	Speed	Agility	Pass	Dribble	shoot
Number	2	30	30	30	30	30	30	30
The value of Z	pre-test	0.164	0.187	0.201	0.162	0.192	0.189	0.203
	Post-test	0.179	0.145	0.138	0.148	0.174	0.195	0.172
Significance	pre-test	0.200	0.125	0.101	0.209	0.141	0.154	0.097
	Post-test	0.168	0.213	0.225	0.210	0.194	0.156	0.191

4. Discussion

The results showed that caffeine consumption has a significant effect on the lower limb strength of young footballers. The results of repeated measures analysis of variance test showed that among the three experimental groups, placebo and control, only the caffeine group had a change in lower limb strength from pre-test to post-test. The results also showed that there was a significant difference between the experimental group and the placebo and control groups, but this difference was not observed between the placebo and control groups. These results show that young athletes can increase and benefit from the strength of their lower limbs by consuming a certain amount of caffeine supplement. These results are consistent with the real findings of Azizi Masouleh et al., Strino et al. On the positive effect of caffeine consumption on fitness factors, and inconsistent with the results of Crow et al. (23, 27-29). Crow et al. Concluded in their study that caffeine had no energizing effect on repetitive cycling times with maximum intensity and could be detrimental to anaerobic performance (29). On the other hand, in a review study, Strino et al.

Examined the effect of caffeine on motor performance in high-intensity, low-duration activities. Studies have shown that 29 studies specifically addressed the effect of caffeine consumption on the performance of short-term high-intensity activities. The results showed that 11 out of 17 studies indicate that in team sports and strength-based sports, a significant improvement was observed after caffeine consumption. Six studies also showed the beneficial effects of caffeine consumption in resistance exercise (27).

Caffeine reduces muscle tissue fatigue. Fighting fatigue is stimulated by stimulation of the central nervous system as well as direct function on the muscle (30). Consumption of 300 mg of caffeine increases the capacity of individuals to do muscle work (31).

The results of the present study showed that caffeine consumption has a significant effect on the maximum oxygen consumption of young footballers. The results of repeated measures analysis of variance test showed that among the three experimental groups, placebo and control, only the caffeine group changed from the pre-test to the post-test in the maximum oxygen consumption. The results also showed that there was a significant difference between the experimental group and the placebo and control groups, but this difference was not observed between the placebo and control groups. These results show that young athletes can consume significantly more oxygen by consuming caffeine supplements. These results are consistent with the findings of Christensen et al., Lara et al., Azizi Masouleh et al., And inconsistent with the findings of Greer et al. (22, 28, 32, 33). One of the most likely factors influencing the response to exercise and sports supplements is age range. Research has reported that with age, the effects of aerobic exercise and the effects of supplementation decrease (34). The participants of the study were Greer and his colleagues were elderly people and based on theoretical principles, one of the possible causes of inconsistency of the results can be attributed to this issue (32).

The results showed that caffeine consumption has a significant effect on the speed and agility of young footballers. The results of the analysis of variance test showed repeated measures that among the three experimental groups, placebo and control, only the caffeine consumption group changed in speed and agility from pre-test to post-test. The results also showed that there was a significant difference between the experimental group and the placebo and control groups, but this difference was not observed between the placebo and control groups. These results show that young athletes can benefit from a considerable amount of speed and agility by consuming a certain amount of caffeine supplementation. These results are consistent with the findings of Ranjbar et al., Schnicker et al. Is inconsistent with the findings of Patton et al. (27, 35-37).

Regarding the effect of caffeine on athletic performance, three major and possible mechanisms have been suggested. Caffeine increases cyclic adenosine monophosphate (cAMP) and thereby increases lipolysis, mobilization of intracellular calcium from the sarcoplasmic reticulum, and competing antagonist agonist antigen system. . Caffeine increases the oxidation of fatty acids and stores muscle glycogen. This practice can improve performance, especially during endurance activity. However, it has been said that short-term and vigorous activities, such as speed and agility tests, are not limited by the amount of carbohydrates available. Therefore, it seems that the effect of caffeine through this mechanism does not play a major role in such activities (15). The results of the present study showed that caffeine consumption has a significant effect on the skill performance of young footballers.

The results of repeated measures analysis of variance test showed that among the three experimental groups, placebo and control, only the caffeine group had changes in pass, shoot and dribble football skills from pre-test to post-test. The results also showed that there was a significant difference between the experimental group and the placebo and control groups, but this difference was not observed between the placebo and control groups. These results suggest that young athletes can achieve significant success in dribble, shoot and pass skills by consuming caffeine supplements. These results are consistent with the findings of Lara et al., Schneiker et al., And inconsistent with the findings of Lara et al. (22, 23, 37). Although the exact mechanism that describes the ergogenic effects of caffeine in intense short-term activity, especially at physiological concentrations of caffeine, is not known; But these effects are probably multifactorial. However, it has been suggested that the main possible mechanism of action of caffeine in short-term and intense activities is the action of caffeine as a competitive antagonist of adenosine receptors (27). Caffeine binds to adenosine receptors in the central nervous system, causing more motor units to be used and increasing nerve drainage; Two factors that increase voluntary contraction and productive force (10). Caffeine can also increase performance by altering perceptions of exercise pressure, reaction time, or mental state (increased alertness and well-being) (13).

Conclusion

At the end of consumption of 5 mg of caffeine per kilogram of body weight by adolescent and young footballers, has a significant effect on physical indicators (lower limb strength, maximum oxygen consumption, speed and agility) and skill indicators (passes, shots and dribbles) and Leads to the improvement of each of these factors against placebo and non-use. Therefore, the use of these energizers for young athletes requires more research and encouragement from coaches.

Compliance with ethical standards

Conflict of interest The authors declare no conflict of interest in publishing this article.

Ethical approval the research was conducted with regard to the ethical principles.

Informed consent Informed consent was obtained from all participants

Author contributions

Conceptualization: P.P., M.H.; Methodology: A.D., M.H.; Software: P.P.; Validation: A.D., M.H.; Formal analysis: P.P., A.D.; Investigation: M.H., A.D.; Resources: P.P., M.H., A.D.; Data curation: M.H., P.P.; Writing - original draft: A.D., M.H.; Writing - review & editing: P.P., A.D.; Visualization: M.H., P.P.; Supervision: A.D.; Project administration: M.H.; Funding acquisition: P.P., A.D.

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