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RESEARCH ARTICLE

The effect of sport drink on some functional variables for soccer players

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Abstract

Objective To examine the effects of sport drink (Pocari Sweat) on some Functional variables for soccer players during aerobic work with a progressive intensity.

Methods Twenty two male soccer players were selected for this study and were assigned to two groups: the first group consumed water and second group consumed sport drink during aerobic work with a progressive intensity, the Functional variables was measured before and after the physical effort, the Functional variables included heart rate, systolic, diastolic blood pressure, and blood electrolytes (Sodium and Potassium). The researchers used SPSS to analyze the data by using the style of (Analysis of Covariance).

The results showed for analysis of covariance (ANCOVA) there were statistically significant differences at level of 0.05 between groups (water, sport drink) in the all functional variables except systolic blood pressure in favor of the second group.

Conclusions The aerobic work with a progressive intensity has made a change in the value of heart rate, blood pressure and blood electrolyte (Sodium and potassium) comparing to the rest time. There is statistical significant different in these values in favor of the group which have taken sports drink.

Introduction

Water is an essential element of nutrition to humans. It comprises of approximately 60-70% of the human body weight, and plays an important role because losing approximately 20-22% of body weight can result in death (Guyton & Hall, 2006). Therefore the body needs water to compensation loss of liquids by sweating. The important of fluid compensation to prevent problems cause by dehydration, especially during the practice of physical effort in warm environments, has been demonstrated (Moises et al., 2007). According to Bilzon et al. (2000) dehydration resulting from sweat loss, and increase in core temperature are the primary cause of fatigue even in moderate climatic conditions.The high sweat rate during intermittent exercise can result in dehydration, and dehydration associated with as little as a 2% bodyweight loss can impair exercise performance (Xiaocai & Gisolfi, 1998). Sport drinks are most widely used to compensate this loss, maintain the level of blood sugar and part of the carbohydrates consumed, rebalance the level of liquids and saps the body of different enzymes as well as mineral salts to levels close to normal(Hazza, 2007). Sports drinks have been used over several years to improve and develop the level of athletic achievement, especially in sports that may cause irreparable damage characterized by heavy training such as long distance running and cycling. These activities require large amounts of calories from various energy sources in the body. Factors such as temperature, high humidity and wind speed lead to the loss of large amounts of body fluids and salts (Saunders et al., 2005). It must be noted that electrolytes are physiologically important substances that control the body's hydration, nerve and muscle function (David, 2001). Also loss of fluid, electrolyte and reduction of the body's carbohydrate stores has been known to be the major cause of fatigue in prolonged exhaustive exercise.

However, according to Stefan (2007), sports drinks can be more advantageous than water for athletes. Sports drinks contain electrolytes, such as sodium and potassium, which are known as the most important additives, in addition carbohydrates. Sport drinks will also interact with factors such as the volume and concentration of other ingested solutions, because such factors can interfere with gastric emptying and intestinal absorption processes. Numerous studies have shown that sports drinks have beneficial replenishing properties during, and after exercise or after any physical activity for prolonged periods of time. Gonzalez et al. (1992) reported that sports drinks help the body to retain fluids after exercise better than when water alone was used. While Jordan (2002) found that water drinking blunts the orthostatic tachycardia but has only a modest effect on blood pressure. Water drinking also has effects on blood pressure and heart rate in normal subjects, although the actions are more subtle. The cardiovascular effects seem to be in part mediated through sympathetic activation. Vrijens & Rehrer (1999) compared intakes of plain water versus sports drinks during exercise, and observed that people who consumed plain water were more likely to have lower sodium levels. This decrease in sodium concentration was related to decreased exercise endurance and earlier fatigue. Electrolyte replacement promotes suitable rehydration, which is important to delay fatigue during exercise. Carbohydrates a primary fuel utilized by exercising muscle are important in maintaining exercise and sport performance (Sawka et al., 2007) Electrolytes such sodium and potassium in sports drinks help in keeping the blood pressure and heart rate lower than water consumed alone (Taylor & Madeleine, 2008).

Hence demonstrated the importance of research to identify the effect of fluid lost as a result of training loads on some functional variables whether to take water or sports drink, especially when performance of physical effort antenna rising intensity. It is scientific serious attempt to promote the importance of fluid which the body loses even though athlete does not feel thirsty, especially when training or competition within the warm atmosphere and the extent of the importance of this information and its impact on the level of the players.

Research papers have numerous on the subject of sports drinks and their impact on functional variables, the study of Nassis. et al, (1998) aimed to identify the effect of a carbohydrate-electrolyte solution on endurance capacity during prolonged intermittent running. Nassis's sample for this study included nine subjects (eight men and one woman). The subjects ran on a motorized treadmill to the point of exhaustion on two occasions separated by at least a 10 day period. The subjects underwent an overnight fast and subsequently performed repeated 15 second bouts of fast running (at 80% VO_2 max for the initial 60 minutes and at 85% VO_2 max for the next 60 to 100 minutes of exercise and finally at 90% VO_2 max after the 100 minutes, to the point of exhaustion. The activity was separated by 10 seconds of slow running (at 45% VO_2 max). On each occasion the subjects drank either a water placebo (P) or a 6.9% carbohydrate-electrolyte (CHO) solution just before the run and subsequently after every 20 minutes. The result of this study showed that performance times did not differ between the two trials. It was found that blood glucose concentration was higher in the CHO trial at the 40 minutes mark during the exercise ($p<0.05$). However, there was no difference in the total carbohydrate oxidation rates between the trials. The findings of this study show that the onset of fatigue during repeated bouts of submaximal intermittent high intensity running is not delayed by drinking a 6.9% CHO solution.

According to Ooi et al., (2001) during exercise, it is necessary to replace the lost of fluids to remain well hydrated. The fluids intake is considered a physiological ergogenic aid to enhance the performance. The aim of this study was to evaluate the effects of acute ingestion of herbal drink (H) or water placebo (P) on cycling performance. The subject of this study were nine trained young male cyclists exercised at $71.9 \pm 0.7\%$ (VO_2 max) on a cycle ergometer until exhaustion at two separated occasion trials in 1-week. In each exercise subjects have of H or P every 20 min. There was no significant difference between herbal drink and water placebo trials in the total of running time to exhaustion. Changes in oxygen consumption were similar in heart rate and perceived rate of exertion for both groups. These results show there was no different between herbal drink and water placebo in physiological responses and exercise performance during endurance cycling.

Serge et al., (2004) found that fluid levels are vital to help achieve maximum performance, and fluctuating electrolyte levels and dehydration in excess of 2% of body weight were shown to consistently impair aerobic exercise performance. Several studies have also confirmed that performance is impaired when athletes are dehydrated. It is recommended that for endurance athletes, it is preferable to drink beverages containing electrolytes and carbohydrates during and after training (or competition) rather than before or after training (or competition). Fluid loss in athletes due to sweat loss is seldom replaced fully. It is imperative that athletes are adequately hydrated during training or competition to enhance performance. It will also help athletes avoid thermal stress, delay fatigue, and prevent injuries related to dehydration and sweat loss. Adversely, hyperhydration or over-drinking before, during, and after endurance events may lead to sodium depletion which could possibly result in hyponatremia. For endurance athletes during training or competition, it is imperative that sweat loss is replaced by fluid intake containing about 4-8% of carbohydrate solution and electrolytes. Athletes are recommended to drink approximately 500ml of fluids 1 to 2 hours prior to an event and continue to drink cool or cold drinks at regular intervals to replace fluids lost through sweating. Athletes performing intense prolonged exercise exceeding 1 hour must consume between 30 and 60g/h and drink between 600 and 1200 mL/h of a fluid solution containing carbohydrate and sodium (0.5 to 0.7 g/L of fluid). In order to decrease fluid loss, maintain performance, decrease submaximal exercise heart rate, maintain plasma volume, and reduce heat stress, heat exhaustion and possibly heat stroke, it is essential that suitable hydration is maintained before, during and after training and competition. Appropriate hydration during training or competition will not only lead to improved performance but also avoid possible thermal stress, maintain plasma volume and delay fatigue which will prevent injuries related to dehydration and sweat loss.

The purpose of study Darrell and Will (2010) was to compare effects on performance and related physiology of a new sports drink, Mizone Rapid (hypotonic; containing carbohydrate and electrolytes) with three other drinks: Mizone (hypotonic; carbohydrate only), Powerade (isotonic; carbohydrate and electrolytes), and a water placebo. Sixteen well-trained cyclists were randomized in balanced double-blind crossover fashion to consume each of the four drinks on separate days at a rate of 250 ml every 15 min during a 2-h steady ride at constant power, followed by a continuous incremental test to peak power. Tests were performed on a cycle ergometer at room temperature (18-22°C) and were separated by 3-7 d. Found Peak power with Mizone Rapid was substantially higher than that with water and Mizone (4.3% and 3.2% respectively) but similar to that with Powerade (0.2%) (90% confidence limits for differences, ±2.6%). Analysis of urine composition and volume after the performance test provided evidence that Mizone Rapid was excreted and therefore probably absorbed more rapidly than the other drinks: it produced both the lowest urine osmolarity and the highest urine volume. There were no clear differences between the effects of the drinks in the steady ride on tympanic temperature, heart rate, blood glucose and blood lactate that were consistent with the effects on subsequent performance.

The purpose of research Nnamdi and Dale (2012) was to investigate the acute effects of a low-calorie caffeine-taurine energy drink (AdvoCare Spark) on repeated sprint performance and anaerobic power in National Collegiate Athletic Association Division I football players. Twenty football players (age 19.7 ± 1.8 yr, height 184.9 ± 5.3 cm, weight 100.3 ± 21.7 kg) participated in a double-blind, randomized crossover study in which they received the energy drink or an isoenergetic, isovolumetric, non-caffeinated placebo in 2 trials separated by 7 days. The Running Based Anaerobic Sprint Test, consisting of six 35-m sprints with 10 s of rest between sprints, was used to assess anaerobic power. Sprint times were recorded with an automatic electronic timer. The beverage treatment did not significantly affect power ($F = 3.84$, $p = .066$) or sprint time ($F = 3.06$, $p = .097$). However, there was a significant interaction effect between caffeine use and the beverage for sprint times ($F = 4.62$, $p = .045$), as well as for anaerobic power ($F = 5.40$, $p = .032$), indicating a confounding effect. In conclusion, a caffeine-taurine energy drink did not improve the sprint performance or anaerobic power of college football players, but the level of caffeine use by the athletes likely influenced the effect of the drink.

Material and Methods

Sample

The research community of the squad Hadhramout University of Science and Technology's 28 players, were excluded goalkeepers and some injured players, bringing the number the sample 22 players (age 20.8 ± 0.89 years, height 175.6 ± 6.01 cm, body mass 68.63 ± 5.06 kg), were divided randomly into two equal groups, first dealing with the water and the second dealing with one of the sports drinks. Each subject gave written informed consent. The study was approved by the Ethics Committee in Hadhramout University, Yemen.

Sport drink

Pocari Sweat was chosen for the study because this drink is the most popular drink in Yemen. Majority of the people drink it, although many are not aware of the advantages and disadvantages of this drink. The composition of this drink is presented in Table 1:

Table (1) Composition of Pocari Sweat drink

Nutritional Facts per 100 ml:	
Calories	26Kcal
Protein	0
Fat	0
Sugar	6.7g
Sodium	49mg
Calcium	2mg
Potassium	20mg
Magnesium	0.6mg

Procedures

This study followed the protocol described by Nassis et al., (1998). 100 ml of water was given to the control group before and during exercise till exhaustion, while similar amount of Pocari Sweat was given before and during the exercise till exhaustion. Both drinks were of the same color and provided within containers of the same design. They were kept in the refrigerator at 8 – 9 °C temperature.

The tests were performed in a laboratory with an environmental temperature of 35 °C and 60% relative humidity. The test involved running to exhaustion on a treadmill for each player, and recording of heart rate, blood pressure and blood electrolytes (Sodium ion, Potassium ion) before and immediately after the trial. The running speeds were equivalent to 45, 60, 70, 80, 85, and 90% VO2 max.

The subjects ran on the level treadmill for four minutes at each speed, and then the speed was stabilized at 90% until exhaustion.On the day of the experimental trial each subject arrived in the laboratory early in the morning after an overnight fast of 10 to 12 hours.

The warm up consisted of five minutes continuous treadmill running. The trial running speeds were equivalent to 45, 60, 70, 80, 85, and 90% VO2 max. The changes in running speed were initiated and controlled manually by the researcher. Exhaustion is defined as the point when the subjects indicate that they could no longer run at the required speed or cadence (Nassis et al., 1998).

Data Analysis

The researchers used SPSS to analyse the data by using the style of (Analysis of Covariance). The results show for analysis of covariance (ANCOVA) to find if there are statistically significant differences at level of 0.05 in the functional variables between the two groups.

Result

The researches considered the identification of means and standard deviations for the functional variables to the two groups after performance the effort of incremental intensity as showing in Table (2).

Table (2) shows the values of means and standard deviations for the functional variables to the two groups.

Variables	First group Water Group		Second group Sport Drink Group	
	Mean	Std. D	Mean	Std. D
Heart rate	178.73	9.71	171.18	6.57
Systolic blood pressure	195.91	13.75	185.55	10.69
Diastolic blood pressure	78.18	7.83	66.09	7.69
Sodium ion	142.24	1.74	138.36	2.42
Potassium ion	4.24	0.32	3.84	0.31

The results above shows there is apparent differences in the means of first group (Water group) and second group (Sport drink group) for some of functional variables to verify if these statistically significant between the two groups the researchers have used (ANCOVA). Table 3 shows the results.

Table (3) shows the results of the analysis for variance covariance to the variables functional for the two groups for dimensional measurement.

Variables	Source	Sum of squares	df	Mean Square	F	Sig.
Heart rate	Pre test	299.708	1	299.708	5.302	.033
	Group	506.594	1	506.594	8.961	.007
	Error	1074.11	19	56.532		
	Total	675087	22			
Systolic blood pressure	Pre test	80.722	1	80.722	.519	.480
	Group	669.712	1	669.712	4.309	.052
	Error	2952.915	19	155.417		
	Total	803916	22			
Diastolic blood pressure	Pre test	2.693	1	2.693	.043	.839
	Group	806.288	1	806.288	12.747	.002
	Error	1201.853	19	63.255		
	Total	116489	22			
Sodium ion	Pre test	.253	1	.253	.054	.818
	Group	79.594	1	79.594	17.093	.001
	Error	88.474	19	4.657		
	Total	433335	22			
Potassium ion	Pre test	.314	1	.314	3.556	.075
	Group	.82	1	.82	9.290	.007
	Error	1.677	19	.088		
	Total	361.3	22			

The results show in the table above there is statistically significant effect at the 0.05 level for the two groups depend on the type of drink for the all functional variables under discussion, except systolic blood pressure reaching F Value in analysis of variance covariance for the two groups for the functional variables (8.961, 4.309, 12.747, 17.093, 9.290) with level of significance (0.007, 0.052, 0.002, 0.001, 0.007) these values have statistical significant in the level of significance(0.05) for the all functional variables except systolic blood pressure which was in the same level of significance (0.05). There is statistical significant different between the water and sport drink in the all functional variables except systolic blood pressure which show not statistical significant different between the two groups.

To find out for which group attributed the differences in the results, table 4 shows the values of the averages for the functional variables after performance the effort of incremental intensity.

Table (4) shows the values adjusted means for the functional variables after performance the effort of incremental intensity.

Variables	Mean Dependent adjusted	
	First group Water Group	Second group Sport Drink Group
Heart rate	180.054	169.855
Diastolic blood pressure	78.194	66.079
Sodium ion	142.305	138.331
Potassium ion	4.230	3.843

The table (4) shows that averages adjusted for variables functional for the first group (water group) after the performance of physical effort was greater than the averages of the second group (sports drink group), this demonstrates that differences in favor of the second group (sports drink group).

Discussion

The researchers attribute the cause of these differences for the lost fluids compensation by sweating contributes significantly to maintain the internal stability of the body, as well as the level for the performance during training or competitions throughout the football game, which may take 90 to 120 minutes, , Has been scientifically proved that a simple degree of dehydration (loss of 1-2% of body weight) leads to higher internal body temperature and this is caused by decreased blood flow to the skin, resulting in the body inability , an early stress and an increased risk of thermal (Asker & Micheal, 2010). The researchers believes that taking of sports drink led to limit of drought ,increase in the body temperature, and maintain the thermal regulation of the body (Sergej & Sanja, 2002) ,as well as taking it during the performance for long periods such as football match works to delay fatigue.

There is a direct correlation between the intensity of physical effort and heart rate, Heart rate increases during exercise, with heart rate accelerating immediately after, or perhaps even before, the onset of exercise. The rapidity with which heart rate returns to normal at the cessation of exercise is often used as a test of cardiovascular fitness. In many types of work, the increase in heart rate is linear with increase in workload (Arthur, 1991),as well as that the increases resulting from the effects of nervous and hormonal on Sinoatrial node, which increase the heart rate, and therefore increase cardiac output because of impact one of its factor, and these increases come under the effects of neurological and chemical as well as lower resistance as a result of the expansion of vascular which occurs in arterioles and working muscles (Mheisen & Fouad, 1987).Has pointed out (Uday, 2011) that the viscosity of the blood is one of the factors affecting the blood flow resistance, where resist blood flow occur as a result of friction between the blood and the vascular wall that passing by it .As the greater the degree of friction, greater blood flow resistance, this is led to be sport drink group less pressure than the water group after effort because the effect of drink on blood viscosity, which has led in its entirety to that pulse rate for a drink group was less than it was to water group after performance of antenna escalating intensity of physical effort.

In spite there are no significant differences between the two groups in the systolic blood pressure after performance for the physical effort, but this effort was impacted on systolic blood pressure more than its effect on diastolic blood pressure and the resulting decrease vascular resistance to blood flow during the performance of exercise and the resulting vascular expansion that occurs in the arterioles and muscles working (Larry, 1981)that noted there is low level of diastolic blood pressure, especially for a total of drink as this decline is an advantage and an indication of functional brew on the impact of the ability of the heart muscle by reducing peripheral resistance with an increase in cardiac output.

In the opinion of the researchers that the difference incident that the slight increase of the concentration of sodium was due to the implement physical load, its intensity and its duration, which has caused an increase in metabolic processes, as well as in the sweat processes and thus increased the concentration of sodium reflects increasing of the Testosterone hormone activity of sweat glands and renal tubules. The increasing in the concentration of sodium related by increasing exercise intensity, its working duration in case the usual thermal conditions, the safety of vital organs, increase physical fitness(Wilkerson, et. Al 1982). The increasing in the concentration of sodium related by increasing exercise intensity , its working duration in case the usual thermal conditions , the safety of vital organs , increase physical fitness. This reflects the high level of sodium for a total of drink was more than the high level of sodium for total water due to increased metabolic processes and sweat processes with a total of water and this in turn impact on the duration of load physical.

In spite of the high level of potassium after performing physical effort but it is within normal limits, the subjects for this study show physiological ability through their response to carry load physical and adapt to maintain the concentration of potassium within normal limits, which led to the excitability of cardiac muscle fibres physiologically consistent with the work physical. The performance of physical effort for a long time increases the metabolic processes and raises the temperature of the muscle fibers, causing a decrease or increase or maintain the concentration of potassium and this goes back to the safety of the organs responsible to maintain the level of adjustment for loads physical (Ammar, 2001), and this therefore reflects the existence of differences between the two groups and explain the researchers so as to contribute to Testosterone hormone in the absorption of sodium for a water larger than its contribution to the absorption of potassium therefore contributed to put up a large part of it out of the body, and this shows to be adaptable devices while performing physical effort for the water group not be equivalent for the sport drink group. This is consistent with what referred to (Shehata, 2006) the water intake is not considered ideal drink to replace lost fluids in sweat because it not contains carbohydrates or some Electrolytes, such as sodium and potassium.

Discussion

The physical effort incremental exercise has made a change in the Value of heart rate, blood pressure, and blood electrolyte (Sodium and potassium) comparing to the rest time, There is also statistical significant different in the heart rate, diastolic blood pressure, and blood electrolyte (Sodium and potassium) during the physical effort in favor of the group which have taken sports drink and there is no statistical significant different in the systolic blood pressure during the physical effort between the water group and sport drink group. Through what has been reached must expand the use of covariance analysis method to include aspects of physical, skill, tactical and psychological, cause of success it in the discovery of the difference between the groups with a statistically rid of associated variables, and increase the attention of compensation of the internal body fluids before, during and after the football match to maintain the water balance of the body. As well as football coaches should benefit from the results of this study, and they have to make Similar studies which it raise the efficiency of players physical, technique and functional.

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