PRINT: ISSN 0973-5070 ONLINE: 2456-6772
Ethno Med, 9(2): 197-201 (2015)
DOI: 10.31901/24566322.2015/09.02.06

The Effect of Sports Drinks and Water Consumption on Electrolyte Levels of Football Players

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KEYWORDS Exercise. Fluid Replacement. Dehydration. Regular Training. Contests

ABSRACT The aim of the study is to investigate the differences in blood electrolyte values for football players in the case of consumption of water and sports drinks during contests and regular training. One group was given 1000 ml (4x250ml) of sports drinks starting 20 minutes before the training match and during the whole exercise, and the other subject groups were given water to consume at the same time and rate. The level of significance was set at 0.05. In the exercises lasting up to 90 minutes no effect of water and sports drinks were found on electrolyte levels. It was concluded that replacement between sports drinks and water consumption reflect similar results and depending on the type that athletes are accustomed to, both type of fluids can be used during exercise.

INTRODUCTION

It is generally accepted that physical activities cause water and electrolyte losses in the body (Sawka et al. 2007). A net fluid loss during exercise might cause athletes discomfort, dehydration, and greatly hinder performance. On the other hand, fluid gain during exercise might also cause discomfort, negatively affect performance due to the excess weight gained, and cause exercise-associated hyponatremia (Hew-Butler et al. 2008) and place the athlete at a severe health risk.

During dehydrogenation, in order to ensure normal blood osmolarities in the skeletal muscle compartments, fluid flow increases from within the cell to exterior of the cells and hyperosmolarity is exacerbated. Muscle proteins are affected by the distribution sarcolemma electrolytes (sodium-potassium) depending on dehydration and by calcium release and reuptake (Balnave et al.1993; Clarkson et al. 2002).

Fluid loss by sweating is approximately 30g/min. This may exceed 1.8 kg per hour. By sweating, not only is water lost from our body but at the same time, electrolytes that have a very important role in muscle contraction like, sodium (Na), chlorine (Cl), potassium (K) are also lost. The loss of Na and Cl is much greater than K (Epstein et al. 1999; Naghii 2000; Gowrishankar et al. 1996).

The replacement of lost body fluids is called rehydration. Before and after the exercise, athletes are weighed, the amount of fluid lost is calculated and accordingly a rehydration strategy is determined. Before and during the exercise, fluid and carbohydrate intake can reduce the negative effects of dehydration on circulation, temperature regulation, and exercise performance. To reduce fatigue and prevent dehydration, it is of great importance to determine the volume and the optimal combination of fluids (Eroglu 1997).

The aim of the study is to investigate the differences in electrolyte values according to water consumption level during contests and training for football players, who consume sports drinks that in recent years, athletes from all ages have begun to consume in large quantities.

METHODOLOGY

The aim of the study is to investigate the effects of water and sports drink consumption on blood electrolyte values for football players during training.

Experimental Design

20 football player subjects who are involved in the amateur sport of football, undergo regular training three days per week, with average age (20.5), average height (177.1) and average body weight (76.15) participated in this study as trained football players. A training competition was coached for 90 minutes in a day with air temperature at 27 °C. The first group was given a total 1000 ml (4x250ml) of sports drinks starting from 20 minutes before the training match and during the whole exercise, and other subject groups

were given water to consume at the same time and the rate. Before and after exercise, 10 cc of blood samples were taken from the subjects' elbow venous and centrifuged at 4000 rpm for 10 minutes and later sodium (Na), potassium (K), and chlorine (Cl) levels were determined by ISE method and calcium (Ca) levels determined by o-cresolpthalein complex one method using Siemens Dimension rxl max model device and body weights calculated by using Casio brand weighing machine.

Statistical Analysis

Statistical evaluation of the data was performed with the IBM-SPSS 20. The normality of distribution was tested using the Shaphiro-Wilk test. Descriptive statistics were shown as mean and standard error. In repeated measures a two-way variance analysis and in the event of differences between groups, differences were found between measurements with Tukey HSD test. The level of significance was set at 0.05.

RESULTS

In the measurement of football players' consumption of sports drinks during exercise, the body weight levels of the post-exercise values (Table 1) with compared to pre-exercise values were determined to be significantly lower ($p<0.05$). No significant differences were observed in all other before and after exercise values ($p>0.05$).

In athletes' water consumption measurements, body weight (Table 2) after exercise levels were lower than pre-exercise levels ($p<0.05$). Before and after exercise, sodium, potassium and chlorine levels were similar ($p>0.05$). Calcium levels after exercise when compared to before exercise, showed a statistically significant rise ($p<0.05$).

In the comparison of subjects' intergroup before and after exercise values (Table 3), sports drinks and water consumption values were found to be statistically similar ($p>0.05$).

Table 1: Consumption of sports drinks value of football players

Variables n=10	*Pre-exercise mean± SS*	*Post-exercise mean ± SS*	*P*
Body Weight (Kg)	75.97 ± 8.71	75.25 ± 8.65	0.00
Sodium (Na)	139.60 ± 1.07	141.00 ± 1.41	0.13
Potasium (K)	4.21 ± 0.30	4.39 ± 0.35	0.10
Chlor (Cl)	99.40 ± 1.42	99.30 ± 1.70	0.10
Calcium (Ca)	10.00 ± 0.22	10.17 ± 0.24	0.15

Table 2: Water consumption value of football players

Variables n=10	*Pre-exercise mean± SS*	*Post-exercise mean ± SS*	*P*
Body Weight (Kg)	76.15 ± 8.60	75.45 ± 8.51	0.00
Sodium (Na)	140.00 ± 1.49	140.80 ± 1.47	0.06
Potassium (K)	4.25 ± 0.31	4.38 ± 0.31	0.09
Chlor (Cl)	99.50 ± 1.26	99.30 ± 1.70	0.05
Calcium (Ca)	9.93 ± 0.30	10.17 ± 0.25	0.03

Table 3: Sports drinks and water consumption intergroup values of football players

Variables	*Measurement time*	*Sports drink n=10mean± SS*	*Waterconsumption n=10mean ± SS*	*P*
Body Weight (Kg)	Pre - exercise	75.97 ± 8.71	76.15 ± 8.60	0.92
	Post - exercise	75.25 ± 8.65	75.45 ± 8.51	0.92
Sodium (Na)	Pre - exercise	139.60 ± 1.07	140.00 ± 1.49	0.75
	Post - exercise	141.00 ± 1.41	140.80 ± 1.47	0.18
Potassium (K)	Pre - exercise	4.21 ± 0. 30	4.25 ± 0.31	0.08
	Post - exercise	4.39 ± 0. 35	4.38 ± 0.31	0.06
Clor (Cl)	Pre - exercise	99.40 ± 1.42	99.50 ± 1.26	0.71
	Post - exercise	99.30 ± 1.70	99.30 ± 1.70	1.00
Calcium (Ca)	Pre - exercise	10.00 ± 0. 22	9.93 ± 0. 30	0.24
	Post - exercise	10.17 ± 0. 24	10.17 ± 0. 25	0.66

DISCUSSION

During training and competition periods, athletes spend energy and lose water and electrolytes by sweating (Ersoy and Ersoy 2013). During intense exercises in hot and humid conditions sweating increases and can reach up to 3 liters per hour. This can cause dehydration, which is equivalent of one to eight percent body fluid (Demirkan et al. 2010). Drinking appropriate levels of water can normalize this loss (rehydration) (Gunay and Tamer 2013). Sports drinks have been developed to help athletes to replace their water, electrolyte and energy (carbohydrates) consumption during and post exercise periods (Ersoy and Ersoy 2013).

In this study (Tables 1 and 2), during exercise both groups were given a total of 1000 ml of two type of fluids and the statistical values of athletes after exercise fell ($p<0.05$), dehydration limits mentioned in the literature for 90 minutes of exercise were preserved and they lost less than two percent of their body weight. When four percent of body weight is lost because of exercise-induced sweat, blood volume decreases, and cardiovascular and thermoregulatory functions are affected (Orkun 2010). The levels of body weight detected after 1000 ml fluid replacement given to groups that started from pre-exercise and continued during the exercise is consistent with the Edwards and colleagues' report (Sproule 1998). According to this study's findings during the 90 minutes of exercise it can be said that this rate of fluid consumption may be helpful in protecting athletes from dehydration.

The findings in this study (Table 3) suggest that measuring sodium (Na) levels before and after exercise for sports drinks and water-consuming groups showed no significant differences ($p>0.05$). In addition, intergroup sodium values also statistically reflect similar results for consuming sports drinks and water groups, ($p>0.05$). This study's results are comparable to the literature since the type of fluid consumed by both groups during exercise, after exercise, the sodium (Na) values were found to be similar in comparison to the pre-exercise values. The results of the studies examine sodium values without liquid supplements and subjected to dehydration have opposite results to the findings. Thus, Kenefick et al. 2004 (Fahlström et al. 2006) got athletes exercised for 90 minutes and ensured that two to four percent body weight would be lost. Then, the subjects' blood hematocrit parameters were evaluated and it was observed that blood and sodium (Na) levels decreased.

Similarly in his research, Wechsler 2006 looked at the amount of the body fluids and lost sodium (Na) after athletes performed a 3-hour training in 34°C temperature and in sixty percent VO2max, and found low results that also support this study's findings (Edwars et al. 2007).

This study (Table 3) examines the differences in sports drinks and water replacement that there is a statistically significant similarity in sodium (Na) levels. Intergroup potassium (K) values do not reflect a statistically significant difference ($p>0.05$).

Also, the results of potassium (K) of subjects, who consume sports drinks and water within the group before and after exercise, are similar ($p> 0.05$).

Twerenbold et al. (2003) in their study researched running exercises and various sodium-containing beverage supplements given. In the obtained conclusions and according to the results obtained in restricted fluid section while in the values of blood sodium (Na), a significant decrease was observed; in the liquid supplement parts a statistical significance was not found (Kenefick et al. 2004). In another study by Morgan et al. 2004 (Weschler 2006) eight male subjects were studied while cycling for 2 hours and fluid restriction was applied to the subjects during this time. After examining blood parameters a significant increase in blood potassium levels was found. Then in a repeated study, exercises were completed without liquid restrictions to the subjects and no significant increase in the level of blood potassium (K) was observed.

These results (Table 3) in both the liquid types of replacement revealed differences in potassium (K) levels are similar with the results of this study. In this study, chlorine (Cl) levels were measured for the groups who consumed sports drinks and water before and after exercise and no statistically significant differences were detected ($p>0.05$). In addition, between groups that were given sports drinks and water replacement during exercise, before and after exercise chlorine levels were found to be statistically similar ($p>0.05$). In this study, the two fluid types supplemented during exercise have maintained chlorine values similarly. Literature data that supports these results is available.

As a matter of fact, Maglishco 1993 (Hew-Butler et al. 2008) stated that water loss in the early stages of the exercise involve chloride ions along with the body of water. It was also reported that if declining water and electrolytes in the body were not to put back, the volume of intravenous fluids was reduced. Similarly, Rivera et al. 2006 (Morgan et al. 2004) in their study made 18 female participants exercise under a temperature of 33.4°C and at sixty percent VO2max. As a result they found a decrease in the level of chlorine (Cl) in the blood. These results are in line with this study wherein as a result of the liquid supplement, chlorine levels were protected.

For calcium (Ca) levels, which is another parameter that the researcher investigated in this study (Table 3), while no significant differences were found for sports drink consuming groups' before and after exercise values ($p>0.05$), in the water-consuming group, statistically higher results were observed ($p<0.05$). However, in the determination of the differences of two drinks, which was the main subject of this research, the sports drinks and water-consuming groups' intergroup before and after exercise values were found to be statistically similar. According to calcium (Ca) results acquired after the 90 minute soccer training contest, no differences were observed between sports drink or water consumption.

In a study conducted by Ocal (2007) and Maglishco (1993) it was pointed out that sports drinks contain carbohydrates that are a muscle energy source. The researcher stated that for endurance exercises that last more than 60 to 90 minutes the benefits of sports drink are important. Reporting that for those who exercise less than an hour, sports drinks are not required to support the findings of this study.

CONCLUSION

As a result, in exercises that last up to 90 minutes, no difference was found between the water and sports drinks on efficiency of electrolyte levels. Athletes have to check their body weight before and after exercise and determine the amount of fluid they use, whereby the athletes will not face dehydration and may protect their performance levels. According to the conclusion of this study, for sport activities that last up to 90 minutes, sports drinks, which are used as an energy drink have no positive effect on the performances.

RECOMMENDATIONS

It was concluded that since sports drinks and water replacement reflect similar results, depending on the athletes' habits, both fluids could be used during exercise. Similar studies should be performed for different durations and loading intensities in sports activities and in terms of other variables, the study area should be supported.

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