Available online www.jocpr.com

Journal of Chemical and Pharmaceutical Research, 2016, 8(7):708-716

Research Article

ISSN : 0975-7384
CODEN(USA) : JCPRC5

The effects of two energy drinks (Zamzam and Isostar) on changes in glucose and insulin in football players

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ABSTRACT

The purpose of this study was to determine the effects of two energy drinks on changes of metabolic indices of soccer players. 48 club soccer (24 women and 24 men) with mean age of 7 .4 ± 7. 18 years, height 1.7 ± 5. 159 cm, weight 8.6 ± 66.53 kg, BMI $_{(kg/m2)}$ 68. 1 ± 77.20, and $_{(Ml.Kg\text{-}1.min)}$ Vo $_2$ max 63 .4 ± 37.59 were selected as two groups and in two groups of long-term intermittent exercise(Ekblom endurance test) and short-term intermittent exercise (RAST anaerobic test) were divided; each group of three groups randomly drink Zamzam (SD), Isostar (ID) placebo (P) beverages. long-term intermittent exercise include 6 stages of exercise (every stage includes 4 repeated endurance test of Ekblom) as two half (like soccer) that in each half time, there was 3 stages of exercise and 10 minutes of rest between two half. Fifteen minutes after eating standard breakfast (23 grams of carbohydrates, 4 grams of fat and 3 grams of protein), 6 ml / kg of beverage and at the end of stages 4, 2, 1 and 5, 1 ml / kg of beverage have been drunk by players. Also they drank 4 $_{ml\ /\ kg}$ of beverage at the end of the 3rd stage (first half). Before exercise and immediately after long-term intermittent exercise, venous blood samples were made and Glucose, insulin and triglyceride were measured. Blood lactate at rest, 3 minutes after the first half and second half of the fingertips were measured. Short-term intermittent exercise, including three complete stages of RAST test (peak anaerobic power, mean power and fatigue index) with 10 minutes rest. Fifteen minutes after eating standard breakfast 2 ml / kg of beverage and at the end of each stage 2 ml / kg beverage were drunk.Glucose and blood lactate at rest and immediately after each stage of RAST test were measured through blood fingertips. Result Results showed a significant increase in the rate of insulin and blood glucose levels after long-term activity in SD and ID groups compared to P group. Also there was a significant increase in the rate of blood glucose levels in 3 minutes immediately after every stage of the RAST test in SD and ID groups compared to P group. While in the other variables, any significant difference wasn't observed in group ID compared to SD. The consumption of beverages made by company of Zamzam and Swedish Isostar relatively cause to increase level of blood glucose and insulin after long-term high- intensity intermittent exercise.

Key words: Energy beverage, periodic implementation, Zamzam, Isostar, Ekblom test, RAST tests.

INTRODUCTION

In the preparation, athletes often face difficult and onerous training conditions and for more rapid return to normal condition, energy reserves lost during exercise must be rebuilt and the athlete must get ready to execute the next step of the training. In fact, speed of recovery to the initial status is one of the signs of optimal compatibility and physical fitness in athletes.

In most sports competitions the time between two competitions is not so long for the energy sources to recover completely and for the athlete to return to first state. In this case, athletes should consider nutritional considerations. If the period of return to the initial state is not properly done, athlete's performance in physical exercise decreases and early fatigue follows (1). Due to feeding and gastrointestinal problems related to routine daily nutritional intake

(solid) and the effects of digestion and hormonal changes on athletic performance, athletes' attention was drawn to the use of soluble drink before, after, and especially during exercise activity with different compounds and concentrations. Sports drinks based on the needs of the athlete have specific features to replace fluids and electrolytes and replenish glycogen. Most research see the use of carbohydrates with different levels(4 to 10 percent) in exercise solutions as a nutritional principle (21,1).

Due to abundance and cheapness, being especial fuel for central nervous system, easy digest, oxidation of lipids and proteins, storage to produce instant energy in anaerobic glycolysis system and participation in membranes built and tissues and body composition, carbohydrates is of great importance (2,1).

Fatigue increases along with reduction in muscle glycogen. With the increase in consumption of carbohydrate, muscle glycogen levels increases after exercise, which can be the most important principle for strength, endurance and speed athletes (3).

Many studies have been conducted to investigate the role of glycogen in the improvement of sport and its rapid reconstruction and recovery roles. Many factors influence the rate of muscle glycogen resources including carbohydrates consumption time, amount and servings, consumption levels and adding vitamins, protein and carbohydrate supplements (24). On the other hand, reducing the availability of blood sugar by acting on the secretion of stress hormones can have an indirect effect on immune function. Suppressive effects of stress hormones (e.g. cortisol and aldosterone) are widely used to justify a great deal of exercise-induced immunosuppression (13).

The athlete who does exercise in carbohydrate depletion mode experience further increase in stress hormones circulating in the blood, and many disorders in several indicators of immune performance. Today, the football game will require significant metabolic hard because this sport involves running a distance of about 10 km and 1400 change in the intensity of activity. The legal play of football is 90 minutes and during the halftime break, players have the opportunity to consume fluids or other nutrients. There is evidence that suggests that carbohydrate drink for tests simulated in different intensity exercise like football have energy producing characteristics. Given the intermittent nature and severity of football activities, studying the efficiency of carbohydrate beverage on metabolic responses can be very useful in the effectiveness of training and competitions for athletes. In recent years, many sports drinks with potassium, sodium, magnesium, carbohydrates with different glycemic, protein, vitamins soluble in water, caffeine, taurine, glutamine, branched amino acids and so on have been sent to the marketed. R4 drink is of these drinks in which electrolytes, carbohydrates, protein, glutamine, amino acids and vitamins E and C are used (1). Seifert et al (1999) reported 55 percent increase in strength and a 65 percent reduction in the amount of free radicals and decreased 36% in muscular injuries during using R4 drinks during endurance consecutive activities. Zamzam Synergy Drink recently made in the country has nearly similar components as energy Red Bull drink in which caffeine, electrolytes, carbohydrates, amino acids and vitamins are used. Red Bull drink is only used in research by Alfred (2000) and Forbes and colleagues (2007) used and rather different results have been reported (6). Little field and laboratory research is available for the optimal use of drinks. Different compounds are used in most drinks according to theoretical theories spend of used in their construction, while sports drinks should have the feature set to meet the needs of the athlete with the intensity, duration and volume of exercise. Studies have interpreted their results from the use of drinks in different ways and in future research they have alterations in training models and contents of drinks and time of their use, until finally provide a beverage or drinks with different models with different goals. Given the importance of the subject and the background of previous research, this study is to evaluate the metabolic response to energy drink consumption (energy drink manufactured by Zamzam Company and Sweden Isostar) and study the effectiveness of energy drinks made inside and outside the country to determine the nutritional needs of athletes and coaches.

EXPERIMENTAL SECTION

A. The population and the method of selecting subjects

The statistical population consists of players from football clubs in Isfahan. A total of 24 people were selected through convenience (targeted) sampling. After selecting subjects, the subject, purpose, and method of its implementation, as well as the uses and probable dangers to them were given to them. Then, subjects voluntarily signed consent to participate in the study. Then the status and health history of them in the past few months was assessed through a questionnaire. According to research methods and goals, after obtaining measurements of maximum oxygen consumption test (12 min running test), based on strength and physical fitness, subjects were purposefully divided long-term intermittent exercise group (especially endurance test for Ekblom Football) and periodic short-term (anaerobic test RAST). Each group was randomly assigned to Zamzam drink (SD), Isostar drink (ID) and placebo (P). Long-term intermittent exercise had 6 activity phases (each phase including 4 repetition of endurance Ekblom test) as split-half football game simulation exercise, each half was carried out with 3 activity

phases with 3 minutes rest and 10 minutes break. Before and immediately after the interval of long-term intermittent exercise venous blood samples were collected and immediately transported to the laboratory and blood glucose and insulin levels were measured. Blood lactate at rest and 3 minutes after the first half and second half was measured from the fingertip. Short-term intermittent exercise included three RAST tests with 10 minutes rest. Glucose and blood lactate at rest and immediately after each RAST test were measured through fingertip blood. Measured anthropometric features included height, weight and their maximum oxygen consumption (Cooper test) that were measured in the first session (Table 1).

B. Measurement of blood parameters

Plasma glucose was measured by using a specialized kit from Pars Azmoon Company based on (GDD-PAP) enzymatic method. First, photometer with glucose reagent solution was initially set to zero. Using a 10 ml sample of the athlete and after mixing with reagents for twenty minutes at 20 to 25 degrees (room temperature), it was incubated and then the standard optic absorbance of the sample of the patient versus control was measured. Optical density remained stable for 60 minutes during which the measurement was done. Insulin was measured professional kit and immunoenzymometric method using ELISA.

Blood lactate was measured from fingers blood sample using Scout Lactometer manufactured by Senslab Germany. Body mass, fat percentage and BMI were measured using Body composition Analyzer InBody 3.0 made in Korea. Energy drinks included Synergy Drink by Zamzam Co. and isotonic powder by Sweden Isostar Co. (Table 1).

Table 1: components of energy drinks by Zamzam and Isostar companies in 100 ml

Caffeine	Electrolytes and additives	Niacin	Vitamin B	Fat	Protein	Carbohydrate	Calorie	Energy products	Trademark
0.3 percent	Apple juice concentrate (7.6%) and pineapple (2%), sodium benzoate, taurine	10.1 mg	B_5(5.3mg) B_6(5.2mg) B_{12}(1.1mg)	g 0.1	0.1 g	12.3 g	220 Kj.49kcal	Zamzam Drink	Synergy
-----	Sodium (0.7 g), potassium (18 mg), calcium (32 mg), magnesium (mg 12), orange juice concentrate		B_1(0.5mg)	---	---	7 g	127Kj.29kcal	Isostar Drink	Isostar

C. Short and long-term intermittent exercise protocol especial to football

1) Short and long-term intermittent exercise protocol (anaerobic test RAST) and supplementation method:

A session before the start of the test, players' maximal oxygen uptake were measured using Cooper Test. After a period of 8 to 12 hours of taking no food (fasting) during two different sessions, subjects (12 males and 12 females elite soccer players) were present in a sport hall at 7 am. Fasting baseline lactate and glucose were measured.

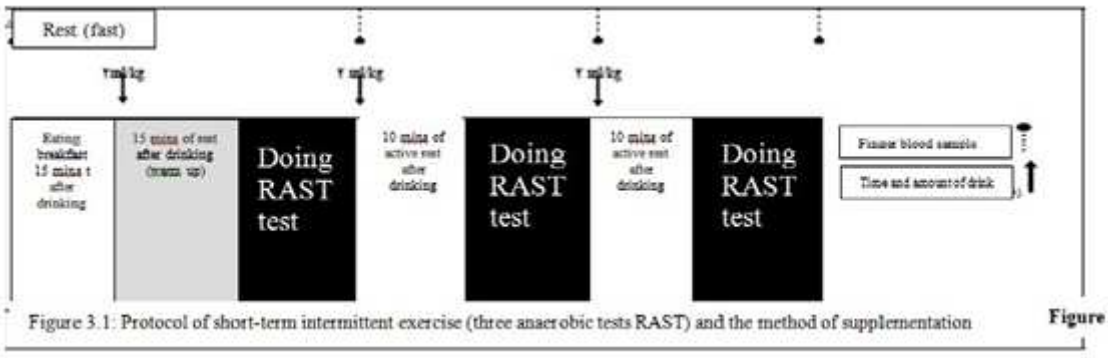

Figure 3.1: Protocol of short-term intermittent exercise (three anaerobic tests RAST) and the method of supplementation

Figure 1

15 minutes after taking a standardized breakfast (23 g carbohydrates, 4 grams of fat and 3 grams of protein) (11), subjects were randomized into three groups: Isostar energy drink (ID), Zamzam energy drink (SD) and ingesting aspartame or placebo (P) 2ml/kg and at the end of each go, they drink 2ml/kg. Anaerobic power[1] and fatigue index[2] of the subjects were obtained using anaerobic sprint test (RAST) which contains 6 times 35 meter sprinting with 10

[1] anaerobic power= (weight × distance) ÷ time^3

[2] fatigue index= (minimum power - peak power) ÷Total time for 6 stages

average power= 6 reps divided by 6 The highest and lowest power= peak power and least power between 6 reps

seconds of rest between repetitions (18). Anaerobic periodic exercises were done 3 times with 10-minute rest period between repetitions. Short-term intermittent exercises were done as three RAST test with 10 minutes of rest. Glucose and blood lactate at rest and immediately after each test were measured by fingertip blood sample through RAST test (Figure 1).

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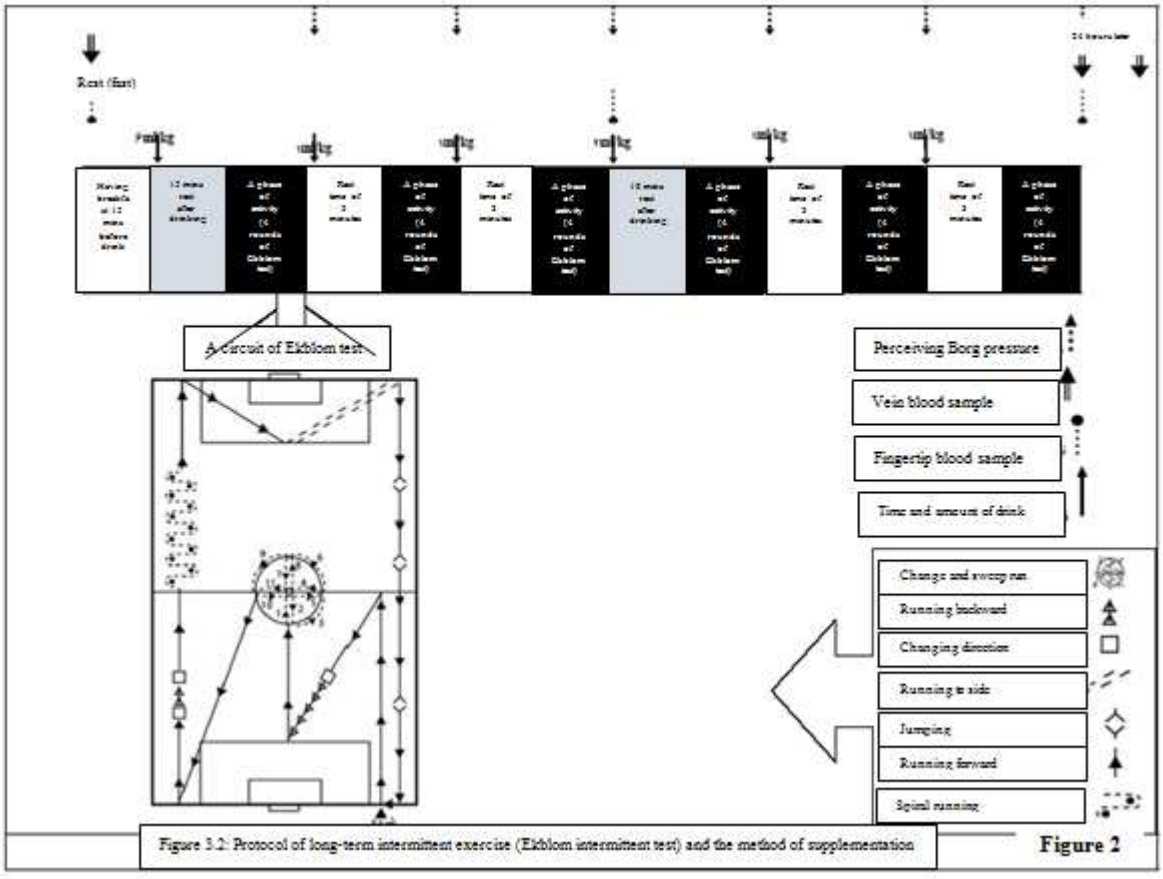

Figure 3.2: Protocol of long-term intermittent exercise (Ekblom intermittent test) and the method of supplementation

Figure 2

Long-term intermittent exercise protocol (Ekblom periodic test) and supplementation method:
A session before the start of the test, after a period of 8 to 12 hours of taking no food (fasting), base vein blood was measured and on the same day in the evening, players' maximal oxygen uptake was measured using Cooper Test. Then during two different sessions, subjects were present in soccer field at 7 am.

15 minutes after taking a standardized breakfast (23 g carbohydrates, 4 grams of fat and 3 grams of protein), subjects were randomized into three groups: Isostar energy drink (ID), Zamzam energy drink (SD) and ingesting aspartame or placebo (P).

15 minutes after drinking, long-term intermittent exercise test of soccer endurance test protocol that was designed by Ekblom began. Each exercise consisted of 4 rounds of Ekblom test (running backwards and forwards, Pabex, jumping, spiral) on the soccer field with about 75 to 80 maximum heart rate (19). At the end of each exercise (4 Ekblom periods) Borg perceived exertion scale was used to evaluate activity (13). 15 minutes after the consumption

[3] anaerobic power= (weight × distance) ÷ time^3
[4] fatigue index= (minimum power - peak power) ÷Total time for 6 stages
average power= 6 reps divided by 6 The highest and lowest power= peak power and least power between 6 reps

of standardized breakfast, 6ml / kg drink at the end of each round 1, 2, 4 and 5 ml / kg1 drink was given. At the end of round 3 (after the first half) 4ml / kg drink was consumed (11). Before and immediately after long-term intermittent exercise, vein blood samples were collected and immediately transported to the laboratory and glucose, insulin, rest blood lactate, 3 minutes after the first half and second half were measured from fingertip (Figure 2).

Tabl2: Anthropometric physiological and information of the subjects (data are as M±SD)

Group Variable	SD		ID	P
Age (years)	Men	19.33±2.94	18.33±1.96	19.66±3.87
	Women	19.66±3.8	19.33±2.94	18.33±1.96
(Kg)Weight	Men	66.33±5.00	65.66±5.8	53.83±6.7
	Women	53.83±6.7	66.33±5.06	65.66±5.8
(cm) Height	Men	172.66±5.36	178.83±6.15	158.66±6.5
	Women	158.66±6.5	172.66±5.3	178.83±6.14
BMI	Men	22.26±1.63	20.5±0.8	21.43±1.77
	Women	21.34±1.77	26±1.63	20.5±0.81
Vo_2max ($ml.Kg^{-1}.min$)	Men	62.21±4.17	59.92±5.53	61.23±3.9
	Women	59.14±3.91	58.88±5.1	58.72±3.53

Zamzam drink (SD), Isostar drink (ID) and placebo (P)

D. Statistical methods

In this study, data were classified and described as mean and standard deviation. ANOVA was used to compare the measured variables at each stage and to identify significant differences among the three groups. To test the hypothesis LSD post hoc test was used and 5% significance level was used ($P \leq 0.05$). Also, Kolmogorov-Smirnov test was used to ensure normal distribution of subjects. Given the normal distribution of data, parametric statistics were used. For calculations, SPSS 14 statistical program was used.

RESULTS AND DISCUSSION

A) Blood metabolic response to long-term intermittent exercise

Table 3 shows levels of insulin in blood glucose levels at rest, immediately after long-term intermittent exercise, and lactate at the end of the first half and second (rounds 3 and 6) as mean ± standard deviation. The results of the ANOVA and post hoc test showed a significant difference in blood levels of insulin and glucose in the blood sample immediately after long exercise in SD and ID groups compared to the placebo drink ($P \leq 0.05$).

However, no significant change was observed in ID group compared to SD drink ($P > 0.05$). In addition, no significant changes were observed in insulin and glucose relax, blood lactate relax after long exercise drink in groups SD, ID and placebo ($P > 0.05$) (Tables 4 and 5) (Figure 3 and 4).

Table 3: Comparison of metabolic indices of blood at rest, and immediately after long-term intermittent exercise

Group	Variable	blood at rest	Blood immediately after activity (and lactate after the first half)	Blood lactate after the second half
		mean±Standard deviation	mean±Standard deviation	mean±Standard deviation
SD	Glucose mg/dL	**10.97±80**	**9.04*±99.16**	-
ID	Glucose mg/dL	**6.01±82.71**	**7.67*±90.71**	-
P	Glucose mg/dL	**11.25±87.33**	**10.66±80.16**	-
SD	Insulin mg/dL	**2.79±7.31**	**3.19*±14.13**	
ID	Insulin mg/dL	**2.7±7.92**	**3.31*±13.24**	
P	Insulin mg/dL	**1.8±9.38**	**3.75±10.08**	
SD	**Lactate ($mmol/l^{-1}$)**	**0.28±1.28**	**2.92±7.2**	**0.25±8.66**
ID	**($mmol/l^{-1}$) Lactate**	**0.28±1.12**	**1.62±6.54**	**3.28±8.32**
P	**($mmol/l^{-1}$) Lactate**	**0.40±1.42**	**3.77±8.7**	**4.04±11.58**

Zamzam drink (SD), Isostar drink (ID) and placebo (P)

* *is the sign of statistical significance*

Table 4: ANOVA of blood, metabolic indices of blood at rest, and immediately after long-term intermittent exercise

Statistic Variable	Change source	The mean squares	F	P	Statistic Variable	Change source	The mean squares	F	P
Glucose rest mg / dL	**Intergroup** **Intragroup**	**90.93** **87.92**	**1.03**	**0.3**	Insulin immediately after exercise mg / dL	**Intergroup** **Intragroup**	**27.4** **5.8**	**4.66**	**0.02**
Glucose immediately after exercise mg / dL	**Intergroup** **Intragroup**	**466.51** **77.97**	**5.98**	**0.01**	Resting lactate (mmol / l-1)	**Intergroup** **Intragroup**	**0.16** **0.1**	**1.57**	**0.2**
Insulin rest mg / dL	**Intergroup** **Intragroup**	**6.79** **2.3**	**2.94**	**0.09**	--	--	--	--	--

Table 5: Intergroup analysis of variance (LSD) of metabolic indices of blood at rest, and immediately after long-term intermittent exercise

Statistic Variable	Standard Deviation			P value		
	SD with ID	SD with P	ID with P	SD With ID	SD With P	ID With P
Glucose immediately after exercise mg / dL	**4.91**	**0.9**	**4.91**	**0.2**	**0.00***	**0.04***
Insulin immediately after exercise mg / dL	**1.34**	**1.4**	**1.34**	**0.5**	**0.01***	**0.03***

Zamzam drink (SD), Isostar drink (ID) and placebo (P)
** is the sign of statistical significance.*

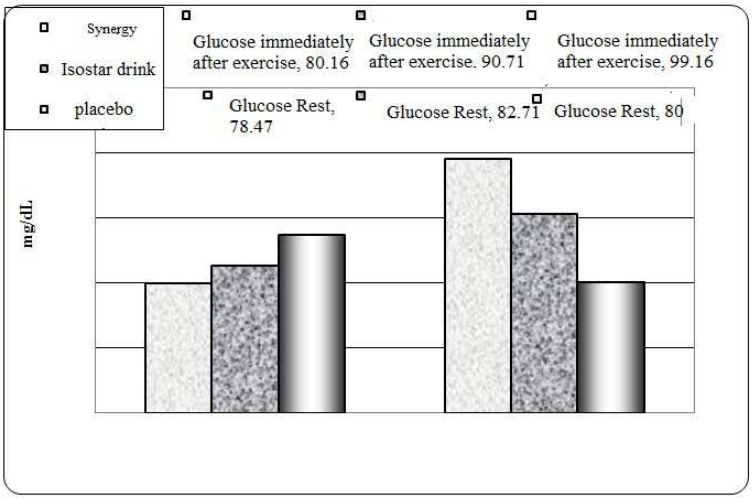

Figure 3: Comparison of blood glucose rest, after long-term intermittent exercise

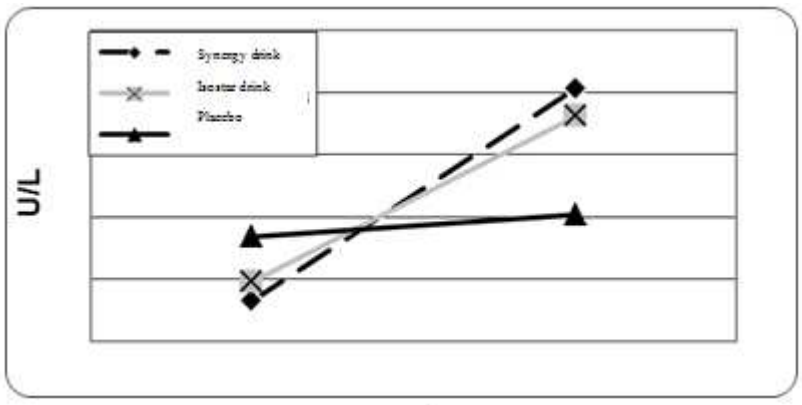

Figure 4: Comparison of blood insulin at rest and immediately after the long-term intermittent exercise

B) Blood metabolic response to short-term intermittent exercise blood (RAST):

Table 6 shows blood levels of glucose and lactate at the end of anaerobic exercise RAST test as mean ± standard deviation. The results of the ANOVA and post hoc test showed a significant increase in blood glucose levels 3 minutes after interval of three round of short-term RAST drink in SD and ID groups compared to placebo ($P \leq 0.05$).

However, no significant change was observed in ID group compared to SD drink (P>0.05). In addition, no significant changes were observed in glucose relax, blood lactate relax after short-term exercise RAST in SD and ID drink groups and placebo (P>0.05) (Tables 6 and 7) (Figure 5).

Table 6: Comparison of metabolic indicators in the short-term intermittent exercise (RAST)

Group	Variable	Relax	End of the first implementation of the RATS	End of the second Implementation of the RATS	End of the third Implementation of the RATS
		Standard deviation mean±	Standard deviation mean±	Standard deviation mean±	Standard deviation mean±
SD	**Glucose** mg/dL	**5.64±100.5**	**17.41*±0.16 126**	**7.39*±0.33 118**	**11.65*±0.16 115**
ID	**Glucose** mg/dL	**13.4±99.16**	**10.5*1±0.33 129**	**7.73*±122.33**	**5.6*±117.66**
P	**Glucose** mg/dL	**10.26±94.16**	**6.74±112.66**	**14.14±0.16 102**	**16.76±95.83**
SD	Lactate (mmol / l^{-1})	**0.37±1.18**	**1.44±10**	**0.91±11.3**	**0.83±12.93**
ID	Lactate (mmol / l^{-1})	**0.3±1.15**	**0.43±10.28**	**0.65±12.1**	**0.83±13.55**
P	Lactate (mmol / l^{-1})	**0.32±1.16**	**1.33±10.85**	**1.11±11.85**	**0.6±13.85**

Zamzam drink (SD), Isostar drink (ID) and placebo (P)
** is the sign of statistical significance.*

Table 7: ANOVA results of metabolic indicators of the end of the short-term intermittent exercise (RAST)

Statistic Variable	Change source	The mean squares	F	P	Statistic Variable	Change source	The mean squares	F	P
Glucose rest mg / dL	**Intergroup Intragroup**	**120.222 105.67**	**1.13**	**0.3**	Resting lactate (mmol / l^{-1})	**Intergroup Intragroup**	**0.00 0.11**	**0.01**	**0.9**
Glucose end of the first implementation of the RATST mg / dL	**Intergroup Intragroup**	**557.38 150.63**	**3.7**	**0.04**	The first implementation of lactate (mmol / l^{-1})	**Intergroup Intragroup**	**1 1.06**	**0.94**	**0.4**
Glucose end of the second execution RATST mg / dL	**Intergroup Intragroup**	**830.72 104.9**	**7.91**	**0.00**	The end of the second execution lactate (mmol / l^{-1})	**Intergroup Intragroup**	**0.72 0.67**	**1.07**	**0.3**
Glucose end of the third implementation of RATST mg / dL	**Intergroup Intragroup**	**1029.38 149.4**	**6.89**	**0.00**	The end of the third implementation of lactate (mmol / l^{-1})	**Intergroup Intragroup**	**0.95 0.55**	**1.71**	**0.2**

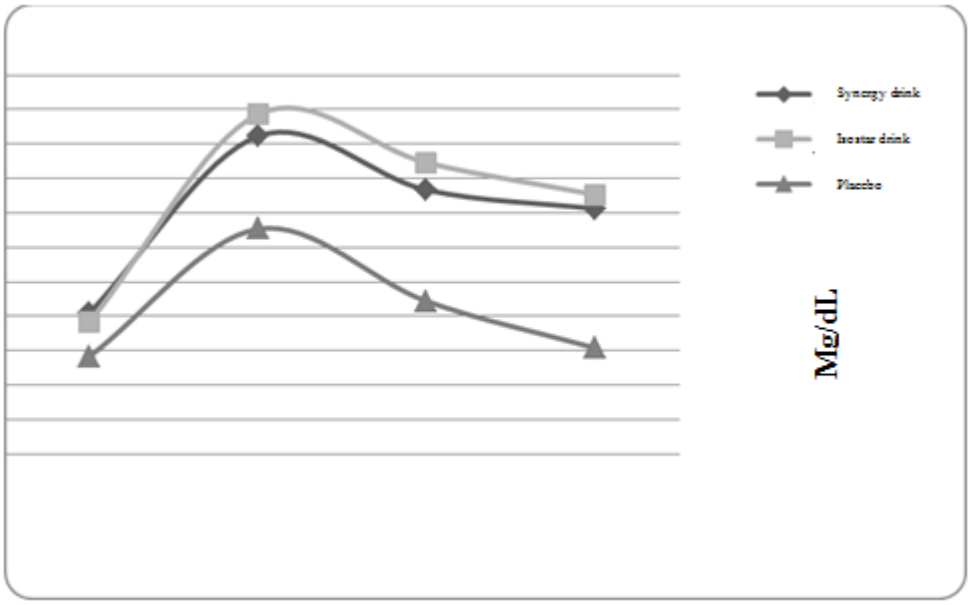

Figure 5: Comparison of blood glucose rest, 3 minutes immediately after each RAST test

Table 8: Analysis of variance between groups (LSD) metabolic parameters at the end of short-term intermittent exercise (RAST)

Statistic Variable	SD			P value		
	with SD ID	with SD P	with ID P	with SD ID	with SD P	with ID P
Glucose end of the first implementation of the RATS mg / dL	**7.08**	**7.08**	**7.08**	**0.4**	**0.05***	**0.02***
Glucose end of the second execution RATST mg / dL	**5.91**	**5.91**	**5.91**	**0.2**	**0.02***	**0.01***
Glucose end of the third implementation of RATSTmg / dL	**7.05**	**7.05**	**7.05**	**0.7**	**0.01***	**0.00***

Zamzam drink (SD), Isostar drink (ID) and placebo (P)
** is the sign of statistical significance.*

The results indicate a significant increase in levels of insulin and glucose in the blood sample immediately after long-term intermittent exercise in SD and ID groups compared to the placebo drink (P≤0.05). Moreover, significant increase in blood glucose levels with 3 minutes after three phases of short-term intermittent exercise RAST in SD and ID drink groups compared to placebo (P≤0.05). Most studies revealed a significant increase while drinking carbohydrate drinks compared to placebo or water in sport activities, especially activities in different models of long-term or high frequency. The research that has measured insulin levels after consumption of carbohydrate and carbohydrate-protein and glycogen depletion have reported results similar to the results of this study (24,17,6) .

Most soft drinks contained carbohydrates, which with increase in blood glucose and carbohydrate oxidation decrease hepatic glucose output that potentially guarantee blood glucose and muscle glycogen until the final stages of activity (24). Glycogen depletion causes restriction in runs and consumption of energy drinks in a period of recovery increases insulin levels and subsequently increases in glycogen in the reconstruction. Insulin is one of the anabolic hormones, which can inhibit protein degradation and increasing its synthesis (18).

By increasing insulin sensitivity muscle glucose uptake increases. Also, increase in the concentration of glucose transporters in plasma membranes of muscle is also considered (18, 12). Because of the importance and necessity of insulin in the replacement of muscle glycogen after exercise, researchers have focused on increased release of insulin in the period of recovery. Insulin is a hormone produced by the pancreas gland released in response to carbohydrate intake.

One of the main functions of insulin is to move glucose into the liver and muscle tissue to store it as glycogen. Insulin also has a role in stimulating the enzyme glycogen synthase that helps to build glycogen from glucose. Time is a key factor to replace muscle glycogen. During the first two hours post-exercise, muscle cells are sensitive to insulin. Assuming the availability of adequate carbohydrate, high insulin levels in the bloodstream after exercise speed up the transfer of glucose into muscle cells, which leads to accelerate the pace of glycogen building (24, 1) .
In this study, a non-significant increase in blood lactate was observed after the second half of the long-term intermittent exercise in SD and ID groups compared to the placebo drink (P=0.09). Moreover, a significant difference was not observed in blood lactate at first half of long-term intermittent exercise and blood at 3 minutes after three phases of short-term intermittent exercise (RAST) in the group of SD and ID drink compared to placebo. The results of this study was consistent with the results of Betty and colleagues (2007), Peterson et al (2007), Marjrson et al (2007), Davids et al. (2000) and Welch (2002) (29, 28, 26, 18), while Ivy et al (2002) reported reduction in blood lactate at 30.60 and the 120-minute recovery period intervals during a depletion of glycogen in the carbohydrate group (13).

It is believed that fatigue due to local metabolic factors such as lactic acid and depletion of phosphagen energy resources and possibly an increase in blood lactate showed an increase in fatigue. The research did not cite specific reasons on the mechanisms and causes of change or no change in blood lactate when taking carbohydrate drinks (18). Patterson et al (2007) cited the increase in lactate immediately after exercise as a reason to the efficiency, high intensity exercise and fatigue factor during drinking the mentioned carbohydrate drink (19). However, it is crucial to mention the role of organisms in absorption and excretion of lactate such as the heart, liver, kidney and even cell-to-cell organisms and inactive muscles and the effect of drinking in providing the required energy of these organism needs to be studied and work there.

CONCLUSION

Drinking the drinks made by Zamzam and Swedish Isostar companies have fairly similar improvements in exercise performance (time and intensity of the activity), blood glucose and insulin levels after a long interval. While in the short-term intermittent exercise (less time and fewer reps), no significant differences in performance (anaerobic power and fatigue index) and blood lactate was observed, although blood glucose levels increased.

Accordingly, production of domestic beverage with optimum nutritional quality can stop the tendency of coaches and athletes towards foreign drinks of similar or undesirable quality and using scientific-experimental strategies, one can move towards production of new and effective drinks.

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