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Acute and delayed Effect of Running and Drinking CHO supplement on IL-6 Serum in Men

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ABSTRACT

IL-6 production during exercise is influenced by exercise intensity and duration and low volume of muscle glycogen stimulates its production. The purpose of this study is to determine the acute and delayed effect of 60 minutes running and CHO intake on IL-6 Serum. Nineteen male subjects with the average age of 24.89 ±2.37, BMI 72.25±6. 97 kg, height 176.1 ± 4.60 cm, fat percentage, 5.80 ± 1.18 kg and Vo2max 56.40 ± 1.74 kg per liter/minute were placed in two CHO or PLA groups. Each of the subjects ran on the treadmill for 60 min with 80% MHR. 10 minutes before the exercise, immediately after the exercise and 24 hours after the exercise blood samples of were collected from the subjects. The subjects drank either of PLA or CHO drinks during exercise. Samples were analyzed by ELISA method. Data analysis was done in the form of descriptive and inferential statistical methods. To decide on affirmation or rejection of hypotheses, the significance level of 0.05 was considered. IL-6 Serum in both groups significantly increased under the influence of exercise and this increase was more sizable in PLA group CHO group and the difference was significant. 24 hours after exercise, IL-6 serum concentrations in the two groups were different but the difference was not significant. The results of this study show that in exercises affecting IL-6 serum concentration, glucose-containing supplements can prevent the increase of the concentration of this cytokine.

Keywords: IL-6, carbohydrate supplements, sub-maximal exercise

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INTRODUCTION

Sports and health professionals believe that exercise and immune system are closely interrelated. Cytokines' response to exercise is apparently complex and depends on such parameters as, exercise history, locality of measurement (tissue, blood, urine) and method of measurement [1]. In sports activities, plasma concentration of IL-6 increases more than other cytokines. IL-6 production during exercise is influenced by exercise intensity and duration and the low volume of muscle glycogen stimulates its production. During exercise the IL-6 derived from muscle is released in large volume in blood circulation and has a hormone-like function affecting the liver and visceral adipose tissue, therefore, during exercise helps to maintain vital to glucose balance and is an intermediary for exercise-induced stimulation lipolysis [2]. Information obtained from the Copenhagen Marathon 1996, 1997 and 1998, n = 56 shows that there is a reciprocal relationship between exercise intensity and the increase in plasma IL-6 [3]. Also the direct relationship between IL-6 and heart rate has been confirmed [4]. It has previously been demonstrated that IL-6 peak during exercise is correlated with plasma lactate levels

[4]. Several studies have reported that carbohydrate consumption during running and cycling reduces plasma IL-6 [5, 6]; in contrast, however, researchers in Melbourne, Australia [7] have reported that Plasma IL-6 was not affected by carbohydrate consumption during cycling exercise [6]. The same group further reported carbohydrate intake slows down increase in Plasma IL-6 in response to cycling and running [8]. When subjects exercised under depleted glycogen condition, an upward reaction was observed in the increase of Plasma IL-6 [9]. It is proven that an eccentric training method that increased CK levels 1000-fold only increased the Plasma IL-6 4-fold has which appeared with delay after a few days [2].

MATERIALS AND METHODS

Subjects: The statistical population of the study consisted of male students in undergraduate programs in Physical Education at the University of Imam Hussein (AS) in the second semester of the academic year 2008-2009 and the total number of them was 37 with a mean age was 24.89±2.37 years, BMI 72.25 ± 6.97 kg, height 176.1± 4.60 cm, fat percentage, 5.80 ± 1.18 kg and Vo2max 56.40 ± 1.74 kg of liters per minute.

Exercise program: before conducting the test, the subjects in both CHO and Pla groups were briefed on the objective and the method of study. The subjects were prohibited from doing any heavy exercise 24 hours before each test and they were advised strictly only to attend theoretical classes. The subjects were advised to use only the dormitory food, from 24 hours before the first bout of running until the end of the second bout, and take their night rest from 22.00 to 06.00. After 10 to 12 hours of night fasting the subjects participated in the test from 8 to 9:30 AM and 9 to 10:30 AM in form of groups of two. After a 10-minute break the first blood sampling was done by collecting 5 cc of blood from the brachial vena cava of the subjects and after 5 minutes they warmed up for 10 minutes which included 5 minutes of walking with 50% maximum heart rate and 5 minutes of running on the treadmill with 60% Maximal heart rate and after the warm-up the subjects an on the same treadmill for 60 minutes with 80% maximum heart rate. All the way through the exercise, subjects' heart rate was controlled by a heart rate meter manufactured by Polar Company, China. Subjects each drank 0.8 liters of beverages with a temperature of 3 to 5°C given to them four times; respectively at minutes 0, 15, 30, 45 of the exercise and the volume of each drink was about 0.2 liters. The CHO group drank 6% carbohydrate solution containing 48 grams of pure glucose with GIBCO brand produced in Canada and 0.02 ± 0. 75 liters of RO water treated at “Zamzam Tehran” Company which contained 20 ppm soluble solids and while the Pla groups only drank 0.8 liter of RO water. Immediately after the exercise, a second blood sample was taken from the subjects to compare changes in plasma IL-6 levels in the two groups; 24 hours later after identical eating and resting conditions, the subjects attended the test place and the test protocol of the day before was repeated. During the tests the ambient temperature was 21±2 and the humidity was 24±1.5. Blood samples were centrifuged for 10 minutes at the rotation speed of 4000 to 4500 rpm. Then the samples were poured in small 1cc tubes and were kept at -80 degrees centigrade until all samples were collected.

Statistical methods:
To ensure normal distribution of data and to evaluate the impact of changes of time and the groups, IL-6 variable Kolmogrov-Smirnov test was used. Paired t-test with Bonferroni adjustment was used for two-by-two comparison of times. Also, independent t-test was used for comparing the groups at any test point of time. The correlation of IL-6 variables in different time scales was tested with Pearson correlation test and Spearman’s rank correlation [10]. To decide about affirmation or rejection of hypotheses, the significance level of 0.05 was considered. SPSS 15 software was used for data analysis and Microsoft Excel 2007 software was used for drawing the diagrams.

RESULTS

60 minutes of running with 80 percent of maximum heart rate increases concentration of serum IL-6. This increase was significant in both CHO and PLA groups ($P<0.05$), but in the PLA group it had a greater increase and IL-6 concentration difference in between the two groups was significant ($P<0.05$). IL-6 concentrations were still higher than baseline concentrations in both groups until 24 hours after the first exercise and this difference was reported to be lower in CHO group, but the difference between the two groups was not significant ($P>0.05$). After the second bout of exercise, there was no significant difference IL-6 serum concentration in CHO and Pla groups ($P>0.05$) but the IL-6 of PLA group significantly increased after the second bout of exercise compared with that of before the the first bout while this amount was not significant in the CHO group. Table 1 shows the changes in serum concentrations of IL-6 of the two groups.

Table 1) concentrations of serum IL-6 in the three instances of blood sampling in CHO and Pla groups

instance of blood sampling	Group	Average pg ml-1	Minimum pg ml-1	Maximum pg ml-1	Standard deviation
IL6_T1 (Pg / ml.)	CHO	0.7150	0	1.8	0.23
	PLA	0.6150	0	1.6	0.11
IL6_T2 (Pg / ml.)	CHO	0.6300	0	1.7	0.14
	PLA	0.9175	0	2.3	0.23
IL6_T3 (Pg / ml.)	CHO	1.7150	0	2.8	0.26
	PLA	1.3313	0	2.7	0.31

** Data reported based on the mean and standard deviation.*

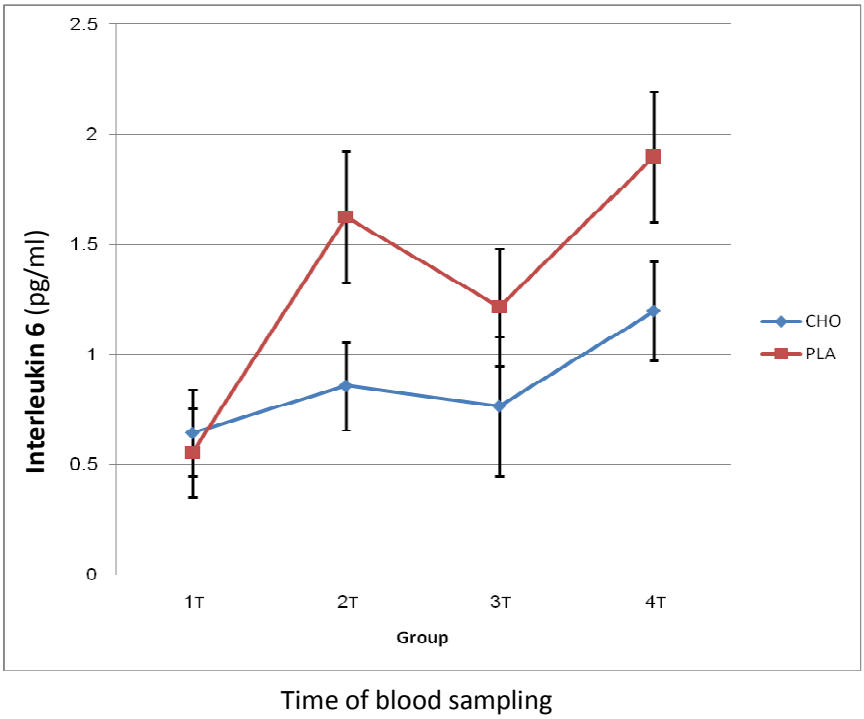

Fig 1: The change pattern on IL_6 in response to exercise test

DISCUSSION AND CONCLUSION

Based on the above discussion it can be concluded that serum IL-6 concentration would increase under the influence of 60 minutes running on the treadmill with 80% of maximum heart rate and CHO supplement is effective on decreasing the trend of Serum IL-6 concentration.

Accordingly, the impact of exercise on serum IL-6 among the researches conducted on sports immunology, the effect of eccentric exercise on plasma cytokine levels was explored [11]. Healthy moderately trained young men pedaled on the erogometer bike for one hour with 75% of maximum oxygen uptake. Plasma IL-6 levels significantly increased during exercise which is consistent with the results of this study. In contrast in a study with 12 subjects with the mean age of 30 years Rozendal at al (2004) found that after performing a low-intensity exercise session, regardless of increased IL-6 of muscle tissue, there were no significant changes in concentration of plasma IL-6 [12]. The difference between the findings of

the said study from those of this study can be caused by differences in the intensity of exercise in the two studies. The findings of Starkie et al (2001) shows that carbohydrate supplementation during exercise would slow down the increase of serum IL-6 concentration in humans [13] which is consistent with the findings of this study. In the mentioned study 7 moderately trained men were randomized into four groups and performed 60 minutes of exercise based on the individual lactate threshold; two groups by running on the treadmill and two by pedaling on ergometer bike. One of the two groups used carbohydrate beverage during exercise. The venous blood samples were collected at rest, 30 minutes after exercise (during exercise) and at the end of exercise. The research data showed that carbohydrate ingestion during both running and pedaling have prevented exercise further increase of plasma IL-6 concentrations prevented. In contrast Nyman et al (2003) reported CHO intake would have no significant effect in preventing the increase or decrease in IL-6 [14] which is inconsistent with the findings of this study. In the study of Nyman et al (2003) 30 power-trained subjects performed 2 hours weight training that is conducted where the first set was performed with 40% of one maximum repetition and the next ones were performed with 60% of one maximum repetition including 10 moves in 4 sets and 10 repetitions in each set with 2 to 3 minute intervals. CHO group of subjects drank 10 ml. kg-1.h-1 of 6% carbohydrate drink during exercise. Although the comparison of blood samples before and after exercise indicated a significant difference in levels of Serum IL-6 in both groups, but there was no significant difference in the IL-6 increasing trend in CHO and Pla groups [14]. Also in another study the effect of consumption of sugar drinks during 3 hours of cycling on serum IL-6 concentration was investigated in eight male subjects. The serum IL-6 concentration increased in response to exercise but carbohydrate intake significantly slowed down the increase of serum IL-6 levels in CHO group compared with the Pla by the end of the exercise [15]. In a study the effect of using CHO drink during two 90-minute bouts of cycling on the concentration of plasma IL-6 was investigated. Venous blood samples were taken from both groups 5 min before exercise, immediately after exercise and 18 hours after the second bout of exercise. The main findings of this study were that ingestion of CHO compared with Pla during the second exercise caused plasma glucose concentration to be maintained at better levels and slowed down the increase of plasma IL-6 concentration [9]. In other studies, IL-6 was not measured during running exercise but at some points of time after the exercise. Maximal levels of IL-6 were measured immediately after exercise, which indicated a rapid decrease [16, 17]. Also when the subjects performed 5 times of exercise on one leg, plasma IL-6 concentration reached a peak 90 minutes after exercise and remained elevated for 4 days [18]. When subjects exercised in a depleted glycogen state, an upward reaction was observed in Plasma IL-6 [9]. The results of study showed under depleted glycogen condition IL-6 expression occurs one hour earlier in the absence of glycogen depletion (control group) [19, 20].

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