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The effect of CHO supplementation on serum interleukin 6 during exercise in boy students

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ABSTRACT

Background and Objective: Fitness experts reported a close relationship between exercise and immunity system. The main purpose of this study is to evaluate the effect of carbohydrate (CHO) supplementation during 60-minute running with 70 percent Vo2max on the serum IL-6. Methods: Nineteen students from University of Imam Hussein (AS) with of 24.89 ± 2.37 year of aged participated in this study and divided into experimental (CHO supplementation) and control (placebo supplementation) groups by randomly. All subjects completed an exercise test for 60 minutes running with 70% Vo_2max on treadmill. Oral CHO or placebo supplementation ingested in 4 times: at first and in 15, 30 and 45 min of exercise test in experimental and control groups orderly. Blood sampling was performed before and immediately after each exercise test. Results: The findings show that serum IL-6 was increased after exercise test in two groups. But this increase was lower in experimental than control groups. Conclusion: CHO supplementation has an importance role in control IL-6 as inflammation cytokine during exercise.

Keywords: Interleukin-6, Carbohydrate supplementation, Exercise.

INTRODUCTION

Physical stresses affect the immune system reactions in various forms such as surgery, burns, air travel, and tissue lesions. Sports and physical activities can also cause virtually similar physiological responses. Changes in immunological markers caused by exercise depend on, age, sex, level of physical fitness and the duration, intensity and type of activity [1, 2]. Many of these changes remain constant for several hours or even several days after the exercise [3]. There are solution factors in the blood and other body fluids that can trigger a range of immune functions. The most important solution elements that have been studied in exercise immunology are immunoglobulin, glutamine and cytokines [4]. The Cytokines response to exercise depends on sports variables, inheritance, training, locality of measurement (tissue, blood, urine) measurement method [1]. In sports activities, plasma IL-6 concentration increases more than other cytokines. For example, following marathon IL-6 cytokines plasma concentration increased 100-fold [5], [6],[7]. Several studies have reported that carbohydrate intake during running or cycling, decreases plasma IL-6 [8]. Conversely; Australian researchers reported that plasma IL-6 was not affected by carbohydrate intake during cycling exercise [9]. Another research examined the effects of ingesting carbohydrate supplements during the second stage of two 90-minute cycling sessions. In above mentioned study,

venous blood samples were taken from both groups 5 minutes before exercise, immediately after exercise and 18 hours after the second exercise. The main findings of this study was that consuming carbohydrate compared with placebo during the second exercise session, caused plasma glucose concentration to be maintained at a better level; it also slowed down adrenaline response.

MATERIALS AND METHODS

Methodology

Subjects: This study consisted of boy students of physical education and sport science department (University of Imam Hussein University). A total 37 boy students with a mean age of 24.89±2.37, body mass of 72.25±6.97 kg, height of 176.1±4.60 cm, percentage of body fat 5.80±1.18 kg and Vo2max of 56.40±1.74 kg per liter per minute participated in this study. Table (1-3) shows the anthropometrical indexes of the subjects.

Exercise Program: Each participant received written and verbal explanations about the nature of the study before signing an informed consent form. The subjects were prohibited from doing any heavy exercise 24 hours before each test. Since they stayed at the dormitory, the subjects were advised to use only the campus meal plan from 24 hours before exercise test and to take night rest between 22:00 to 06:00. After 10 to 12 hours of overnight fasting the subjects were divided into groups of two and while still fasting attended the test venue between 8 to 9:30 AM and 9 to 10:30 am. After a 10-minute break 5 cc of arm vena cava blood was taken for the first time from the subjects and they had a 10-minute warm-up after 5 minutes including 5 minutes of running on the treadmill with 50 percent of maximum heart rate and another 5 minutes of running with 60 percent of maximum heart rate and then the subjects continued running for 60 minutes with 80% of maximum heart rate. At all times during exercise, subjects' heart rate was controlled by China Polar rate meter. Each of the subjects was offered 0.8 liter of drink at the temperature of 3 to 5 degrees Celsius which they drank four times respectively, at minutes 0, 15, 30, 45. The volume of each drink was about 0.2 Liters. The CHO group drank 6% carbohydrate solution containing 48 grams of pure glucose, GIBCO brand made in Canada and 0.75±0.02 liters of RO water purified in ZamZam Company which contained 20 ppm dissolved solids and Pla group drank only 0.8 liter of RO water. Immediately after the exercise, a second blood sample was taken from the subjects in order to compare changes in plasma IL-6 levels in the two groups. During the test the ambient temperature and humidity were 21±2 and 24±1.5 respectively. The blood was centrifuged immediately and stored at –80°C. Samples were centrifuged immediately for 10 minutes in 4000 to 4500 rpm in order to measure serum IL-6 levels.

Statistical analysis: All values are represented as mean ± SD. Data were analyzed by computer using SPSS software version 15.0. To ensure normal distribution of data and the effect of changes in the time and groups on IL-6 variable, Kolmogrov-Smirnov test was used. For binary comparison of times Bonferroni adjusted paired t test was used. Also to compare the groups at any given point independent t-test was used. All values are represented as mean ± SD. Data were analyzed by computer using SPSS software version 15.0. Also the relationship between IL-6 variables at given points of time was tested Pearson correlation test with Spearman rank correlation (Czar, 1998). The results were considered statistically significant for $p<0.05$.

RESULTS

There were no differences in plasma IL-6 concentrations between experimental and control groups in baseline (Table 1). Compared with preexercise in either exercise session, there were a significant increase in IL-6 in experimental and control groups. In fact, Based on the results of paired t-test after the first phase of 60-minute running with the 80 percent maximum heart with CHO intake IL-6 serum concentration represented significantly higher increase than the pre-exercise condition ($P<0.05$)

Table 1) serum IL-6 concentrations before and after exercise test in CHO and Placebo groups

Blood sampling times	*Group*	*Average pg ml $^{-1}$*	*Minimum pg ml $^{-1}$*	*Maximum pg ml $^{-1}$*	*Standard deviation*
IL6_T1 *(Pg / ml.)*	CHO	0.6450	0	1.6	0.64025
	PLA	0.5550	0	1.8	0.63035
IL6_T2 *(Pg / ml.)*	CHO	0.6000	0	1.8	0.61553
	PLA	0.8575	0	2.7	0.66241

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

Table 2) changes in serum IL-6 concentrations during 60-minute running phases with 80 percent of maximal heart rate in Placebo Group

Dependent variable	*t*	*df*	*P-value*
T1-T2	-4.367	7	0.003

Table 3) changes in serum IL-6 concentrations during 60-minute running phases with 80 percent of maximum heart rate in CHO Group

Dependent variable	*T*	*df*	*P-value*
T1 - T2	-2.767	9	0.022

DISCUSSION

Based on the presented discussions it can be concluded that IL-6 serum concentrations increases as a result of 60 minutes of jogging on the treadmill with 80% of maximal heart rate and the CHO supplementation is effective in reducing the increasing trend of IL- 6 serum concentration.

Therefore, as to the impact of exercise on IL-6 serum concentration among researches on exercise immunology, In a study [10] examined the effect of introverted exercise on plasma cytokine levels [10]. Healthy young men with moderate exercise cycled on ergometer for one hour with 75% maximum oxygen consumption. Plasma IL-6 levels significantly increased during exercise, which is compatible with the results of this study. In contrast in a study involving 12 subjects with mean age 30 years [11] showed after one a low-intensity continuous exercise session, despite the increase in muscle tissue IL-6, there was significant change in plasma IL-6 concentrations [11]. The difference with the findings of the study findings could be due to differences in the intensity of exercise used in the study. Also, as to the effect of two exercise phases on IL-6 serum concentrations [9] showed in a research that repetitive exercise phases has a significant impact on plasma IL-6 levels and IL-1ra which is compatible with the results of this study. In these studies they compared the effect of repeated prolonged bike exercise with the effect of an instance of prolonged cycling exercise on plasma IL-6. Nine well-trained men participated in four different tests with 12 to 17 days of intervals. The first test consisted of a two phases, the first one of which was conducted from 8.00 to 9.30 am and the second one began 6 hours later in the afternoon of the same day and continued for 90 minutes. The second test also consisted of two phases of exercise the first one of which was conducted from 11.00 am to 12:30 pm and the second after 3 hours in the afternoon of the same day. In the third test one phase of exercise was conducted in the afternoon and in the fourth test subjects just rested. All phases of exercise were done on the ergometer bike with 75 percent of Vo2max. In the end they concluded that endurance training on one day brings about significant increases in IL-6 and IL-1ra compared with a similar phase of exercise, which may be associated with depletion of muscle glycogen [12]. However, the results of [13] showed that 12 weeks of training although with increased strength and maximal oxygen consumption and decreased serum reactive protein C (CRP), does not significantly affect IL-6 serum concentration which is different from results of this study. The aim of the study was to evaluate the effect of 12 weeks of combined training (aerobic-resistance) with low intensity on concentration of inflammatory cytokines and CRP. The research subjects were divided into two groups; those with exercise and those with no exercise. Blood sampling was done before and after the training course and indicated that the concentration of IL-6 and IL-1 serums does not significantly change influenced by training [13], which is inconsistent with the findings of this study. Possible reasons for this discrepancy could be the duration and intensity of exercise, because in the present study, serum IL-6 concentration was examined during two 60-minute running phases with 80 percent of maximum heart rate, but in the study of [13] resting levels of IL-6 were evaluated after 12 weeks of combined (aerobic-resistance) exercise.

As to the effect of carbohydrate supplementation during exercise one exercise phase on serum IL-6 concentration; [14] stated in a study that carbohydrate ingestion during exercise can slow down the increase of serum IL-6 in the human [14] that the findings are compatible with the study. In the study, [15], 7 men with moderate exercise placed in four random groups performed a 60-minute exercise based on individual lactate threshold; two groups on ergometer bike and two groups ran on the treadmill. One of the two-fold groups used carbohydrate drinks during exercise. Venous blood samples were collected at rest, 30 minutes after starting the exercise (during the exercise) and at the end of exercise. The research data showed that carbohydrate ingestion during both running and cycling activities prevented higher increase of plasma IL-6 concentration. In contrast [16] reported CHO intake does not

have a significant effect on the prevention of increase or decrease of IL-6 [16] which is different from the findings of this study. In the research of [16] 30 subjects with strength training in two CHO and Pla groups performed a 2-hour weight training in which the first set was with 40 percent and a maximum repetition and the next sets were with the 60% one maximum repetition including 10 moves and 4 sets of 10 repetitions per set with 2 to 3 minutes of resting intervals between sets. Subjects of CHO group consumed 6% carbohydrate drinks during exercise at 10ml.kg-1.h-1. Although the comparison of blood samples before and after exercise, revealed significant differences in serum IL-6 in both groups, there was no significant difference between IL-6 increase trends in CHO and Pla groups.

Considering the effect of carbohydrate supplementation during two phases of exercise on serum IL-6 concentration, in a study involving eight male subjects [17] examined the effect of consuming carbohydrate drink during 3 hours of cycling on the concentration of serum IL-6. Serum IL-6 concentration increased in response to exercise, but carbohydrate intake significantly decelerated the increased serum levels of IL-6 in CHO group than in the Pla group by the end of exercise [17]. Also in a research [18] studied the effects of carbohydrate supplementation during a two-stage continuous cycling on immune system responses. First stage of the exercise was performed at 9.00 and the second one was performed at 13:30. Each stage consisted of 90 minutes of cycling with the 60% maximum oxygen consumption. Among the findings of the research was that CHO ingestion compared with Placebo ingestion slowed down the increase of serum IL-6 in the second phase of activity that is compatible with the findings of this study [18].

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