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EFFECTS OF CARBOHYDRATE WITH L-ARGININE SUPPLEMENTATION ON GLUCOSE LEVELS DURING RECOVERY TIMES AFTER MAXIMAL AEROBIC ACTIVITY

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ABSTRACT

The aim of this study was comparison effects of carbohydrate with L-Arginine supplementation on glucose levels during recovery times after maximal aerobic activity. Consequently, 12 females physical education students with mean age 21.33 years old, Height 165.42 cm, Weight 59.41 kg and mean body mass index 21.71 kg m^2 volunteered to participate in this study. Participants performed study protocols in the form of experimental and control groups within a week. In the control occasion, subjects performed maximal aerobic activity and then drink Carbohydrate supplement (1.1 g/kg glucose+ 200 ml of water). In the experimental occasion, after aerobic activity, carbohydrate with L-Arginine supplementation was drinked (1.1 g/kg glucose+ 0.13 g/kg L-Arginine + 200 ml of water). Blood samples were taken before and after exercise, 1, 2 and 3 h after supplementation. Data were analyzed by analysis of variance (ANOVA) with repeated measures using spss software. The results showed that supplementation carbohydrate with L-Arginine increased glucose ($p=0.003$), during recovery period after exercise. This study concludes that supplementation carbohydrate with L-Arginine increased glucose concentration during recovery period after exercise which can increase muscle glycogen synthesis during the recovery.

Keywords: carbohydrate supplementation, glucose, **insulin**, **L-Arginine**, **recovery**, **maximal aerobic activity**

INTRODUCTION

In the recovery period after exercise when carbohydrate is consumed, glycogen recovery rate directly is linked to insulin response to glucose [1]. Insulin increases glucose muscle transmission and muscle glycogen synthesis [2]. Therefore, any mechanism which increase insulin and insulin response to glucose, it can increase glycogen resumption after sport activity.

Floyd et al (1966) showed that intravenous infusion of the amino acid L-arginine increase insulin secretion in humans. Also has been shown that increase of glucose level with increase of signal caused by beta cells of the pancreas increase the insulin secretion [3]. Other performance of L-arginine is to produce nitric oxide that affects vascular smooth muscle contraction. Also, Lira and colleagues (2007) reported that nitric oxide increase GLUT4 expression in skeletal muscle [4]. It has been shown that increase of L-arginine level reduce the narrowing of the arteries and thus increase the muscle blood flow [5]. Due to the effects of L-Arginine on increase insulin secretion, increase muscle blood flow and increase GLUT4 expression through the production of nitric oxide, L-arginine can increase glucose uptake in human muscles. Increases of more plasma insulin have been reported after ingestion of dietary supplements containing high doses of L-arginine in humans [6]. There are many carbohydrate drinks in the market for carbohydrate resumption and to maximize muscle glucose in the recovery time. Beaumier *et al* (1995) showed that consuming high doses of L-arginine (25 grams per deciliter) for 7 days led to a significant reduction of sodium in urine and reduced water and body weight [6]. High doses of L-arginine are harmful and causes gastrointestinal upset in some people [7]. High doses of arginine can have a negative impact on metabolism and absorb of muscle glucose in the recovery time, thus, this research has investigated the effect of 0.31 grams per kg L-Arginine on concentration of glucose and insulin in the recovery time after activity.

Types of sport activity have different effects on glycogen resumption after activity. For example, long introspective activity causes depletion of muscle glycogen stores. If carbohydrates be available immediately after exercise, resumption of muscle glycogen stores quickly done [8]. But resistance activities haven't effect on muscle sensitivity to insulin [9]. Also extroverted resistance exercise caused muscle disorder in muscle glycogen resumption after activity [10]. So to answer this question whether carbohydrate supplement with L-arginine

on glucose serum concentration in the recovery time after maximal aerobic activity is effective or not?

METHODOLOGY

This is a quasi-experimental study. The participants in this study 12 female physical education experts' students of Islamic Azad University of Kermanshah who selected availability and voluntary. Subjects participated in university practical classrooms on a regular basis. Participants haven't medical history of any kind of illness, medication consumption or smoking. To get individual information, questionnaire of individual data was completed by subjects. First, entire protocol was explained to the participants to become familiar with goals, then each of the participants were completed a testimonial based on the satisfaction of participating in this research and then the body anthropometric characteristics such as height, weight and body fat percentage was recorded. Subjects after aerobic activity consumed carbohydrate supplement in addition to a certain amount of L-arginine (1.1 gr glucose + 0.13 gr/kg L-arginine + 200 ml of water; Zhang, 2011). At first, samples were taken at each meeting and then aerobic activity was conducted. After 250 ml of water and a half hours rest, the second blood sample was taken and then nutritional supplement was consumed (Robinson, 2003) And then, at one, two and three hours after the activity blood sample was taken (Figure 1). Aerobic activity included 10 minute warm-up and then running with 80 to 85 percent of maximal heart rate up to fatigue limit, finally, 10 minutes was considered as cooling. Heart rate before, during and after the activity was measured by using Polar wrist. To measure heart rate during activity, Polar wrist was closed to 4 People's hand. Three days before the execution of each step of the study, subjects were banned of consuming high protein meals such as meat and eggs. During the protocol implementation were given to subjects the same lunch meals and aerobic activity was conducted at 5 pm. During the recovery time, every half-hour 200 ml of water was consumed to prevent the impact of changes in plasma volume.

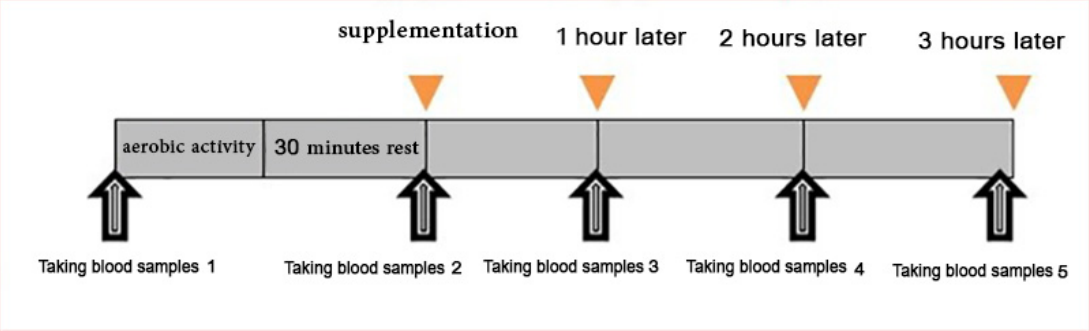

Figure 1: Timeline research at every stage

The inclusion criteria included, gender of female participants, having public health, not using of any tobacco substance and not having any kind of disease by using medical examination and questionnaire.

Exclusion criteria included abandoning the subject of research with the absence, being disease and severe physical injury, Use of any medications during the study, having extreme sports activities in the three days before and during the study, consumption of high-protein meal three days before the execution of each step of the research and drug consumption during the last month.

The instruments included digital scale for weighing; calipers to measure subcutaneous fat; Polar wrist to measure heart rate; anthropometric ruler to measure the height (height gauge); Syringes, garo, alcohol and test tube for taking blood samples; centrifuge to centrifuge the blood sample; lab kits for the measurement of blood glucose and insulin levels. Height gauge were used to measure the height of subjects. Height subjects was measured without shoes, while the legs are attached, hips, shoulders, head rear was in contact with Gauge height. Weight subjects were measured with light clothing, without shoes and by using Seca digital scale made in Germany. Body Mass Index (BMI) was calculated by dividing weight (kilograms) to height (meters) square. To measure subcutaneous fat was used calipers harpenden (company Indictors England) with one mm wrong. Subjects subcutaneous fat at three points triceps brachia, thigh and above pelvis on the right side of the body and after insertion into the general equation Jackson- Pollock for women (equation 3-1), total body density and body fat percentage were determined by using Siri equation (equation 3-2) (Gene. M. Adams, 2011). Samples were taken from hand in the sitting position. First, with disinfection of sample location by 96% alcohol, 2 ml of blood were taken from vein ulna. The blood was placed slowly on the glass tubes and allowed to coagulate completely at room temperature. After clotting, tubes was placed within centrifuge device with 3000 revolutions per minute for 15 minutes. Serum at -70 frozen and saved for next analysis. Concentration fasting glucose serum (milligrams per deciliter) were measured by glucose oxidase method and using a kit of Pars Azmoon Company, made in Iran and auto analyzer photometer made in Germany Model (CHEm5v3). Carbohydrate supplements in addition to L-Arginine included 1.1 grams of glucose + 0.13 gr/kg L-arginine + 200 ml of water with 5 drops flavors liquid of banana. L-arginine pill contained one hundred percent L-arginine manufactured by Puritan Pride, made in America. To evaluate the normal

distribution of data was used Kolmogorov-Smirnov test. Using analysis of variance with repeated measures were evaluated, time effect and time interact × group. To find the difference among the groups was used Bonferroni post hoc test. SPSS 18 software was used to analyze the data. The significance level was selected less than 0.05.

RESULTS

The mean and standard deviation of research variables in study steps are shown in Table 1.

To compare the carbohydrate intake in addition to L-arginine on glucose levels in recovery times after activity on glucose concentration at different times was used analysis of variance with repeated measures (Table 3).

Results Table 4-7 shows the difference between the glucose concentrations at different times is statistically significant. Therefore, null hypothesis will be rejected. Means, blood glucose concentration at different times of recovery times after carbohydrate intake in addition to L-arginine, the difference is significant. To evaluate location of difference was used Bonferroni post hoc test (Table 4).

As shown in Table 4, glucose concentration reduced significantly after activity, One hour after taking supplements increased but statistically was not significant, At 2 and 3 hours after taking supplements significantly increased. Diagram 1 shows the difference in glucose concentration at different time.

Table 1: Descriptive characteristics of subjects

	The mean and standard deviation	minimum	maximum
Age(years)	21.33±1.37	19.00	23.00
Height(centimeters)	165.42±3.05	161.00	170.00
Weight(kilograms)	59.41±2.5	57.00	65.00
Body mass index (kg m)	21.71±0.59	20.76	22.76
Fat percentage	16.87±0.72	15.60	18.00

Table 2: Mean and standard deviation of research variables in study steps

variable	Before activity	After activity	1 hour	2 hours	3 hours
Glucose (mg/dl)	76.91±6.97	73.33±5.59	76.58±8.31	83.66±4.33	83.75±7.13

Table 3: Results of analysis of variance test with repeated measures for comparing the glucose concentration in the experimental stage 2

	Degrees of freedom	F	P
time	4	8.256	*0.0001

Table 4: Results of Bonferroni post hoc test to compare glucose concentration in the experimental stage 2

	3 hours	2 hours	1 hour	After activity
Before activity	MD= -6.833 P=0.735	MD= -6.75 P=0.065	MD= 0.333 P=1	MD=3.583 P=0.001*
After activity	MD=-10.417 P=0.053	MD= -10.333 P=0.001*	MD= -3.250 P=0.230	
1 hour	MD= -7.167 P=0.524	MD= -7.083 P=0.167		
2 hours	MD=-0.083 P=1			

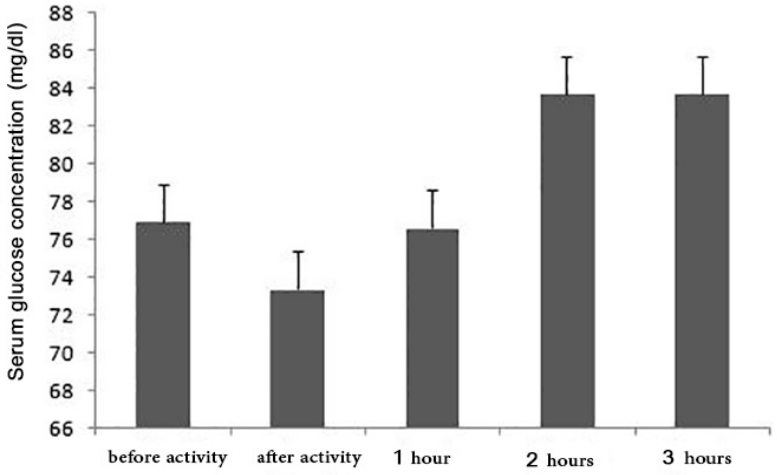

Diagram 1: serum glucose concentration at different time

DISCUSSION AND CONCLUSION

In this study, it was found that taking carbohydrates supplements in addition to L-arginine in the recovery period increased glucose levels in 2 and 3 hours after carbohydrate intake. In this regard, our findings with the results of Tsai and colleagues study (2009) is consistent with the results of Robinson study (2003) is inconsistent.

Cause of disparity of present study with Robinson and Associates study can be the amount of used L-Arginine. So that L-arginine used in Robinson study was powder and its amount 10 grams, while in the present study was used 0.13 g/kg L-arginine pill (one hundred percent). In Tsai study, L-arginine is used alone and it wasn't along with carbohydrates, but nonetheless increased glucose levels in the recovery period after activity. Cause of compatible of Tsai [11] study with results of present study can be duration and intensity of activity and readiness of subjects. Activity of Tsai study was 60 minutes at 70 in the maximum oxygen consumption (about 82% of maximum heart rate) and subjects had practiced that has many similarities with present study.

REFERENCES

[1] Zawadzki KM, Yaspelkis BB 3rd, Ivy JL. (1992). Carbohydrate-protein complex increases the rate of muscle glycogen storage after exercise. J. Appl. Physiol. 72:1854 – 1859.

[2] Rodnick KJ, Piper RC, Slot JW, James DE. (1992). Interaction of insulin and exercise on glucose transport in muscle. Diabetes Care. 15(11):1679-89.

[3] Robinson TM, Sewell D, Greenhaff PL. (2003). L-Arginine Ingestion after Rest and Exercise: Effects on

Glucose Disposal. Med Sci Sports Exerc, 35(8):1309-1315.

[4] Lira VA, Soltow QA, Long JH, Betters JL, Sellman JE, Criswell DS. (2007). Nitric oxide increases GLUT4 expression and regulates AMPK signaling in skeletal muscle. Am J Physiol Endocrinol Metab, 293:E1062-1068.

[5] Tang JE, Lysecki PJ, Manolakos JJ, MacDonald MJ, Tarnopolsky MA, Phillips SM. (2011). Bolus Arginine Supplementation Affects neither Muscle Blood Flow nor Muscle Protein Synthesis in Young Men at Rest or After Resistance Exercise. The Journal of Nutrition, 195-200.

[6] Beaumier L, Castillo L, Ajami AM, Young VR. (1995). Urea cycle intermediate kinetics and nitrate excretion at normal and "therapeutic" intakes of arginine in humans. Am. J. Physiol. 269:E884 – E896.

[7] Gater DR, Gater DA, Uribe JM, Bunt JC. (1992). Effects of arginine/lysine supplementation and resistance training on glu-cose tolerance. J Appl Physiol. 72(4):1279-84.

[8] Ivy JL, Goforth HW Jr, Damon BM, McCauley TR, Parsons EC, Price TB. (2002). Early postexercise muscle glycogen recovery is enhanced with a carbohydrate-protein supplement. J Appl Physiol 93: 1337–1344.

[9] Chapman J, Garvin AW, Ward A, Cartee GD. (2002). Unaltered insulin sensitivity after resistance exercise bout by post-menopausal women. Med. Sci. Sports Exerc. 34:936 –941.

[10] Pascoe DD, Gladden LB. (1996). Muscle glycogen resynthesis after short term, high intensity exercise and resistance exercise. Sports Med. 21:98 –118.

[11] Tsai PH, Tang TK, Juang CL, Chen KW, Chi CA, Hsu MC. (2009). Effects of Arginine Supplementation on Post-Exercise Metabolic Responses. Chin J Physiol, 52(3):136-142.