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The Alterations of Some Pancreas Gland Hormones after an Aerobic Strenuous Exercise in Male Students

M. Javad Pourvaghar, A. Reza Shahsavar

***Abstract*—The alterations in pancreas gland secretion hormones following an aerobic and exhausting exercise was the purpose of this study. Sixteen healthy men participated in the study. The blood samples of these participants were taken in four stages under fasting condition. The first sample was taken before Bruce exhausting and aerobic test, the second sample was taken after Bruce exercise and the third and forth stages samples were taken 24 and 48 hours after the exercises respectively. The final results indicated that a strenuous aerobic exercise can have a significant effect on glucagon and insulin concentration of blood serum. The increase in blood serum insulin was higher after 24 and 48 hours. It seems that an intensive exercise has little effect on changes in glucagon concentration of blood serum. Also, disorder in secretion in glucagon and insulin concentration of serum disturbs athletes' exercise.

***Keywords*—Intensive Exercise, Bruce Protocol, Glucagon, Insulin

I. INTRODUCTION

INSULIN is produced as a prohormone in pancreatic islets from the insulin gene, located on chromosome 11 in humans [1]. Exercise can improve skeletal muscle lipid metabolism, induce mitochondrial biogenesis [2].

Intervention studies in adults have shown that weight loss and exercise training may improve insulin action on target tissues [3, 4]. It is of interest that aerobic exercise training may improve insulin sensitivity even without body weight loss [5, 6].

During strenuous exercise, or in prolonged light exercise, insulin levels fall significantly and glucagon concentration rises [7]. Even in these circumstances, the precise role of these changes in maintaining glucose homeostasis is not clear. In humans, if glucagon is free to change [7], a fall in insulin concentration is not necessary to maintain normal blood glucose concentration during exercise. This observation, however, made in studies of insulin-dependent diabetics, did not encompass the effects of simultaneous changes in insulin and glucagon in normal subjects [7].

M. J. Pourvaghar, Physical Education Department, Km 6 Ravand Road, University of Kashan, Kashan I. R. Iran (Postal Code : 87317-51167; 0098 361 5912561; e-mail: vaghar@kashanu.ac.ir).

A. R. Shahsavar, Physical Education Department, Payame Noor University, 19395-4697 Tehran, I.R. Iran (Postal Code: 1955754345; 0098 2122450545; e-mail: shahsavar6@gmail.com)

During exercise, hepatic glycogen stores are mobilized and gluconeogenesis is accelerated to help meet the increased energy demands of working muscle [8].

Research has shown that exercise training can reduce fasting insulin levels and insulin resistance in adults with and without type 2 diabetes [9, 10, 5]. The finding strongly supports the view that chronic exercise increases the sensitivity of the liver to glucagons [11]. The main purpose of present study was to find out the changes in hormones secretions of pancreas gland in order to know whether strenuous aerobic exercises can change glucagon and insulin hormones or not. Also, this study took blood samples two days after strenuous aerobic exercises.

II. PROCEDURE

This quasi-experimental research was conducted with 16 healthy male athlete students as research participants. The participants' health was surveyed by a questionnaire. All the participants filled in a questionnaire on health and have expressed their consent for their participation in this study. The survey showed that they were all healthy and they did not suffered from diabetes by inheritance. Participants' age, height, weight and body mass index (BMI) were respectively as follows; (21.09±1.34), (173.84±2.28), (76.3±4.25) and (22.4±2.34).

All the participants were present in sport physiology lab in the morning of the testing day. First, their systolic and diastolic blood pressures were measured and recorded. Three cc of blood was taken from each participant's elbow vein. Then each participant ran on treadmill model h/p/cosmos Para graphic made in Germany and they performed Bruce exhausting aerobic running test. They promised to perform this test to their exhaustion. The participants' Maximum Oxygen Consumption ($VO_{2\ max}$) was calculated according to the duration and stages of aerobic test. Then an immediate sample of their blood was taken. They were asked not to use any drug during the test. Also, they were ordered not to do any difficult exercises. Later, the participants were sent to blood lab and the third and forth stage of blood testing carried on. They were resting when they were blood tested. Their blood was held in lab condition and was properly analyzed. For serum insulin and glucagon analysis, the Chemiluminescence method was used.

The data collected in these 4 stages were analyzed using SPSS. The statistical procedures such as repeated measure and paired samples t-tests were used for the comparison between blood samples in 4 stages of blood testing.

III. RESULTS

The results of blood samples analysis are presented in tables 1. Serum insulin was measured according to microgram IU divided by milliliter (mic IU/ml).

TABLE I
MEAN AND STANDARD DEVIATIONS OF INSULIN (MIC IU/ML), GLUCAGON (PG/ML), AND P VALUES

	Variables (M±SD)	Variables (M±SD)	T Value	P Value
Insulin Stages (mic IU/ml)	[a] I S 1, 3.35±0.97	I S 2, 9.3±7.09	2.57	0.03
	I S 1, 3.35±0.97	I S 3, 4.4±3.51	1.07	0.311
	I S 1, 3.35±0.97	I S 4, 5.9±2.77	3.327	0.009
	I S 2, 9.3±7.09	I S 3, 4.4±3.51	2.361	0.043
	I S 2, 9.3±7.09	I S 4, 5.9±2.77	1.438	0.184
	I S 3, 4.4±3.51	I S 4, 5.9±2.77	1.348	0.211
Glucagon Stages (pg/ml)	[b] G S 1, 61.25±6.06	G S 2, 56.14±8.77	2.60	0.029
	G S 1, 61.25±6.06	G S 3, 52.62±8.01	3.97	0.003
	G S 1, 61.25±6.06	G S 4, 49.35±8.33	5.89	0.0001
	G S 2, 56.14±8.77	G S 3, 52.62±8.01	1.27	0.374
	G S 2, 56.14±8.77	G S 4, 49.35±8.33	3.69	0.005
	G S 3, 52.62±8.01	G S 4, 49.35±8.33	0.98	0.351

[a] Insulin Stage 1, [b] Glucagon Stage 1

Also, the four samples of the participants' serum insulin were compared. As shown in table 1, there was a significant difference between serum insulin before and after intensive aerobic exercise (P=0.03). However, this difference was not statistically significant between second and third stages (P=0.043).

Serum glucagon was measured according to pg/ml unit. The comparison between the first stage and the second stage before and after aerobic exercise revealed a significant difference in serum glucagon (P=0.029), (t=2. 602).

The observed difference between the first testing stage and the third testing stage, with 24 hours interval turned out to be statistically significant (P=0.003), (t=3.97). Furthermore, the results of the second stage which was after aerobic exercise and the forth stage which was 48 hours after exercise were statistically significant (P=0.005), (t=3.699). The observed difference between the first stage and forth stage also proved to be significant.

IV. DISCUSSION AND CONCLUSION

The results showed that a little amount of change in these hormones causes extensive changes in foodstuff metabolism, lipids, proteins and carbohydrates [6]. So, awareness of such changes is really vital for coaches and athletes. In the present study, the average 15.35 minutes was calculated for running. The result of the analysis of serum insulin indicated that there is a significant difference in their serum insulin following an intensive and exhausting exercise. For example, there was a statistical significant difference in serum insulin before and after exercise (P=0.03). So, it can be concluded that an intensive exercise can cause a significant change in insulin. This study indicates that the amount of insulin increases to 177.6% mic IU/ml after an exercise. The present research confirms Nassis et al. (2005), study who argued for the effectiveness of exercise on the amount of insulin. They pointed out that insulin can have a better function on target tissues [12].

Insulin controls gluconeogenesis by decreasing the amount of liver enzymes. On the other hand, this study is not compatible with wolf et al. (1986). They showed that exercise stimulates metabolic changes in athletes and decreases insulin and increases glucagon and growth hormones [7]. This research confirms the results of Bonjorn et al. [2002]. He reported that after an acute and chronic activity, liver cells become sensitive toward insulin and glucagons [11]. Reduction in the participants' serum glucagon was statistically significant (P=0.022). This decrease was 8.34 pg/ml and did not continue after 24 hours, but a comparison between the second stage (56.14), and the forth stage (49.35) showed a significant decrease of glucagon (P=0.005). It seems that the concentrations of the participants' serum glucagon changes and its decrease after 48 hours are due to the interaction between insulin and glucagon which stabilizes glucose homeostasis to remain at appropriate level. Obviously, the observed differences in these two hormones are constant for two days after performing exercises. It is worth mentioning that the exercise intensity is the most important factor. As a result, different exercises cause changes in pancreas gland hormones. Also, the amount of exercise duration and intensity lead to a variety of responses in insulin and glucagon hormones secretion. The hormones' response is reverse so that the concentration level of blood glucose can stand of fixed level. Human brain uses blood glucose to for performing vital activities. Two days after exercise, the changes remain in these hormones.

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