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Effects of endurance training on ATP in male rats

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ABSTRACT

In the recent decades development in studies in the field of immunology and hormonal by sport science researchers has increased. And also by the significant interaction between the immune and hormonal systems and physical activities, person will be affected by hormonal and safety changes so the interaction between systems and their changes after physical activities is important for the researchers and it can be useful for athletes health improvement and health of general population. As long as the subjects ofthe different groups of this research were rats, which were in a controlled environment and at a pre and post planned test, under the effects of independent variable [8-week exercise program], so there search method is experimental. In the present research, after the initial agreement, fourteen 3-month-old male Wistar rats were obtained from the Pasteur Institute Centre ofAmol. Variables measured in the exercise and control groups were compared and then the descriptive and inferential statistics were used to analyse the hypothesis test. Natural distribution of data measured by the Kolmogorov Simonov test, and the statistical analysis of the data performed using the software SPSS version 16 by the ANOVA test through repeated measurements based on the normal distribution. To compare variables between the two groups of the t test was used. The significant level for all calculations was considered as p <0.05. The results show that an eight-week endurance training can be considered as an effective factor for the immune and humoral system. Endurance exercise seems to be effective on plasma levels of IL-6 in male rats. The results of this study can be considered as a potential candidate to change the size of IL-6 in plasma of rats, and despite minor differences in the effects of endurance exercises on insulin of male Wistarrats, these results should be carefully considered and analyzed.

INTRODUCTION

In the recent decades development in studies in the field of immunology and hormonal by sport science researchers has increased. And also by the significant interaction between the immune and hormonal systems and physical activities, person will be affected by hormonal and safety changes so the interaction between systems and their changes after physical activities is important for the researchers and it can be useful for athletes health improvement and health of general population [1]. A few years ago level of sports performance was difficult to imagine but now is commonplace and the number of athletes who are able to obtain most of the results increased day by day. This question may arise that what are the reason of these developments? Its clear that there is no easy answer for this question but we can say that sport is a struggle and high motivation made them work hard. And also coaching has a

growth because of correlations and participation of sport science experts.Todays broad scientific studies about athletes are provided which directly reflected in method of exercises. Sport scienceprogressived from descriptive to scientific. Because endurance training cause metabolic energy, the question which always is asked in researches is that why endurance training need more energy than other exercises? As you know the duration of endurance training is more than speedy training. Research carried out by GhanbariNiakiconfirmed this statement that long duration exercise with the intensity of 60 ta 80% Vo2max, especially if last one or more weeks, supply energy of cells [including ATP & glycogen] will decreased and disposed [12]. Woods and colleagues also concluded that there must always be a balance between energy [between intake and cost of energy] so that weight as a simple index cancels the enery balance in a long period of time remains constant otherwise the balance will be disturbed and plus or lose of weight will accur[1].

Result of this research helps coach and players to players with the lowest cost of energy perform perfect. And which place is better to exercise to save the standard norm of density of these factors? And do we have changes in factors after 8 weeks?

ATP

In general, energy is use for force, energy and power but in sport concepts energy means the ability of doing physical works. Energy which is derived from burning food cannot be directly use for muscle contraction but first make a chemical called adenosine triphosphate which is shown as ATP. This article is available in stores in muscle cells and use as fuel. ATP is a complex combination of an adenosine molecule and three groups of phosphates. Energy formation of this compound is related to link of phosphate groups and adenosine. It means that by breaking any of the links which are high energy links, released a group of phosphate and a lot of energy so that it will obtained 8000 to 12000 calories from whole molecule [9]. We need energy to rebuild ATP and it's not strange because ATP analysis release energy. In the other words storage of ATP in muscle cells depend on its rebuild and need energy so that there are 3 systems which provide energy for muscle cells

1.ATP-PC system or Phosphagen: in this system energy needed for rebuilding ATP provide for analysis of creatine phosphate combination. Creatine phosphate like ATP stored in muscle cells. Because ATP and PC have a phosphate group called them phosphagen.PC like ATP when a phosphate groups is removed a large amount of energy is released and the final product of this analysis is creatine and inorganic phosphate. This energy immediately will available for cells and rebuild ATP [3,11,15].

PC→PI + C + energy
energy + ATP + PI→ATP

2.Lactic acid system: this system involves a partial decomposition of carbohydrates into lactic acid. Lactic acid is one of the products of anaerobic glycolysis and lactic acid and when a large amount stored in the muscles and blood made muscles tired [2].

During exercise production of good ATP from glycolysis is less that 3 mol and its because in frustrating exercise muscles and blood just can tolerance concentration of 60 to 70 grams of lactic acid before fatigue; and if all 180 grams of glycogen analyze during anaerobic training will poduce 180 grams lactic acid so 1 and 1.2 mol ATP can reach severe fatique[11].

$[\mathrm{CO}H_{12}\,O_6]_n \rightarrow 2C_3H_6O_3$ +energy
(Glycogen) (lactic acid)

energy + 3ADP + 3PI→3ATP

3. ATP aerobic system: in presence of oxygen one mole of glycogen completely decomposed into anhydride carbonic and release sufficient energy to reconstruct 39 molATP[2].

Several reaction of the aerobic system can be devided into three main categories:
1. Aerobic glycolysis 2. Kerbs cycle 3. Electron transmission system

Aerobic glycolysis: the first batch of reaction in analysis of aerobic glycogen to CO2 and H2O is glycolysis. In presence of oxygen lactic acid cannot concentrate. Oxygen can do this by diverting much of lactic acid production ,pyroic acid to aerobic system after rebuilding the ATP.

Kerbs cycle: pyroic acid which is result of aerobic glycolysis after some chemical changes enter to carbon cycle. In this cycle two chemical phenomena will occur: release of CO2 which is because of release from lungs and oxidation which means release of hydrogen ions and electrons which will enter electron transport system to chemical changes[14].

Electron transmission system: released hydrogen ions (H+) and electrons (e-) from carbonic cycle on entering the electron transmission system have a high energy level and two major disaster will occur, first hydrogen ions and electrons transferred to oxygen by electron carriers to produce water by some enzymatic reactions, second in the time of first incident, ATP in coupled reaction will be reconstructed by released energy and will reconstructed for each pair of coupled electron by released energy and for each pair of transmitted electron 3 mol ATP will be produce [14,10.2].

Estensberg and coworkers [2002] evaluated releasing IL-6 and TNF-a from human contracted skeletal muscles. Six healthy men 180 min workout stretching the knee with legs. Sample of muscles was from side wide muscles and also blood samples were from arteries and veins. Plasma was analyzed for IL-6 and TNF-a. But they find IL-6 and MRNA TNF-a in other muscle samples which IL-6 increased 100-fold during exercise (p<%5). And there was no increase in MRNA TNF-a and TNF-a of plasma dosent increase during exercise. Also there was no TNF-a release before or during exercise but IL-60 increase in plasma during exercise and IL-6 releasing after 120 min exercise was observed (p<%5)[6].

Estensberg and coworkers [2002] examined the effect of interleukin-6 in the contracted skeletal muscles of human which increase the exercised which are decreased. This study was conducted on six healthy men which exercised one leg with knee strain for 5 minutes in W25 and have 40% power and find out arteriovenous differences in exercise and rest and during exercise and before it. Leg blood flow was measured by Doppler ultrasound technique but IL-6 was measured by evaluation and assessment of antigen bound to the anzyme[ELISA]. The result was that density of plasma IL-6 increase19-fold in comparison with rest time. IL-6 releasing from this muscle during 2 hours after exercise increase 17-fold from density increase of IL-6 and in 5 hours exercise, releasing in 1 minutes was half of IL-6 in plasma[7].

Estensberg[2]in his study concluded that IL-6 is like a energy sensor in muscle cells. Also other organs release IL-6 during exercise. But IL-6 which is derived from muscles play an important role in relation between this muscles and other organs to save and provide energy. IL-6 can increase plasma cytokine of IL-lra and IL-10 and cortisol and blood netrophil. And also observed transmission to Th2 WBS can decrease by IL-6. This study can prove that carbohydrate injection during exercise can remove the effect of IL-6 [5].

MATERIALS AND METHODS

As long as the subjects of the different groups of this research were rats, which were in a controlled environment and at a pre and post planned test,under the effects of independent variable [8-week exercise program], so theresearch method is experimental. In the present research, after the initial agreement, fourteen 3-month-old male Wistar rats were obtained from the Pasteur Institute Centre of Amol.

After completion of training and 48 hours after cessation of exercise, and after 4 hours of fasting from food, the rats were anesthetized by intraperitoneal injection of a mixture of ketamine and xylazine. The liver tissue was cut off immediately and placed in liquid nitrogen and then the tissue were homogenized with 17 mm phosphate buffer and with a speed of 8000 rpm. The blood samples centrifuged immediatelyfor 10 min at 1500 rpm.The plasma transferred in special micro tubes[3 samples of each]and became frozen in liquid nitrogen, and was maintained for subsequent measurement in the freezing of the temperature of -80° c.to avoid the evening effects, sampling began from 8 am and was completed 11:30 am.ATP measurement :ATP was measured [adenosine triphosphate] by byafyn kit and biolofianse method of Germany.Variables measured in the exercise and control groups were compared and then the descriptive and inferential statistics were used to analyse the hypothesis test. Natural distribution of data measured by the Kolmogorov Simonov test, and the statistical analysis of the data performed using the

software SPSS version 16 by the ANOVA test through repeated measurements based on the normal distribution. To compare variables between the two groups of the t test was used. The significant level for all calculations was considered as $p < 0.05$.

CONCLUSION

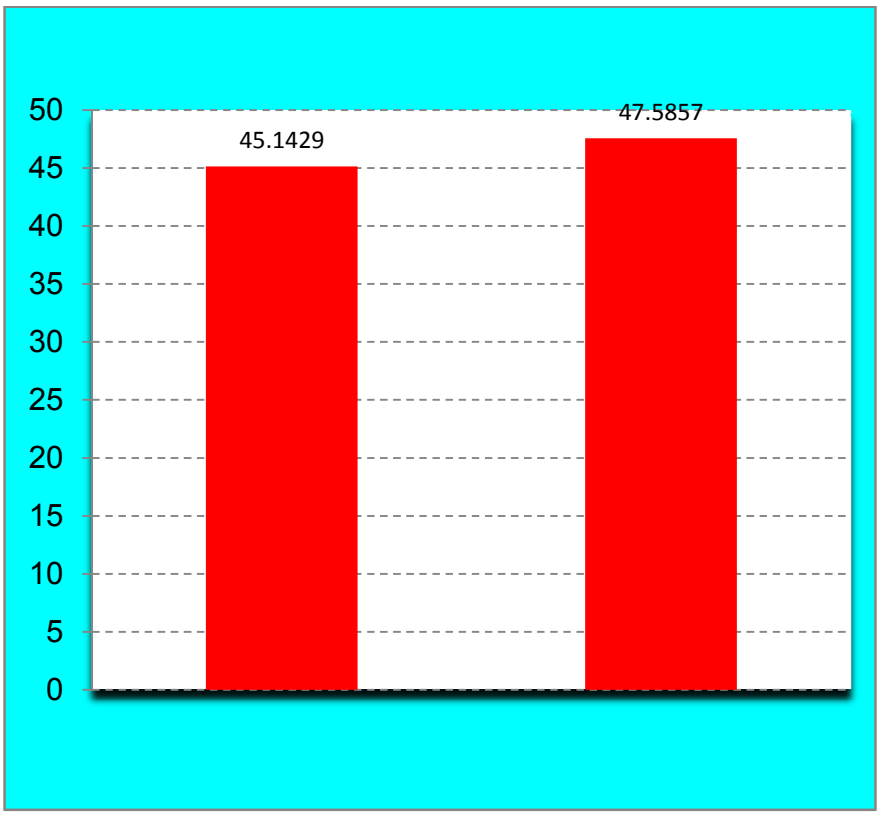
Forth hypothesis: there is a meaningful difference between adenosine triphosphate (ATP) of trained and untrained male rats plasma.

Zero hypothesis(H0): there is no meaningful difference between density of adenosine triphosphate (ATP) of trained and untrained male rats plasma.

Table 1.independent t test to compare adenosine triphosphate of plasma of trained and untrained rats

Result	Significance level	Degrees of freedom	t	Standard deviation	average	variable / group
not rejected the zero hypothesis	0.291	12	-1.106	3.24	45.14	Control group
				4.86	47.59	Training group

Referring to table (1)and t and significance level in independent t-test we cant reject H0 so 8 weeks endurance exercise has no meaningful effect on ATP of male rats plasma ($p \geq 0.05$).



Figure(1).Comparison of ATP (micromole) of trained and untrained male rats.

As you see in the figure 2, ATP of trained male rats plasma in a little more than untrained male rats plasma. However there is no significant difference between two groups.

DISCUSSION

Eight weeks endurance training has no meaningful effect on ATP of male rats plasma (p-0.291) and observed that ATP of trained male rats plasma is a little more than untrained male rats plasma however, there is no significant difference between two groups.

Eight weeks endurance training has no effect on the level of total cholesterol of male rats plasma (p=0.959) and observed that total cholesterol of trained male rats plasma is a little more than untrained male rats plasma however, there is no significant difference between them.

The other result of this study was ATP level changing of male rats plasma which there was no significant change in them. some researchers have also reduced the number of significant changes and afew have reported an increase in liver glycogen density.

Estengel and coworkers observed MRNA control of nocleobaynedine 2 in Andocarbonic cells of stomach after 24 hours be hunger and find out that may Naftaen gen can control bye eating food . In GhanbariNiaki and coworkers [2008] study another consequence of the anti-appetite ,Obestatin, find out that low exercises can reduce Obestatinphondos level in trained male rats intestine and can increase liver glycogen. It seems that results of this study confirm effect of energy sources changes especially liver glycogen as a glandular organ to balance energy [4]. Estensberg in his study find out that IL-6 acts as a sensor of energy within muscels cells and also proved that carbohydrate injection will ineffective hormonal responsesand IL-6 and will save glycogen [5]

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