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The Effects of Three Sessions of Running on a Negative Slope on Serum Levels of Liver Enzymes in Adult Male Rats

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Abstract

***Background*:** The purpose of this study was to investigate the effects of three sessions of running on a negative slope (eccentric contraction) on changes of the serum levels of aspartate aminotransferase (AST) and alanin aminotransferaze (ALT) in adult male rats.
***Materials and Methods*:** 20 adult male rats were divided randomly into two equal groups (exercise and control). Levels of AST and ALT in both groups were measured in a fasting state, 24 hours before and 24 hours after the last session of training.
***Results*:** Exercise increased the levels of serum AST and ALT enzymes, significantly (p<0.05).
***Conclusion*:** Eccentric exercise, without allowing enough time for returning to the pre-exercise state, leads to the damage of some body organs such as the liver.

Introduction

During physical activity, skeletal muscles as the organ which is directly affected and liver as the organ which plays important role in supply of energy for activity of the muscles play distinctive role [1]. Eccentric repeated contractions such as running in negative slope can apply force and more damage to muscles and liver [2, 3]. Studies showed that the best indices for evaluating status of liver are aspartate aminotransferase (AST), alanine aminotransferase (ALT) and alkaline phosphatase [4]. Activity of plasma liver enzymes changes due to term, intensity, type and method of physical exercise [5, 6]. Panu et al. studied effect of running on treadmill in positive slope on serum level of AST and ALT enzymes in male rats of Sprague-Dawley race and serum level of both enzymes increased significantly immediately after exercise [7].

Results of researches of Devaki et al. on animal model and researches of Togashi et al. and Kim et al. on human specimens have been reported to be similar to each other in some cases and contradictory to each other in some other cases [8-10]. Before that time, some studies were conducted on damage of muscular cells following physical exercises but the exercises with eccentric repeated contractions with measurement of serum level of aminotransferases were rarely studied. Therefore, the present research was conducted to study effect of 3 long running exercise sessions on treadmill in negative slope (eccentric repeated contractions) on serum level of enzymes AST and ALT and determine suitable time for returning to the first state. Since serum level of AST and ALT enzymes are effected by food, age, gender and other cases [11] and this research was conducted on male adult rats in order to control these cases in animal specimens and because half life of AST is 17±5 hours and half life of ALT is 47±10 [12], three exercise session were held to answer this question that whether three sessions with repeated contractions which are held every other day prevent damage or not while the potential changes of serum level of enzymes are specified more evidently.

Materials and Methods

Primary design of this research was introduced and enacted in Research Ethical Committee of Clinical Trials of Islamic Azad University, Fars Sciences and Research Branch. The research was conducted in May 2011 in Stem Cell and Transgenic Technology Research Center of Shiraz University of Medical Sciences. 20 male rats of Sprague-Dawley race were randomly selected and were put on treadmill (with speed of 10 m/min and slope of zero) for one week and one hour every day within 7 days before start of exercise plan for familiarity with treadmill (made in Iran). Laboratory temperature was 22±2ºC, suitable light (12 hours of lighting and 12 hours of darkness) and humidity was 54±5%. The animals were stimulated to run on treadmill using electric shock. During this research, rats had free access to water and food.

At the beginning of research, age of the animals was 70±5 days and their weight was 247.4±22.6 grams. The animals were randomly divided into two equal groups each with 10 rats (experimental and control). The experimental group performed three sessions of exercise plan (every other day) designed by the researcher 4 which

was run on the treadmill. Slope of treadmill was set to be -4, -6 and -8 degrees during three sessions and speed of treadmill was 18 m/min in all three sessions. In order to observe principle of overload, exercise term increased in the second and third sessions in addition that the slope increased. Exercise term was 25, 35 and 45 min during these three sessions. During this term, the control group didn't perform physical activity.

Blood of the rats was taken by a specialist within 2 stages (24 hours before the first and 24 hours after the last sessions) after anesthetizing the animals with chloroforms and directly from heart. The obtained clots were taken to laboratory of the hospital and centrifuge and serum taking were done for 15 min in round of 3000. Serum level of the intended enzymes was tested using enzyme kits of Pars Company and measured with method recommended by IFCC (International Federation of Clinical Chemistry and Laboratory Medicine) method [13].

The data was statistically described with central indices and dispersion and distribution of data with Kolmogrov-Smirnov test. Due to normal distribution of data, difference of enzymes serum level in both groups was specified with independent t-test and difference between pretest and posttest in both groups was specified with dependent *t*-test. The software used in this research was SPSS-18. Significance level was considered to be $p<0.05$.

Results

As table 1 shows, there is significant difference between pretest and posttest of the experimental group in serum level of enzyme AST ($p=0.001$) and enzyme ALT ($p=0.001$) in confidence level of 95%. In control group, serum level of enzyme AST increased partially and serum level of enzyme ALT decreased partially and these increase and decrease were not significant. In addition, there was significant difference between serum level of enzymes AST and ALT in both experimental and control groups at the end of exercise plan ($p=0.001$) (Table 2).

Table 1. AST and ALT enzymes within group variation in both experimental and control groups

Enzymes		Pretest	Posttest	*p*-Value
AST (Iu)	Experimental group	44.5±10.1	121.9±21.5	0.001
	Control group	44±12.5	46.1±12.7	0.271
ALT (Iu)	Experimental group	47.6±10.5	72.8±11.9	0.001
	Control group	49±17.4	48.8±16.2	0.756

Table 2. AST and ALT enzymes between group variation in both experimental and control groups

Blood factor		experimental group	Control group	*p*-Value
AST (Iu)	Pretest	44.5±10.1	44±12.5	0.988
	Posttest	121.9±21.5	46.1±12.7	0.001
ALT (Iu)	Pretest	47.6±10.5	49±17.4	0.975
	Posttest	72.8±11.9	48.8±16.2	0.001

Discussion

Research findings showed that serum level of enzymes AST and ALT increased significantly after three exercise sessions in negative slope. Since there was the highest density of AST enzyme in heart, liver, and skeletal muscle respectively and there was the highest density of ALT in liver, kidney, heart and skeletal muscle respectively [12]. This increase of serum level may result from damage and entrance of these enzymes from all mentioned organs. Results of the present research are similar to results of the previous researches in some cases and they are different in some other cases. Devaki et al. studied male adult rats and led them to swim compulsorily for 15 min and observed that there was no significant increase in serum level of enzymes AST and ALT 4 hours after activity [8].

The reason for difference in results of the present study and study of Devaki is type and term of exercise. In the present study, cells were damaged and serum level of enzymes increased significantly due to eccentric repeated contractions and long term exercise. Panu et al. studied effect of running on treadmill on serum level of enzymes AST and ALT in male rats of Sprague-Dawley race. At the end of exercise term, speed increased to 26.8 m/min, slope increased to 10 degrees and time increased to 60 min [7]. Results of the research showed that serum level of both enzymes increased significantly immediately after exercise.

The reason for similarity of results of the present research and research of Panu is type of selected exercise which was run on treadmill in both researches, equal intensity of exercises and equal race of the rats. Based on findings of this research, more intensive exercise with eccentric repeated contractions which is performed in relatively short term damages different tissues of body such as skeletal muscles due to oxidation pressure and increase of the produced free radicals and their attacks to cellular membrane [14]. Although the exercise was performed every other day, serum level of enzymes increased significantly, therefore, it is recommended that the sportsmen not use these exercises especially more intensive ones and in case they perform such exercises, they should spend longer time for taking rest compared with other exercises.

The drawbacks of this research are damage of electric shock of treadmill and entrance of needle of syringe into heart, some organs and its effect on serum level of enzymes. Since one cannot surely say that in what organ or part of body there was increase of serum level of enzymes of AST and ALT resulting from release of these enzymes and considering that these enzymes have different isoenzymes [15], it is suggested that serum level of different isoenzymes be studied in the future researches.

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Authors' Contributions

All authors had equal role in design, work, statistical analysis and manuscript writing.

Conflict of Interest

The authors declare no conflict of interest.

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