New Approaches in Exercise Physiology (NAEP), Vol 4, No 8, 226-242, May 2023

The effect of special endurance training on the activity of some liver enzymes in inactive young men

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Received: May 4, 2023; **Accepted:** May 15, 2023
doi: 10.22054/NASS.2023.73704.1134

Abstract

Purpose: The activity of plasma liver enzymes is intensified under the influence of sports activities, which is affected by the duration, intensity, type and method of training. The purpose of this study was to investigate the effect of a special endurance training session on the activity of serum alkaline phosphatase and aspartate aminotransferase liver enzymes in inactive young men.

Methods: In this semi-experimental study, 16 young inactive men were purposefully selected and examined in two groups (experimental and control). The experimental group performed Bruce's protocol after preliminary warm-up. Blood samples were collected before the test, immediately after the test, 24 hours and 48 hours after the test from both groups at the same time, and the amount of serum ALP (Alkaline Phosphatase) and AST (Aspartate Transaminase) enzymes were measured using an Auto analyzer. Statistical analysis of the data, independent T-test was used to compare the results of two groups and Bonferroni's post hoc test was used to determine the difference between different stages of sampling with a minimum significance level ($P \geq 0.05$).

Results: The results of the independent T-test in the comparison between the groups showed that there is a significant difference between the two groups in the amount of ALP enzyme in the time intervals immediately after the activity ($P \geq 0.020$), but in the time intervals of 24 ($P \geq 0.177$) and 48 hours ($P \geq 0.136$), there is no significant difference between the two groups after the activity. The results

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of the independent T test did not show any significant changes in the amount of AST enzyme in any of the time intervals in the comparison between groups.
Conclusion: Fatigue-inducing sports activity leads to an increase in the amount of enzymes, ALP, this increase can be a sign of damage to liver cells or heart muscle. Considering the role of recovery in liver damage, it seems that by considering enough rest time, it is possible to help improve the adaptation process while preventing the occurrence of muscle and liver damage
Keywords*:* Bruce test, aspartate aminotransferase, alkaline phosphatase, inactive men.

INTRODUCTION

The liver is a group of active cells that play a major role in the overall biochemical order of the body (Chaudhary, gul Javaid, Bughio, & Faisal, 2023). During physical exercise, the liver is exposed to stimuli such as increasing body temperature, formation of reactive oxygen species, stopping blood circulation and reducing glycogen (Sargazi & Taghian, 2020). The liver, the largest internal organ of the body with a weight of 1.5 to 1.5 kg, is of particular importance in the interaction of hormonal and metabolic characteristics with the use of various enzymes during rest, exercise and restoration of energy resources in the return phase (Contrepois et al., 2020). The liver can produce thousands of enzymes, and studying the activity of liver enzymes after exercise and fatigue is very important in the evaluation and diagnosis of various body injuries (Huang & Zhao, 2022). The activity of plasma liver enzymes is intensified under the influence of sports activity, which varies according to the duration, intensity, type and method of exercise. Especially, if the physical activity is intense and long, it greatly affects the activity of enzymes (Mohammad, Esfandiar, Abbas, & Ahoora, 2019). Two of the most sensitive and widely used diagnostic liver enzymes are Aspartate Amino transferase and Alkane Phosphatase (ALP) (Yasmin et al., 2022). These enzymes are usually inside the liver cells and when the liver is damaged, it releases these enzymes into the bloodstream, so that the increase in the blood concentration of these enzymes is a sign of liver damage (Ghosh et al., 2021). Bashiri et al. (2010) investigated the simultaneous effect of creatine monohydrate consumption and resistance training on the activity of liver enzymes in the serum of non-athletes and showed that two months of resistance training and creatine supplementation did not have a significant effect on the activity of AST and ALT enzymes (Bashiri, Hadi, Bashiri, Nikbakht, & Gaeini, 2010).

Rezaei et al. (2013) reported in a review study of adult rats that with 3 sessions of running on a negative slope (eccentric), there is a significant increase in the levels of AST and ALT enzymes (Rezaei & Namdar, 2013). Elham et al, (2019), showed that twelve weeks of endurance training has no effect on the level of liver enzymes ALT and AST (Elham et al., 2019). Kanda and his colleagues found that the amount of ALT and AST enzymes in the serum before and after exercise did not differ in the study of liver damage caused by exercise (Kanda, Sugama, Sakuma, Kawakami, & Suzuki, 2014). van der Windt et al, (2018) investigated the effect of a course of aerobic and resistance training on two liver enzymes in patients with non-alcoholic fatty liver disease and reported that aerobic training reduces ALT levels (van der Windt, Sud, Zhang, Tsung, & Huang, 2018). Keyvan Ghalandari, (2020) The results of his study showed that eight weeks of aerobic training decreased glucose, insulin, AST, ALT and ALP in men with T2D (Ghalandari, Shabani, Khajehlandi, & Mohammadi, 2020). Although it is usually expected that regular exercise reduces the amount of liver enzymes, but Tartibian et al. (2018) reported that 12 weeks of endurance training increases the serum level of ALP enzyme in obese postmenopausal women (Tartibian, Malandish, Afsargharehbagh, Eslami, & Sheikhlou, 2018). Pedram Ghorbani and Abbas Ali Gaini (2013) investigated the effect of a high-intensity interval training session on the liver enzymes AST, ALP and ALT of elite football players and reported a significant increase in the enzyme AST and alkaline phosphatase ALP and no change in the liver enzyme ALP (Pedram Ghorbani, Kordi, Gaeeni, Arbab, & Nafar, 2013). Keating et al. (2012) by examining the effect of aerobic and resistance exercise on liver enzymes showed that exercise alone has no effect on ALP levels (Keating, Hackett, George, & Johnson, 2012). Although so far many studies have examined the effects of various sports exercises on liver enzymes, but in some cases the results have not been consistent, and also considering the role and importance of the liver in the physical health of people in the community and the effects of aerobic exercises on their liver. There are still many questions that need further study. Based on this, this research seeks to answer the question of whether a special endurance training session has an effect on the level of liver enzymes AST and ALP in inactive young men.

METHOD

This research was a semi-experimental type, which was carried out with a pre-test and post-test design. The statistical sample of this research includes 24 inactive healthy male students of Mohaghegh Ardabili University with an age range of 20 to 23 years who were selected voluntarily and available according to the limitations of the research. After explaining the research implementation process, 16 of them declared their readiness to participate in this research. The inclusion criteria for this research included not taking medication, not smoking, being healthy based on the health questionnaire, and not participating in any exercise program for at least six months before participating in this research. The subjects were randomly divided into two experimental groups (8 people) and control group (8 people) and signed the written consent form. The experimental group learned how to run on a treadmill one week before the training protocol. The exercise protocol included three parts: warm-up, main activity and cool-down. Warm-up consisted of 7 to 10 minutes of slow walking, jogging, stretching and softening movements. The main activity was to perform the 7-step protocol of the Bruce treadmill. First, the subjects started walking on the treadmill, and by increasing the speed and slope of the machine, they started running from the third step. Each step of the test lasted 3 minutes. The slope of the device was 10% at the beginning and increased by 2% at each stage. In the first stage, the speed was 2.7, and in the next nine stages, the speed was added as 4.02, 5.47, 6.76, 8.05, 9.65, 10.46, 11.26, and 12.07. In the last stage, the speed of the treadmill was 12.07% and the slope of the treadmill was 28%, the subjects performed this test until they reached exhaustion.

The first blood sample was taken 25 hours before the exercise protocol and after 10 to 18 hours of fasting, the subsequent blood samples from the experimental group were taken immediately, 24 and 48 hours after the protocol. Samples were taken from the brachial vein of the left hand in the amount of 5 cc in a sitting position for evaluation (AST and ALP).

Then the blood samples were poured into tubes containing (EDTA) and after 15 minutes, they were centrifuged for 10 minutes at 3000 rpm with less than 1% error. It is worth mentioning that blood sampling was done from the control group at the same time as the experimental group. Shapirowilk statistical test was used to determine the normal distribution of data. Statistical analysis of data was done using independent T-test to compare the results of two groups and Bonferroni's post hoc test to determine the difference between different stages of sampling with minimum significance level ($P \leq 0.05$). All statistical investigations were done using SPSS version 25, graphs were drawn with Excel version 2020 software.

RESULTS

The characteristics of the subjects are shown in Table 1. the results of the Shapirowilk test showed that the obtained data related to individual characteristics and the desired indicators at the beginning of the study had a normal state. Independent T results did not show any significant difference in the pre-test. Therefore, the values related to the people of the control and experimental groups before the implementation of the research protocol of the statistical population are the same and the data distribution is normal.

Table 1: Individual characteristics of the studied subjects (8 people in each group).

group	Age(year)	height (Contrepois et al.)	weight(1. Rinona poli G et al.)	BMD (Body Mass Index) (kg/m2)	Fat (%)	BP(Mm/hg)
Experimental	22.62±1.93	176.00±4.92	75.62±12.80	24.00±3.00	1.29±1.13	115±10/00
Control	20±1.50	172.25±5.88	65.87±8.35	22.00±1.27	12.85±5.24	110.5 ± 10

BP= Blood pressure

The results of the independent T-test in the comparison between the groups showed that there is a significant difference between the two groups in the amount of ALP enzyme in the time intervals immediately after the activity (P≥0.020). But in the time intervals of 24 (P≥0.177) and 48 hours (P≥0.136), there is no significant difference between the two groups after the activity. The results of Bonferroni's post hoc test for intra-group comparison showed that there is a significant increase in the amount of ALP enzyme in the experimental group immediately after the activity compared to before the activity (P≤0.026). But in the time intervals of 24 (P≤1.000) and 48 hours (P≤0.302), there is no significant increase after the activity compared to before the activity. Chart (1).

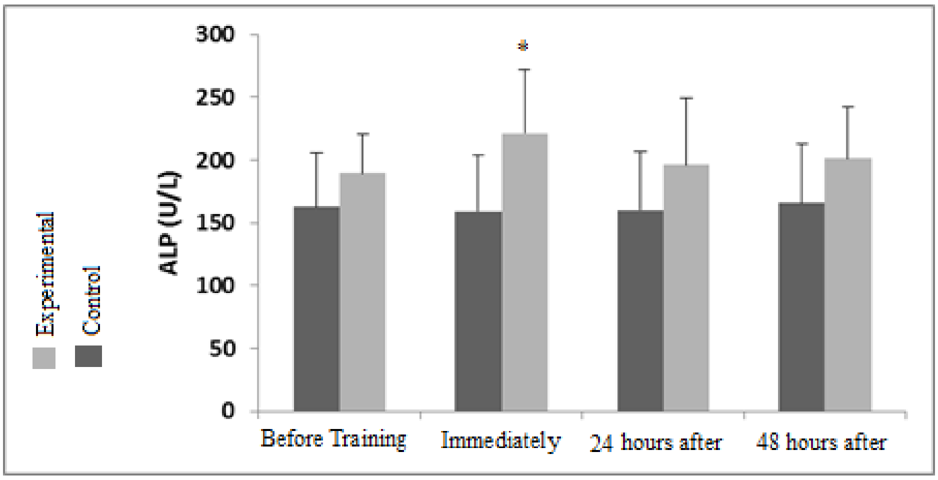

Chart 1: Changes in serum levels of alkaline phosphatase (ALP) between the control and experimental groups. * indicates a significant statistical difference between the groups ($P<0.05$).

The results of the independent T test in the comparison between groups showed that the amount of AST enzyme in time intervals immediately (P≥0.127), 24 (P≥0.239), 48 hours (P≥0.489) after performing the activity There is no significant difference, and the results of Bonferroni's post hoc test for intra-group comparison showed that there are significant changes in the experimental group immediately (P≥0.016) after training, but these changes in the time interval of 24 (P≥1.00) and 48 (P≥1.00) hours after the activity was not significant. chart (2)

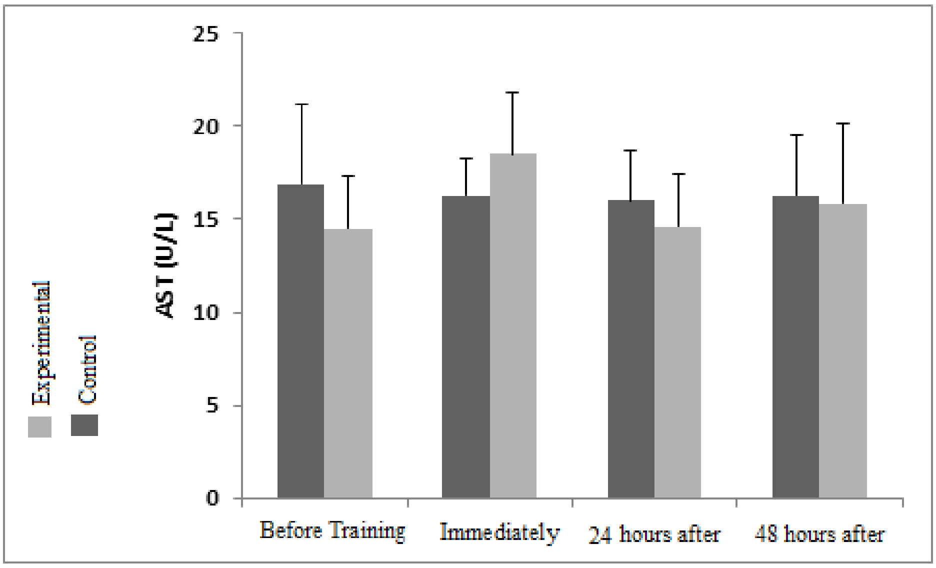

Chart 2: Changes in the serum levels of aspartate aminotransferase (Mohammad et al.) between between two groups.

DISCUSSION

The aim of this study was to investigate the effect of a special endurance training session on the level of liver enzymes in inactive young men. The results of the present research showed that the amount of liver enzyme ALP after a special endurance training session in the experimental group compared to the control group and also in the comparison within the group in all the different stages of measurement (immediately, 24, 48) hours after the endurance activity had a significant change. This result was consistent with the findings of a number of studies. Ghorbani et al. (2013), by investigating the effect of a high-intensity interval training phase on liver enzymes in elite soccer players, concluded that the serum concentration of ALP enzyme after a phase High intensity interval training increased significantly (PGAA Ghorbani & Gaeini, 2013). Also Bergmann et al. (2008), in a study, investigated the changes in liver enzymes on Brazilian triathletes after a semi-professional competition and reported an increase in liver enzyme ALP (Bergmann et al., 2008). Contrary to the findings of the present study, some studies also showed no change in the amount of ALP enzyme due to exercise. Malandish et al. (2016) showed that 12 weeks of aerobic exercise has no significant effect on the serum concentrations of

ALP, osteocalcin and insulin (Malandish, Tartibian, & Rahmati Yamchi, 2016). Also, Shamsoddini et al. (2015) showed that 8 weeks of aerobic training program does not have a significant effect on the liver enzyme ALP in men, it is most likely that the contradiction between the results of the above studies and the results of the present study is due to the difference in the type of training protocol and the duration of the training (Shamsoddini, Sobhani, Chehreh, Alavian, & Zaree, 2015). ALP enzyme facilitates the transport of metabolites such as fat across the cell membrane for aerobic energy production. Therefore, the increase of ALP after training shows the activity of the liver for gluconeogenesis, fat peroxidation, and possibly the increase of bone turnover (McCarthy, Cortizo, & Sedlinsky, 2016). ALP enzyme has the lowest concentration in bones and the highest concentration of this enzyme is related to liver tissue, so an increase in the amount of these enzymes indicates liver damage or excessive pressure on the liver (Malakouti, Kataria, Ali, & Schenker, 2017).

The results of this research regarding the changes of AST enzyme indicate that the amount of this enzyme in the experimental group increased significantly compared to before the training in the time interval immediately after the training. In line with the results of this study, Nobahar et al. (2020) reported a significant increase in AST enzyme by examining a two-peak exercise program on liver stress index in active girls (Nobahar, Mirdar Harijani, & Gorgin Karaji, 2020). Mahdavi Asiabar (2021), by investigating the interaction of an endurance training session and an inhibitory training session on the amount of AST enzyme changes in rats, showed that this enzyme increased significantly in the blood (Mahdavi Asiabar, Nasiri Farsani, & Gheibi, 2021). On the other hand, the results of this research were not consistent with the findings of a number of studies. Ghorbani et al. (2013), in their study, showed that a period of high-intensity intermittent training in elite soccer players did not increase the level of AST enzyme (PGAA Ghorbani & Gaeini, 2013). Bashiri et al. (2010), by investigating the simultaneous effect of creatine monohydrate consumption and resistance training on the activity of liver enzymes, reported no change in AST enzyme levels (Bashiri et al., 2010). Chamera et al. (2014), showed that by running on a treadmill to the limit with a speed of 10.5 km/h and a slope of 20 degrees and an average time of 53 seconds for men and 52.6 seconds for women, AST enzyme activity before and after training, there was no significant difference (Chamera et al., 2014). It should be mentioned that AST enzyme is found in liver, heart, muscle or brain cells and the increase of these enzymes cannot be considered as a result of liver damage only.

CONCLUSIONS

According to the findings of the present study, exhausting sports activity leads to an increase in ALP enzyme levels, this increase can be a sign of muscle, liver or heart cell damage. Considering the role of recovery in liver damage, it seems that by considering enough rest time, it is possible to help improve the adaptation process while preventing the occurrence of muscle and liver damage. Therefore, coaches and athletes are advised to plan and implement training programs in such a way that by properly adjusting the recovery period and preventing the complications caused by overtraining, they can prevent muscle and liver injuries and help the athlete to recover from injuries. The possibility of exercise will be spared. These measures, while increasing the life of the athletes, help to maintain their health and reduce their treatment costs.

Contribution of authors

All authors have participated in the design, execution and writing of all parts of this research.

Conflict of interest

According to the authors of this article, there is no conflict of interest.

Acknowledgments

We are grateful to all the participants in this research and to all the people who helped us in conducting this research.

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