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How Does an Intensive Exercise Training Changes Irisin and Heat Shock Protein 70 Levels in Trained Males?

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ABSTRACT

In this study, it was aimed to investigate the change in irisin and heat shock protein 70 (Hsp70) level of a single intensity exercise which is applied in trained male individuals. Sixty volunteer males who participated in the study regularly training at least three days a week. Blood samples were taken from the participants twice during resting position and after high intensity exercise. Blood samples were separated into serum and plasma by centrifugation. Irisin and Hsp70 levels were determined in serum samples by ELISA method. The data obtained were analyzed using SPSS package program. Paired Samples t test was used to determine the difference between pre-test and post-test values. The significance level was accepted as $p < 0.01$.

As a result of the analysis, it was found that there were significant differences statistically between pre and post-exercise values in levels of irisin and Hsp70 ($p<0,01$). As a result; It has been shown that an heavy exercise increased irisin and Hsp70 levels in trained males. This result is thought to be explained as an increase in the level of irisin as an exercise factor and an increase in the Hsp70 level in parallel with the stress in the organism due to intensive exercise.

1. Introduction

The irisin involved in the circulation combines with the white adipose tissue receptor to stimulate the secretion of UCP1 (Thermogenin, uncoupling protein), thereby allowing the white adipose tissue to brown (1). However, iris can also help regulate energy metabolism by increasing insulin activation and making important effects on body composition (2). For the first time, Irisin has discovered by Boström et al. as a glycoprotein structure hormone, which is released from muscle tissue and consists of 112 amino acids (3). However, it is stated that synthesis of irisin occurs mainly in skeletal and cardiac muscles and adipose tissue (4). When the previous studies on this subject are evaluated, it is seen that the irisin associated with the exercise. Exercise models might changes to irisin level (5, 6). In another study, it was shown that acute aerobic exercises decreased the irisin level but anaerobic exercises increased the irisin level (7).

The human organism has different types of mechanisms to fight with stress. One of them is heat shock proteins that released as a result of stress due to exercise (8). Heat shock protein 70, one of the important members of the family of heat shock proteins, is known as the protector of cells. Furthermore it is stated that Hsp 70 are increased in the skeletal muscles of mammals in cases of stress associated with exercise (9). It has been reported that especially

heavy training programs and high intensity exercise lead to an increase in the secretion level of Hsp 70 (10). Cumming et al. (11) have showed that increases in the level of heat shock protein 70 occurred after 48 hours of resistance exercises. Similarly, Bittencourt and Porto (12) emphasized that physical stress occur by exercise changes in heat shock protein 70 levels in many tissue and cell types. From this point of view, the effects of a very intense exercise were investigated on irisin and heat shock protein 70 in trained individuals.

2. Method

2.1. Participants

The study included 60 volunteer university students randomly who had no health problems or disabilities and who have been training regularly for three days a week for at least the last three months. Before starting the research, the study was explained as detail to the participants and voluntary consent forms were signed by participants. Participants did not participate in any physical activity before three days the day of the study. Participants stopped alcohol and caffeine that if they used consumption for the last 24 hours before the research. The research was conducted according to the pre-test and post-test model.

2.2. Materials

In the study, 5 ml blood samples were taken from the participants with aprotinin tubes before the exercise and within 3 minutes after completed the 20 meters shuttle-run test. Blood samples were centrifuged at 4000 rpm for 5 minutes to separate into serum. Serum samples were stored in -80 degrees until analysis day. Serum Irisin and Hsp70 were assayed according to the kit procedure using trademark kits (Sunred Biological Technology Co., Ltd., Shanghai) using the ELISA method. The obtained test results are expressed in ng / mL.

2.3. Procedure

Procedure of Intensive Exercise

The purpose of this test is to create exhaustion and determine the durabilty in the participants. For this purpose, 20m shuttle run test which is a multi-stage test was applied to the participants (13). The procedure for this test is that the participants run a distance of 20 m round-trip. The running speed is controlled at regular intervals by the cd signaling. The participants started to run on the first beep and ran to reach the other line until the second beep. When the second signal was heard, the test signal was continued to return to the starting line. The running speed, which started slowly at the beginning, gradually increased every 10 seconds. The test was stopped when the participant missed two signals (13, 14).

Statistical Analysis

SPSS 22 package program was used for the analysis of the obtained data. Mean and standard deviation techniques were used as descriptive statistics. Before analyzing the data, the normality of the distribution was tested and it was decided to perform parametric tests. Paired Samples t test was used to determine whether there was any difference between the pre-test and post-test values of the research group and the significance level was accepted as $p < 0.01$.

3. Results

Table 1 shows that there is a statistically significant difference between the pre-test and post-test levels of irisin and Hsp70 values ($p<0,01$).

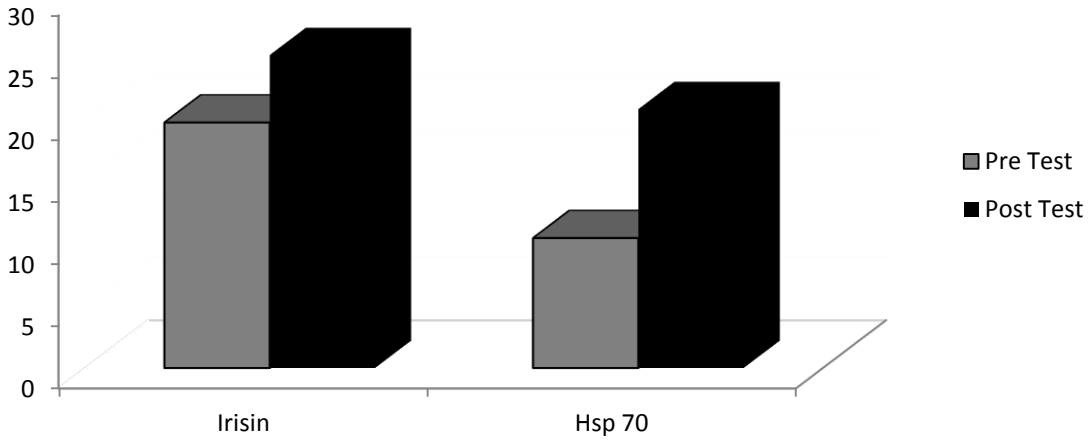
Table 1. Comparison of Pre-test and post-test values the research group

Parameters	Pre Test		Post Test		
	n	Mean	SD	Mean	SD	p
Irisin (ng/mL)	30	19,73	4,96	25,16	5,25	0,000**
HSP70 (ng/mL)	30	10,49	2,22	20,81	3,11	0,000**

** There is a significant difference between measurements (P<0.01) SD: Standard Deviation

When the graph 1 was evaluated, the irisin level was 19,73 ± 4,96 in resting state, and it reached 25,16 ± 5,25 at the end of intense exhaustive exercise and the Hsp70 level have increased from 10,49 ± 2,22 to 20,81 ± 3,11.

Graph 1. Graph of change of Irisin and Hsp70 values



4. Discussion and Conclusion

In this study were investigated the effects of intensive exercise on irisin and Hsp70 levels in trained males. As a result of the analysis of the obtained data, it was determined that intensive exercise training caused significant increases on irisin and Hsp70 values in individuals who exercising regularly at least 3 days a week.

In a study similar to present study, acute exercise increased serum irisin levels in children and adolescents (15). A study on rats also supports our findings and emphasized that there was an increase occurs in irisin level after acute exercise (16). Norheim et al. (17) have investigated the effects of acute and chronic exercise on plasma irisin levels in their study. As a result, they reported that there were decreases due to chronic exercise but increased plasma irisin levels after acute exercise. In another study, the effects of different models of acute exercise were investigated on the irisin level. As a result, it has been shown that resistance exercises create more significant increases compared to endurance exercises (18). In the other study, it was found that acute aerobic exercise caused an increase in the level of irisin in both athlete (trained) and non-athlete individuals (19). In a different study, it was determined that maximal freestyle swimming exercises increased the irisin level in male swimmers (20). This result supports current research

findings. Similarly, acute exercise increases the iris level in handball players who perform regular sports (21). In a study on obese women, the effect of moderate and high intensity exercise was investigated on plasma irisin level. It has been demonstrated that both acute exercise have increased iris levels but more increases have been observed after high intensity exercise (22). The effects of aerobic exercise and high intensity interval training were investigated on muscle iris levels in overweight adolescent girls. Aerobic exercise has not been reported to affect the irisin level, but irisin have increased in the high-intensity exercise group (23). Similarly, Tsuchiya et al. (24) have investigated the effects of high intensity and low intensity exercises on irisin levels under similar energy consumption. As a result, they have reported that there was increase in irisin after high intensity exercise. The results of the acute study on irisin and present study findings showed similar results generally.

It is stated that Hsp family, which are known to be stimulated by exercise, can be easily stimulated in the heart of animals exposed to a short exercise. In particular, Hsp70, an important member of this family, is often associated with exercise (25). Milne and Noble (26) have reported that exercise affects Hsp70 level and this effect changes depending on the intensity of the exercise. Similarly, Thompson et al. (27) have emphasized that Hsp70 levels increase after exercise due to exercise. In another study, the effect of maximal eccentric exercise was investigated on Hsp70 level and as a result, it was found that Hsp70 level increased such as in present research findings (28). In a study conducted on rats, it was also stated that Hsp70 level increased after swimming exercises (29). Similarly, it has been reported that an increase in heart Hsp70 levels after acute exercise (30). In another study, it was found that there was an increase in Hsp 70 level due to heat stress of exercise (31). It is also reported that there was an increase in Hsp70 after low and moderate intensity exercises (32). In a study conducted on animals, it was found that exhaustion exercise did not produce a statistically significant change in Hsp70 level (33). It is thought that this result is different from the results of the present research results due to the material differences (human-rat) and application differences.

As a result; It has been found that a single intensive exercise can increase irisin and Hsp70 levels in trained individuals. This result, as expected, emphasizes the idea that the muscles are activated and that the irisin is secreted more with exercise. However, high intensity and intensive exercises can cause stress in the human organism. It could be said that Hsp 70 level is increased in order to maintain cell integrity in response to this stress.

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