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# Effect of Training Intensity on Serum Leptin and Adiponectin in Male and Female Futsal Players

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## Abstract

**Introduction:** According to the effect of gender on leptin and adiponectin and the inconsistent effects of exercise intensity on these two hormones, the present study aims to evaluate the effect of different exercise intensities in the play-ground on serum levels of leptin and adiponectin of male and female futsal players.

**Methods:** This clinical trial study is done on 12 male and 12 female futsal players. They started the moderate intensity exercise (65% of maximum heart rate) in the play-ground, followed by high intensity exercise (80% of maximum heart rate) next week. Before and after each exercise, blood sample was collected from the players to measure the serum levels of leptin and adiponectin. The data collected was analyzed by ANCOVA, using SPSS.

**Results:** Leptin level was significantly higher in females before exercise (p=0.000). Neither moderate nor high intensity exercise had effect on serum levels of males (p=0.69) and females (p=0.261). Leptin levels of males and females were significantly different after moderate (p=0.003) and high intensity (p=0.023) exercise. Exercise intensity did not affect the levels of adiponectin in females (p=0.118) and males (p=0.435). Adiponectin levels of males and females were not different after moderate (p=0.179) and high intensity (p=0.173) exercise.

**Conclusion:** Exercise intensity (moderate and high) doesn't affect the serum levels of leptin and adiponectin in male and female futsal players. So, to levels of these hormones, it doesn't matter how hard the player exercises.

**Keywords:** Training, Leptin, Adiponectin, Futsal

## Introduction

Homeostasis is the regulations of a system which causes the stability of internal conditions. The balance between intake and use of calorie is a part of homeostasis which may lead to fatigue, decreased strength and ability and increased risk of infection if disturbed (1). Leptin and Adiponectin are two hormones affecting the homeostasis and glucose metabolism (2-4). Leptin is a 16 kDa consisting of 167 amino acids which is coded by ob gene (5, 6). It is mostly produced by adipose tissue, but smaller amounts may be secreted from liver, embryonic cord, gastric epithelium and skeletal muscles as well (7, 8). Normal serum level of leptin is 4.1 to 25 ng/ml for females and 1.2 to 9.5 ng/ml for males. Obesity is the association between serum adipokines (leptin, adiponectin) with BMI and WC (9). There is a direct relationship between total body fat and leptin serum level (7, 10), nd has been observed to have positive correlation with BMI in patients with metabolic syndrome (11). Also, Leptin acts as a signal to

hypothalamus and decreases the appetite due to the amount of fat. It also inhibits the secretion of Neuropeptide Y. Neuropeptide Y is a strong stimulant of appetite (7). Hyperlipidemia causes the chronic level rise of leptin and resistance to leptin if prolonged. Leptin secretion stimulants are: eating, insulin and glucocorticoids. Inhibitors are: fasting, cAMP and beta adrenergic agonists (12, 13). Exercise can affect the leptin secretion (13). A study indicates decreased level of leptin after two month of aerobic exercise in both athlete and non-athlete male individuals (14). Also, various studies have investigated the effect of aerobic and endurance training on the level of lepithin and adiponectin (15-18). However, a Few studies have measured leptin serum levels immediately after exercise, however, they have led to different results. Adiponectin is a 30 kDa including 247 amino acids. Adiponectin levels are reversely associated with adiposity in adults (19, 20). Serum level of adiponectin in women is twice the men. It lowers blood sugar via increasing sensitivity of cells to insulin (14, 21-24). Adiponectin manages many mechanisms to decrease the plasma fatty acid, such as decreasing the rate of gluconeogenesis, oxidation of fatty acids in muscles and transporting them into cells (25). There is a reverse relationship between adiponectin density and obesity (7). It has significant effects on metabolic disorders such as diabetes mellitus, and it leads to insulin resistance, hyper insulinemia and hyperglycemia in subnormal doses (26). Exercise is effective on serum adiponectin level (27). Ten weeks of exercise increased serum level of adiponecting in non-athlete obese patients (28). Sexuality affects the serum levels of leptin (29, 30) and adiponectin (31, 32); and both of them are higher in the women (33, 34); So that a study showed greater influence of 12 weeks of aerobic exercise on leptin serum level of female cases in comparison to males (30). There may be a relationship between serum levels of these two hormones and physical activity according to their regulatory effects on serum glucose. Many studies have been done on the effects of exercise on leptin and adiponectin but few of them measured the noted hormones immediately after exercise; moreover, the measurements were done in vitro using a treadmill, but we checked the serum levels of these hormones after a real play in the playground. According to all above, the present study aims to compare the effects of exercise with different intensities on plasma leptin and adiponectin hormones of male and female futsal players.

## Methods

The research sample of this clinical trial study included all futsal players of Jahrom University. Twelve males and 12 females entered the study and filled the informed consent form. Informed consent sheet was signed by the participants and was approved by the committee of ethics. Inclusion criteria were age between 18 to 25, weekly exercise for at least 3 times a week during last year and being a futsal player. Exclusion criteria are positive history of cardiovascular diseases, hypertension, diabetes mellitus, smoking, drug use or unwillingness to continue futsal. Samples were asked not to do other kinds of heavy physical activity out of the exercise schedule. Height, weight, BMI, body temperature and blood pressure of each sample measured at first. To determine the severity of physical activity, maximum heart rate was measured by Karvonen method (Target Heart Rate = ((HRmax − HRrest) × % intensity) + HRrest) (35). The players were able to keep their heart rate at the desired range using a belt around the chest which was synced to a wrist watch and showed the number of heart rate; so the players were able to keep in required exercise intensity. Samples were asked to fast for 12 hours before the exercise. 5 to 10 minutes of warm up was required to enter the exercise in which the player reached the desired heart rate. After the warming up, samples played futsal for 30 minutes in a

competition in order to reach 65% of maximum heart rate (moderate activity). Similar procedure was taken one week later but the target was 80% of maximum heart rate (severe activity). The physical activity was done in the playground and during a real match, unlike most studies which was done on a treadmill. Cooling down was performed by 10 minutes of low speed run. Drinking water was allowed during the exercise. All the physical activities were done in the playground during a competition. Five cc of venous blood was collected 10 minutes before and after exercise according to the ELISA kit protocols. Leptin ELISA kit was a DBC with the serial number CAN-L-4260 and the adiponectin kit was Boster, EK0595. Blood samples were transferred to the laboratory immediately to measure the serum levels of leptin and adiponectin. The data collected were analyzed by SPSS version 15, using dependent sample t-test and ANCOVA ($p \leq 0.05$).

## Results

Age, height, weight and BMI of all the subjects were in normal range and also there was no significant difference between girls and boys in the demographic factors (Table 1). Serum levels of leptin was higher (P= 0.678) in post-test compared to pre-test in male players (1.81 ± 0.89 versus 1.32 ± 0.68 ;Table 1). also serum levels of leptin was higher (P= 0.077) in post-test compared to pre-test in female players (11.20 ± 2.38 versus 8.63 ± 1.89;Table 1). Serum levels of leptin was lower (P= 0.479) in post-test compared to pre-test in male players (2.24 ± 0.93 versus 2.67 ± 1.00 ;Table 1). also serum levels of leptin was higher (P= 0.461) in post-test compared to pre-test in female players(17.70 ± 4.76 versus 13.29 ± 3.18 ;Table 1). Serum levels of leptin was higher in female player compared to male player in pre-test (8.63 ± 1.89 versus 1.32 ± 0.68; P= 0.001; Table 3) and post- test (11.20 ± 2.38versus 1.81 ± 0.89; P= 0.019; Table 3). Serum levels of leptin was higher in female player compared to male player in pre-test (13.29 ± 3.18 versus 1. 2.67 ± 1.00; P= 0.026; Table 3) and post- test (17.70 ± 4.76 versus 2.24 ± 0.93; P= 0.003; Table 3). Serum levels of adiponectin was lower (P= 0.073)in post-test compared to pre-test in male players(1194.06 ± 3.93versus 1195.73 ± 2.3;Table 4). also serum levels of leptin were lower (P= 0.005) in post-test compared to pre-test in female players (1187.72 ± 2.13versus 8. 1197.96 ± 2.52; Table 4). Serum levels of leptin was higher (P= 0.67) in post-test compared to pre-test in male players (1197.89 ±2.9versus 1196.04 ± 2.08; Table 4). And also Serum levels of leptin was higher (P= 0.415) in post-test compared to pre-test in female players (1192.44 ± 2.71versus 1194.70 ± 1.32; Table 4). Serum levels of Adiponectin was higher in female player compared to male player in pre-test (1197.96±2.52 versus 1195.73±2.3; P= 0.52; Table 5) and lower in post- test (1187.72±2.13versus 1194.06±3.93; P= 0.17; Table 5). Serum levels of Adiponectin was lower in female player compared to male player in pre-test (1194.70±1.32 versus 1196.04±2.08; P= 0.60; Table 5) and post- test (1192.44±2.71 versus 1197.89±2.9; P= 0.59; Table 5).

**Table1.** Demographic information of samples

| Variable | Male | Female | p |
|---|---|---|---|
| Age (year) | 21.90 ± 0.87 | 20.60 ± 1.21 | >0.05 |
| Height (cm) | 170 ± 0.04 | 164.10 ± 3.40 | >0.05 |
| Weight (Kg) | 64.42 ± 6.44 | 57.50 ± 1.83 | >0.05 |
| BMI ($kg/m^2$) | 22.05 ±1.68 | 21.40 ± 1.30 | >0.05 |

**Table2.** Serum levels of leptin changes after moderate and high exercise

| Parameter | Male | | | Female | | |
|---|---|---|---|---|---|---|
| | Pre -test | Post- test | p | Pre –test | Post- test | p |
| Moderate | 1.32 ± 0.68 | 1.81 ± 0.89 | 0.678 | 8.63 ± 1.89 | 11.20 ± 2.38 | 0.077 |
| High | 2.67 ± 1.00 | 2.24 ± 0.93 | 0.479 | 13.29 ± 3.18 | 17.70 ± 4.76 | 0.461 |

**Table3.** Serum levels of leptin in female player versus male player (moderate and high intensity)

| Parameter | Pre- test | | | Post- test | | |
|---|---|---|---|---|---|---|
| | Male | Female | P | Male | Female | P |
| Moderate | 1.32 ± 0.68 | 8.63 ± 1.89 | 0.001 | 1.81 ± 0.89 | 11.20 ± 2.38 | 0.019 |
| High | 2.67 ± 1.00 | 13.29 ± 3.18 | 0.026 | 2.24 ± 0.93 | 17.70 ± 4.76 | 0.003 |

**Table4.** Serum levels of Adiponectin changes after Moderate and High exercise

| Parameter | Male | | | Female | | |
|---|---|---|---|---|---|---|
| | Pre -test | Post- test | p | Pre -test | Post- test | p |
| Moderate | 1195.73 ± 2.3 | 1194.06 ± 3.93 | 0.73 | 1197.96 ± 2.52 | 1187.72 ± 2.13 | 0.005 |
| High | 1196.04 ± 2.08 | 1197.89 ±2.9 | 0.67 | 1194.70 ± 1.32 | 1192.44 ± 2.71 | 0.415 |

**Table5.** Serum levels of Adiponectin in female player versus male player (moderate and high intensity)

| Parameter | Pre- test | | | Post- test | | |
|---|---|---|---|---|---|---|
| | Male | Female | P | Male | Female | p |
| Moderate | 1195.73±2.3 | 1197.96±2.52 | 0.52 | 1194.06±3.93 | 1187.72±2.13 | 0.17 |
| High | 1196.04±2.08 | 1194.70±1.32 | 0.60 | 1197.89±2.9 | 1192.44±2.71 | 0.59 |

## Discussion

The present study aimed to investigate the relationship between the intensity of physical activity and the serum levels of leptin and adiponectin in futsal players of both genders. Based on our research results, moderate and high intensity training did not change the concentration of leptin and adiponectin in male and female futsal players. Mean serum level of leptin in girls was approximately twice of that the boys, which was shown previously. Exercise is a strong stimulus that affects metabolism (36) and homeostasis (37). Therefore, all hormones involved in metabolism and hemostasis (eg, adipokines secreted from adipose tissue) are affected. There are many contradictions about the effects of exercise on adipokines. Nutritional status, neuroendocrine factors, immune system, sex hormones, catecholamines, insulin and physical activity, etc. can affect the concentration of leptin and adiponectin (38). It has been shown that leptin concentration has a direct relationship with BMI and body fat

percentage (39). On the other hand, the female sex hormone, estrogen stimulates the secretion of leptin (40), and the male sex hormones, testosterone has a negative relationship with leptin (41). These two mechanisms and other possible mechanisms describe higher levels of leptin hormone in women than men. The mechanism of leptin changes has not been identified in response to exercise, and there are contradictions in this regard. Some studies similar to ours have reported a lack of changes in leptin concentrations (42, 43), while some studies have reported a decrease in leptin concentrations following exercise(43, 44). The need for energy in exercise activity seems to lead to changes in the concentration of leptin during exercise and afterwards. Long-term exercise alters not only the tissue composition but also makes changes in hormonal settings, especially insulin sensitivity. These changes can affect the expression and concentration of leptin (45, 46). On the other hand, exercise type, severity, duration of exercise, professional or amateur, time of execution, and ... can affect the secretion of adipokines (47). It seems that two important factors of physical fitness and blood sampling time are effective on the concentration of plasma adiponectin. It was reported that the concentration of adiponectin did not significantly change in sportsman subjects immediately after exercise (which is similar to the current study), but increased 30 minutes after exercise (48), Twelve weeks of walking on treadmill had no effect on serum adiponectin of obese males (22). Although the present study expresses no relation between physical activity, its severity and their effects on serum leptin and adiponectin of male and female futsal players, there would be more to discuss about. Lack of change in leptin and adiponectin concentrations might be the result of a long-term physical activity, because all of our samples were athletes and they have been playing futsal for many years. Additionally, if there is a decrease in serum leptin level, it could not be detected unless compared to non-athlete people. Therefore, it is suggested to compare the serum levels of these hormones between athletes and non-athlete people with a larger sample size in further studies.

## Conclusion

There is no significant relation between the moderate to severe intensity physical activity and serum levels of leptin and adiponectin in male and female futsal players within a period of one week.

## Ethical issues

This study was approved by the local ethical committee of Jahrom University of Medical Sciences (June.rec.1393.059). Informed consent sheet was signed by the participants and was approved by the committee of ethics according to the Declaration of Helsinki.

## Authors' contributions

All authors equally contributed to the writing and revision of this paper.

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