Effect of Championship Trainings on Growth Hormone Response in adolescent’s Champion martial girls & boys

Sharif Rezai1, Asghar Nikseresht2

1. Department of Physical Education and Sport Sciences, Estahban Branch, Islamic Azad University, Estahban, Iran
2. Department of Physical Education and Sport Sciences, Jahrom Branch, Islamic Azad University, Jahrom, Iran

Corresponding author email: Rezai.Sharif@gmail.com

ABSTRACT: The present study investigated the effect of exercise on growth hormone and blood glucose response karate elite workers are teenagers. Growth hormone is a strong factor in the growth and increase muscle metabolism and transport of amino acids into the cells involved. Twenty-three young athletes (12 male) and (11 female), martial artist in Milan, as the sample was taken at the end of each group of 8 people survived. Blood samples on three occasions, before practice, after 10 weeks following maximal exercise and maximal exercise was received at the end of 3 weeks. The results indicate no statistically significant effect of exercise on GH peak below the base of both girls and boys (respectively p=0.583, p=0.446). Perform maximal exercise caused a significant increase in basal GH Boys (p=0.029) and the reduction was significant in girls (p=0.048). The results showed a significant effect on the rate of growth hormone on exercise submaximal not teenagers. The maximal exercise increased significantly in the amount of growth hormone secretion in male elite athletes based in the championship, while intense exercise can cause problems in the championship in girls during puberty and should be Cautious.

Keywords: Growth Hormone Level; Puberty; Submaximal; Maximal Exercise

INTRODUCTION

During the exercise, the body is faced with high demand which causes many physiological changes. To survive in such conditions, hemostasis should be kept constant. In this regard, the nervous and endocrine (hormone) systems start and control the motor and all involved physiological processes in a coordinated action. Hormone system is responsible for various metabolic actions of body such as synthesis and activation of cellular enzymes, changes in permeability of cell membranes, protein synthesis, changing the cell metabolism, stimulating the cell secretion and the growth (Wilmore and castile, 2007). Pituitary is one of these endocrine systems, which secretes an important hormone called growth hormone (GH). Human growth hormone (GH) or Somatotrop is a polypeptide with a molecular weight 22000. Like most of the pituitary hormones the growth hormone secretion is done as the pulsatile flow (sanadgol, 2002). This hormone is made of a simple chain without branches. Anterior pituitary contains 5 to 10 mg of growth hormone which is synthesized and stored in somatotrop cells. Age and gender are among the factors which can affect the generation of growth hormone. Estimated daily growth hormone secretion in men is from .4 to 1 mg and this amount of growth hormone in young people, adolescents, and women is higher. Also, women, who are taking estrogen, have higher daily secretion of growth hormone. Growth hormone is metabolized in the liver and its plasma half-life is between 17 to 45 minutes (mcintry and odell, 1997).

Growth hormone is one of the most important factors affecting the general body growth and triple metabolism and at least has two major tasks: First, it will develop the growth and second, it regulates the consumption of fats and sugars at the time of working and physical activity as a hormonal regulator (sanadgol, 2002). Previous studies show that the concentration of growth hormone is increased significantly in special circumstances such as sleep and during exercise and physical activity (sanadgol, 2002). GH hormone secretion during the rest is affected by GH releasing factor which works directly on the anterior pituitary gland.
There is no precise mechanism which makes it quite clear that GH and exercise with their own interaction can increase the protein synthesis, cartilage making, bone growth and cell proliferation. One hypothesis is that the exercise can directly stimulate the GH generation and its oscillating pattern of releasing which leads to stimulation of tissue-making processes. In addition, the exercise stimulates the generation of endogenous opioids which facilitate the GH release by preventing from generating liver somatostatin. Many physiological states (such as exercise, hunger, reduction of plasma glucose concentration and sleep) stimulated the growth hormone secretion by reducing the amount of somatostatin secretion or increasing GHRH secretion (Vander and Shareman, 1990).

Some factors which affect the amount of growth hormone secretion are: shock and stress, sleep, pain, cold weather, surgery, hunger, Hypoglycemia, exercise, some hormones, eating the protein and amino acid Arjinine. The effects of all above factors are justified considering very important physiological property of growth hormone which always prevents the glucose consumption in body. Because at the time of nervous shock, Hypoglycemia, hunger and sleep, the growth hormone leads to a larger amount of free fatty acids in the cells by activating the lipolysis reactions on the one hand, and on the other hand, it increases the amino acids entering into the cell (renewal reactions of glucose) in order to prevent the consumption of glucose and maintain it for brain cells needs (widdowson et al, 2009).

In response to Hypoglycemia (low blood sugar) the growth hormone secretion is increased and by this increase is halted by enhanced blood glucose level. The growth hormone response, caused by reduced absolute glucose and rapid rise in blood glucose, happens even the level of serum growth hormone is normal. By Growth increasing the age the hormone secretion is reduced. Exercise is a strong stimulator for growth hormone secretion. Duration and intensity of severe exercise, external work during the exercise, and muscle mass used during the exercise are effective in the amount of growth hormone secretion (weltman et al, 2002).

Growth hormone is one of the anti regulating hormones, which help to reduce the blood glucose to normal level and thus it has a definite anti-insulin effect. This Hormone in the muscle releases the free fatty acids (FFA) from the glycerides in the muscle by activating the path of Lipolyses and prevents from the reactions of glycolysis. High levels of growth hormone can lead to diabetes in the long term through what is found in Acromegaly (mcintry and odell, 1997).

By developing the research fields in current century, the role of physical activities and its effects on the body and normal growth of child and adolescent have had a vast reflection and in line with the effects of exercise and physical activities on body organs and systems its therapeutic role in controlling the physical and physiological abnormalities are also studied.

This study is important in terms of two aspects, first, all research subjects are among the athletes who have a background of championship and have done severe trainings at the championship level, and second, they were all at the age of adolescence and puberty.

Galbo et al state about changes of features related to the hormonal adaptations by physical activities: We suppose that by starting the exercise the stimulations are sent from the mobility centers to the brain and also to higher endocrine centers through the afferent nerves of active muscles, and depending on working pressure they lead to the automated neural - hormonal response so that it is stated that the hormonal adaptations become essential for facilitating the movement of expected substances. This initial adjustment depends on the status of organism, while the hormonal response is more related to the work pressure which is relatively expressed as the “Vo2 max” and not the work pressure with absolute concept (Satin and Galbo, 1998).

In a study forced 7 men to do activity by Ergomedic bike with 75% VO2 max until the exhaustion. The results of this study have shown that the GH secretion of serum was first rising and was again reduced before the exhaustion. Then they compared the findings of this study with the results of subjects’ activities on the Ergomedic bike with intensities 42 and 98% VO2max and concluded that the rate of growth hormone has been increased dramatically in the activity carried out with 75% maximum oxygen consumption compared to two other activities (Hartley et al, 1989).

About the effect of exercise on growth hormone levels, some research suggest no effect on increasing growth hormone after exercise; the research conducted by (Bennett and et al, 2002) can be pointed out in this regard. In this study, 28 male and female athletes participated and subjects were in 4 groups: male runners and control group, female runners and control group. Male and female runners exercised with an intensity of VO2max 60% and finally the results showed that the male runners had higher GH level from minute 30 to the end of exercise and from minute 3 to 15 minutes after the exercise, but changes was not significant in women (Bunt et al, 2002). In a recent survey on 20 male cyclists in two types of gentle and submaximal exercise, the results showed that the level of growth hormone and Insulin-like growth factor-1 (IGF-I) were increased in both types of exercise (de palo et al, 2008).

For comparing the amount of growth hormone secretion in women and men, used the a comparing study and studied 6 women in a 30-minute exercise in intensities 25 and 75% of difference between resting and lactate and difference between the maximal oxygen consumption and lactate in intensities 25 and 75%, and
along with the results of a research conducted by survey author et al (1999) on men in similar circumstances, they have concluded that the amount of growth hormone in severe exercise was higher in women than men and the basal growth hormone secretion in women was higher than men in any circumstances. Moreover, the increase of exercise intensity leads to a linear increase in the amount of growth hormone secretion (Pritzlaff-Roy et al, 2002).

About the effect of exercise on 24-hour changes of growth hormone, Videman et al. found in a survey conducted on young men and women that contrary to previous suggestions, which believe that the exercise is a trigger for releasing the growth hormone, it should be noted that the threshold of intensity should be considered. Regardless of age and gender, there is a linear correlation between the amount of increased growth hormone secretion and the exercise intensity. By attending in aerobic exercise, it is indicated that the amount of growth hormone secretion in young women is higher than the young men, and this amount is decreased by increasing the age. Short-term exercise has no effect on growth hormone concentration during 24 hours. However, repeating the duration of aerobic exercise during a period of 24 hours can increase the 24-hour correlation of growth hormone concentrations. But, the growth hormone response to acute resistance exercise depends on the frequency of activity-rest, weight load, and the frequency of resistance exercise (wideman et al, 2002).

Another study was conducted on two groups of obese and normal young people with two continuous and intermittent exercise tests. In this study, the subjects were controlled for 24 hours in a laboratory environment. Results showed that both continuous and intermittent exercise increased the concentration of serum GH in 24 hours. Basal amount and rate of growth hormone secretion in obese subjects was reduced at rest (weltman et al, 2008).

About the athletic performance, the increased secretion of growth hormone can directly enhance the athletic performance especially in long term exercise through the transfer of oxygen, increasing the fat oxidation (with saving the glycogen), increasing the muscle strength as well as indirect mechanisms including changes in physical structure or increasing the body temperature (widowson et al, 2009).

Gaeini in his study entitled as "Evaluating the effect of maximal and submaximal activities on athletes and not-athletes growth hormone changes" studied 91 subjects with 15-17 years of age in two groups of athletes and non-athletes and concluded that subsequently the maximal and submaximal exercise is increase in both groups, but after the maximal exercise this increase is more in both groups (Gaeini, 1996).

In a research conducted by Mohebbi, 8 male subjects also participated for two sessions. They exercised for 120 minutes with VO2max intensity 70% in first session. In first experiment, the subjects' blood glucose concentration was kept 12 mmol per liter 30 minutes before exercise and during the exercise. In second experiment, 9% Saline solution was injected into the same volume which was injected with glucose in first experiment. Blood samples were taken 30 minutes before the exercise and at minutes 20, 40, 60, 80, 100, 120 during the exercise. His obtained results are as follows: growth hormone was reduced in plasma, but in general the glucose injection and maintained hyperglycemia during prolonged high-intensity activities stop the hormonal responses to exercise and the basal growth hormone secretion and the exercise intensity. By attending in aerobic exercise, it is indicated that the amount of growth hormone secretion and the exercise intensity. By attending in aerobic exercise, it is indicated that the amount of growth hormone secretion and the exercise intensity.

In a research for evaluating the effect of aerobic athletic activities on the growth hormones, Mirdar chose a group of 10, 16 to 18 year-old students who had good physical fitness and were at excellent level based on Cooper test. Obtained results of changes in hormone serum and findings of statistical research were analyzed and this proves that the aerobic exercise activities affect the growth hormones and increase the Growth hormone significantly (Mirdar, 2004).

Sadeghi (2009) in a research conducted on male students provided two intense resistance trainings with same volume and different rest between among the sets (1 min vs. 3) on 15 bodybuilders and concluded that both exercise programs increased the growth hormone concentration and blood lactate significantly compared to before. But the growth hormone in resistance training exercise with 1 minute rest had significant increase compared to training exercise with 3 minutes rest. IGF-I hormone changes compared to before the training in both resistance training exercise was not statistically significant, however, a significant increase in the concentration of this hormone was observed after doing both trainings (sadeghi and rahimi, 2009).
Research Method

The research is applied with quasi-experimental design along with pre-test post test of male and female champion athletes. It is tried in this research to examine the effect of two submaximal physical activities (Before the competition season) and maximal physical activities until exhaustion (In competition season) on the amount of growth hormone secretion in female and male adolescents. 11 female adolescents and martial artists and 12 male martial artists with the age range 12-18 years, who had won at least one time in state or provincial tournament in Estahban city, were considered as the statistical sample. Some of them were excluded from training due to the injury or large number of being absence and finally 8 girls (with average age 14.75 years, height 1.6 m and weight 51.56 kg) and 8 boys (with average age 14.44 years, height 1.56 m and weight 46.3 kg) remained.

The first blood sample was taken before starting the submaximal exercise from fasting subjects. After 10 weeks of submaximal exercise and 12 hours after the last exercise, the fasting subjects took again the sample. Considering that the maximal exercise began just after the submaximal exercise, the second sampling was considered both as the submaximal exercise post-test and as maximal exercise pre-test. Maximal exercise also lasted 3 weeks and again 12 hours after the last exercise, the blood samples were taken from the fasting subjects. Every time, 10 cc of blood was taken from the subjects and after each sampling the samples were centrifuged in the laboratory and its serum was put in the machine "A wareness Elisa" with model "stat fax" and the kit "Human" made in Germany in order to measure the level of growth hormone.

Exercise Program

Exercise Duration

Submaximal exercise was done for 10 continuous weeks and the maximal exercise was done for 3 weeks just after the submaximal exercise.

Exercise Intensity

Submaximal exercise was done with intensity between 65 to 75 percent of maximum heart rate reserve and the maximal exercise was done with intensity between 85 to 90 percent of maximum heart rate reserve, and they were measured by Karvonen Method (karvonen et al, 1957). In order to determine the heart rate during the exercise, the Electrocardiograph machine made in Finland was used.

Duration and Repeat

In submaximal exercise, 3, 2-hour sessions and totally 30 exercise sessions were done. Maximal exercise was done 6, 2-hour sessions per week and totally 18 exercise sessions.

Statistical Analysis

In order to describe the studied variables, the average values were used as the indicator of central tendency and the standard deviation as the dispersion indicator. Given the small population and statistical sample and in order to evaluate the numerical variables distribution in terms of the conformity rate with normal theoretical distribution, the Kolmogorov-Smirnov statistical test was used. After confirming the normality of statistical population, the research data were studied using the software Spss 16 at the significant level at α=0.05. T-test was used in order to determine the difference between the growth hormone level before and after the training.

Moreover, the Independent T-test was used in order to determine the difference between variables of two groups in both types of exercise.

Research findings

Significant level of Kolmogorov-Smirnov test in studied variables indicated that the samples follow a normal distribution and the Parametric Tests can be used at next stages in order to analyze these variables. Results of dependent groups T-test on data of growth hormone (GH) pre-test and post-test in both male champions' submaximal and maximal exercise are presented in Table (1).
Table 1. Results of dependent T-test for indicator of growth hormone and blood glucose in boys

<table>
<thead>
<tr>
<th>Variable</th>
<th>Type of Exercise</th>
<th>Significant level</th>
<th>df</th>
<th>T</th>
<th>Error of standard deviation</th>
<th>Standard deviation</th>
<th>Mean difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth hormone</td>
<td>Submaximal</td>
<td>0.446</td>
<td>7</td>
<td>0.808</td>
<td>0.479</td>
<td>1.356</td>
<td>0.387</td>
</tr>
<tr>
<td>mg/ml</td>
<td>Maximal</td>
<td>† 0.048</td>
<td>7</td>
<td>2.39</td>
<td>0.578</td>
<td>1.635</td>
<td>1.383</td>
</tr>
<tr>
<td>Blood glucose</td>
<td>Submaximal</td>
<td>0.289</td>
<td>7</td>
<td>1.148</td>
<td>6.2</td>
<td>17.55</td>
<td>7.12</td>
</tr>
<tr>
<td>mg%</td>
<td>Maximal</td>
<td>† 0.045</td>
<td>7</td>
<td>2.43</td>
<td>2.72</td>
<td>7.7</td>
<td>6.62</td>
</tr>
</tbody>
</table>

†: At 0.05 is significant

According to Table 1, changes in basal growth hormone level after the submaximal exercise had no significant difference in male adolescent champions (p ≤ 0.446). However, decrease of basal growth hormone of post-test in boys in maximal exercise was significant compared with pre-test (p ≤ 0.048). Blood glucose had no significant difference after doing submaximal exercise (p ≤ 0.289). But after doing the maximal exercise, the level of subjects' Blood glucose was increased significant (p ≤ 0.045).

T-test of dependent groups on data of growth hormone (GH) of pre-test and post-test in both submaximal and maximal exercise in adolescent champion female is presented in Table (2).

Table 2. Results of dependent T-test for indicator of growth hormone and blood glucose in female

<table>
<thead>
<tr>
<th>Variable</th>
<th>Type of Exercise</th>
<th>Significant level</th>
<th>df</th>
<th>T</th>
<th>Error of standard deviation</th>
<th>Standard deviation</th>
<th>Mean difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth hormone</td>
<td>Submaximal</td>
<td>0.583</td>
<td>7</td>
<td>0.576</td>
<td>4.522</td>
<td>12.792</td>
<td>2.606</td>
</tr>
<tr>
<td>mg/ml</td>
<td>Maximal</td>
<td>* 0.029</td>
<td>7</td>
<td>2.727</td>
<td>3.219</td>
<td>9.106</td>
<td>8.781</td>
</tr>
<tr>
<td>Blood glucose</td>
<td>Submaximal</td>
<td>0.374</td>
<td>7</td>
<td>0.949</td>
<td>5.26</td>
<td>14.89</td>
<td>5</td>
</tr>
<tr>
<td>mg%</td>
<td>Maximal</td>
<td>* 0.014</td>
<td>7</td>
<td>3.27</td>
<td>3.47</td>
<td>9.82</td>
<td>1.13</td>
</tr>
</tbody>
</table>

According to Table 2, changes in basal growth hormone level after the submaximal exercise had no significant difference in female adolescent champions (p ≤ 0.583). However, decrease of basal growth hormone of post-test in female in maximal exercise was significant compared with pre-test (p ≤ 0.029). Blood glucose had no significant difference after doing submaximal exercise (p ≤ 0.374). But after doing the maximal exercise, the level of subjects' blood glucose was increased significant (p ≤ 0.014).

Table 3 indicates the T-test of independent groups on data of post-test growth hormone (GH) in both submaximal and maximal exercise by boys and girls adolescent champions.

Table 3. Results of independent groups T-test for post-test growth hormone in male and female adolescents

<table>
<thead>
<tr>
<th>For values of post test means of t-test</th>
<th>Variance equality test</th>
</tr>
</thead>
<tbody>
<tr>
<td>confidence interval</td>
<td>95%</td>
</tr>
<tr>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Error of standard deviation</td>
<td>Mean difference</td>
</tr>
<tr>
<td>(Sig) significant level</td>
<td>Df</td>
</tr>
<tr>
<td>t-test</td>
<td>Sig</td>
</tr>
<tr>
<td>F</td>
<td></td>
</tr>
<tr>
<td>Submaximal exercise</td>
<td>-2.237</td>
</tr>
<tr>
<td>Maximal exercise</td>
<td>2.731</td>
</tr>
</tbody>
</table>

According to Table 3, significant level p ≤ 0.013 shows that there is a significant difference between the post-test growth hormone of submaximal exercise for two groups of boys and girls, but difference was not significant for maximal exercise p ≤ 0.258.
DISCUSSION

Results of independent T-test suggest that there is a significant difference between the level of post-test growth hormone in female and male champions after doing the submaximal exercise. In the other words, 10 weeks (30 sessions) submaximal exercise before the camp cause a significant difference in boys' and girls' growth hormone. Comparing the results of groups indicated that the amount of post-test growth hormone secretion in exercise before the camp is higher in girls than the boys. With the knowledge that the blood glucose level affects the growth hormone secretion, the researcher also measured the blood glucose level and the above result obtained in a condition that the blood glucose level had no significant difference before and after the exercise. This issue was less considered in previous studies. By more accurate and detailed survey of data, it was indicated that in group of boys all subjects showed small changes in growth hormone level after growth hormone. Comparing the results of groups indicated that the amount of post-test growth hormone level after doing the submaximal exercise, but in group of girls, half of subjects showed increased growth hormone level, and in the other half the effects of submaximal exercise on the growth hormone had been decreased. Therefore, it is obvious that the individual differences affect the above hypothesis. Perhaps some of the neurological factors (stress and mental stress) affect the rate of somatostatin secretion and decrease the growth hormone. These results are consistent with the results of some research (widdosan et al, 2009; bunt et al, 2002), but are also inconsistent with other research (Gaeini, 1996; kanaly, 1999; irving et al, 2009). However, most of these researchers have sampled in early hours of recovery, but sampling in this study was performed 12 hours after the exercise.

Comparing the results of two groups showed that 10 weeks (30 sessions) submaximal exercise makes a significant difference in boys' and girls' growth hormone. Secretion of post-test growth hormone in submaximal exercise was higher in girls than boys. In justifying this result it can be stated that the growth hormone secretion in girls has been the result of higher growth hormone secretion (mcintry and odell, 1990). This result is consistent with the findings by most of the researchers (Eskandari, 2006; Pritzlaff-Roy et al, 2002; bunt et al, 2002; Widdowson et al, 2009) and Eskandari (2006) and most of the researchers have reported the higher level of growth hormone in girls than boys after doing the submaximal exercise.

3 weeks (18 sessions) intense training during the camp reduced the basal growth hormone level in girls significantly. These results obtained while most of the researchers have been reported the increased level of growth hormone after the intense exercise. These results are inconsistent with the results obtained by researchers such as (Gaeini, 1996; Irving et al, 2009) and the cause of this inconsistency can be the factors such as high stress and psychological pressure, exercise intensity and duration, intensive exercise (6 sessions per week for current study), type of exercise, and especially the subjects' age and level of being skilled. It is reported in some of research that it has been higher in untrained individuals than the trained ones (Gaeini, 1996).

Based on previous studies, several factors are effective in decreasing the growth hormone. In some of these studies, less lactate has been introduced as the cause of less secretion of growth hormone in ready people at the time of exercise activity. In the other words, the more the athlete is prepared and has higher lactate threshold, the less growth hormone is secreted (Satin and Galbo, 1998). The blood glucose concentration is another factor affecting the growth hormone. There is an inverse relationship between the blood glucose and growth hormone (Mohebbi, 1998; McIntry and Odell, 1990) so given the significant increase of girls' blood glucose in this study, it seems that it is increased due to the secretion of some blood glucose regulators. Cortisol, glucagon and epinephrine are the blood glucose regulators (Gaeini, 1996). there is some evidence which indicate that the intense secretion of Cortisol, which is made in female athletes due to the stress and psychological pressure of athletic activities, increases the blood sugar and secretion of hormone which inhibits the growth hormone (somatostatin) and this leads to reduced growth hormone secretion.

Therefore, since the severe anxiety and stress in long-term exercise (more than one hour) causes that the body to enter the Cortisol secretion phase, if there are stressful frequent situations, it increases the weakened immune system, weight gain and obesity, insomnia, heart diseases, depression and lack of coordination in digestive disorders and also increases the blood pressure, cholesterol, and fat accumulation around the abdomen. Therefore, it seems that if the exercise Kyokushin kaikan, which is an intense exercise with high collision, is done continuously and intensively and with high pressure, it can have negative effect on female adolescents and growth problems in soft and skeletal tissue during the puberty. In contrast, the intense exercise in group of boys increases the basal growth hormone level significantly. These results were obtained while the subjects were under a lot of pressure during the exercise. However, the growth hormone showed a significant increase.

More detailed survey on data indicates that all male subjects' basal growth hormone level has been increased after the maximal exercise. Since the growth hormone in adolescence is a strong metabolic factor, which facilitates the muscle growth and hypotrophy and increases the amino acids transferring into the cells and also as a hormonal regulator adjust the fats and sugars consumption at the time of work and body activity, this increase of basal hormone increase the athletic performance as well as stimulating the formation of a GH-
dependent called Somatomedin c (Somatomedin intermediary hormones) or insulin-like growth factor 1 (IGF-1) and may lead to a positive nitrogen balance and stimulate the growth of skeletal and soft tissue (Mcintry and Odell, 1990). These findings is consistent with the findings obtained by (Gaeini, 1996; Barati, 2000; Sadeghi and Rahimi, 2009; Irving et al, 2009), and the results by (Weltman et al, 2002; Eliakim et al, 2005). In order to explain this difference, we can cite the type, intensity of exercise, and age, done on non-athletes adults in both research, and more importantly, the sampling time after the exercise in these studies has been done 2 initial hours after the exercise.

Comparing the results of post-test maximal exercise in both groups indicated that there is no significant difference between the level of growth hormone in boys and girls after doing a 3-week continuous and intense exercise, "Kykushin kaikan" Karate. However, the girls' growth hormone level in pre-test was higher than the boys and most of previous researchers have reported that the intense exercise has increased the growth hormone more in girls than the boys. For explaining these results, it can be stated that the high decrease of girls' growth hormone caused that the basal growth hormone level in both female and male adolescents to be equal. These results are inconsistent with the findings by (Eskandari, 2006; Pritzlaff-Roy et al, 2002). In order to explain this difference, the type and intensity of exercise, age of subjects, hereditary factors, and more importantly the sampling time after the exercise can be pointed out.

ACKNOWLEDGEMENT

We sincerely appreciate the cooperation of trainers and athletes who helped us in this way.

REFERENCES

Barati BK. 2000. the effect of aerobic and anaerobic exercise on male school students' levels of growth hormones and blood testosterone, M.S thesis in physical education: University of Isfahan.


Sadeghi BS, Rahimi R. 2009. GH and IGF-1 18 hormones response to two resistance programs with same volume and different rest among the sets. Olympic. 17 (1): 57-68.
