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Medical Science**
Journal homepage: www.Sjournals.com**Original article****GH and IGF-1 responses of elite boxers and field hockey players to increasing maximal aerobic exercise****M. Hazar^{a,*}, I. Otağ^b, A. Otağ^c, I. Okan^a**^a*School of Physical Education and Sports, Gazi University, Ankara 06500, TURKEY.*^b*Vocational School of Health Services, Cumhuriyet University, Sivas 58140, TURKEY.*^c*School of Physical Education and Sports, Sivas 58140, TURKEY.*

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ABSTRACT

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To evaluate the response of some metabolic factors in elite sportsmen performing individual (boxing) and team (Field hockey) sports who apply different training models to the increasing maximal aerobic exercise. The study included 14 young elite Field hockey players and 10 young elite boxers. The sportsmen were applied shuttle run test. The sportsmen run with an increasing speed of 8 km/h between two lines apart from each other with a distance of 20 m. The runs were started with a signal sound. When the sportsmen missed two signals, the test was terminated. Blood samples were taken threefold as once immediately before the exercise, once immediately after the exercise and once after one hour. The blood samples taken were kept on - 80oC until the analysis. Using Growth Hormone (GH), insulin (INS), Insulin Like Growth Hormone (IGF-1) and protein-bound Insulin Like Growth Hormone (IGF-bp) original kits in the analysis, serum levels of these metabolic factors were measured. The data were evaluated statistically. In the analysis of blood samples taken immediately after the exercise, it was seen that GH, IGF-1 and IGF-bp serum levels increased. As to the INS serum level, while the Field hockey players showed an increase, the boxers showed a decrease. Especially GH increase in the boxers was greatly more than the levels of Field hockey players before the exercise. When the serum levels obtained one hour after the exercise were compared to the levels immediately after the exercise, a decrease

was detected in both groups of sportsmen except for IGF-1. Differences were detected between the responses of GH, IGF-1, IGF-bp and INS to increasing maximal aerobic exercise in elite Field hockey players and boxers. The response of metabolic factors was found useful in terms of health and body composition in both groups of sportsmen in spite of the differences.

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1. Introduction

Physical exercise induces endocrine changes, These include anabolic hormones, mainly those involved the Insuline Like Growth Factor (IGF) system and Growth Hormones (GH) and Insuline (INS).

Growth hormone, also called somatotrophic hormone or somatotropin, is a small protein molecule that contains 191 amino acids in a single chain and has a molecular weight of 22,005. It promotes increased size of the cells and increased mitosis, with the development of greater numbers of cells and specific differentiation of certain types of cells (Guyton et al., 2003). Secretion of GH increases several hours after meals, with exercise and after the start of sleep (Ghos et al., 1995). Exercise stimulates GH secretion. GH level begins to increase within several minutes after the start of exercise, and reaches its peak at the end of or a short time before the end of exercise (Gibney et al., 2007). Response of GH to exercise may change according to age, gender, body composition, physical appropriateness and intensity of exercise. With a decrease in insulin level in circulation as a result of the exercise, GH amount which increases with exercise is important for arranging utilization of fatty acids. Utility level of fat acids contributes to the changes in exercise performance and body composition (Giustina et al., 1998). GH secretion increases together with the intensity of exercise (Hansen et al., 2012; Jeukendrup et al., 2002).

Insulin like growth factors (IGFs) is peptides which accelerate the growth. IGF-1 is generally synthesized in the liver and then sent to the circulation. However, it is also synthesized in tendons and ligaments regionally (Jurimae et al., 2007). They are available in the circulation either freely or bounded to protein (IGF-bp). Together with the exercise, the increase in IGF-1 level is independent from GH level. Because, the increase in serum GH level occurs later than the increase in serum IGF-1 level. While IGF-1 increases both in low and high intensity exercises, GH does only increase in high intensity exercises. IGF-1 is affected differently from various exercise types. While endurance type exercises result in significant increases in serum IGF-1 level, weight exercises don't result in any significant change in IGF-1 level (Kraemer et al., 2004). Insulin is a small protein; human insulin has a molecular weight of 5808. It is composed of two amino acid chains, the insulin plays an important role in storing the excess energy (Guyton et al., 2003). Exercise decreases plasma glucose, basal and postprandial insulin levels; increases insulin sensitivity and improves lipid profile (Baker et al., 1993).

The subjects such as the response of metabolic factors to the same exercise, the differences between these responses and the reasons thereof in Field hockey players and boxers were not researched much. A study to be performed with the sportsmen of boxing which is an individual challenge sport and Field hockey, which is a team sport will contribute to the evaluation of the responses of different sportsmen to the same exercise and the differences among these responses.

Boxing is an individual challenge sport which has a highly dynamic and static features, a complex structure and which requires much effort (Ahmed et al., 2007; Arseneau et al., 2011). It requires especially an explosive effort and this effort is related to anaerobic metabolism (Aziz et al., 2000). On the other hand, Field hockey is a team sport for which the players should develop physically in order to reach physical standards at elite level. Aerobic and anaerobic effort levels are either better than or similar to the levels of the players of other team sports (football, basketball, etc.) (Bahadır et al., 2012). In Field hockey players among team sports and boxers among individual sports, heart rate, blood lactate concentration and oxygen consumption were examined (Baker et al., 1993; Cappon et al., 1994; Claustres et al., 1987; Cappon et al., 1994; Fong et al., 2012; Frisch, 1999). In our study, GH, IGF-1, INS and IGF-bp serum levels were examined in Field hockey players and boxers before, immediately after and one hour after the exercise.

With short rest intervals, a high intensity exercise performed with wide muscle groups produces great increases in GH and IGF-1. GH and IGF-1 which increase after the exercise don't increase muscle hypertrophy reached as a result of intense training programs. These hormones are not necessary for muscle hypertrophy (Jeukendrup et al., 2002). However, GH and IGF-1 are important factors playing key roles in growth and development (Kraemer et al., 1990; Kraemer et al., 1999; Lemmink et al., 2006).

2. Materials and methods

2.1. subjects

10 elite young male boxers and 14 elite young male Field hockey players were included in the study after taking their health reports and written participation forms.

2.2. Exercise protocol

The subjects were applied Shuttle Run Test (Ramsbottom et al., 1988). The subjects began the test with a slow speed of 8km/h, and then they run between two lines apart from each other with a distance of 20 m. Signals were arranged as the speed of running would increase 0.5 km/h per minute. The test was terminated for the subject who missed two signals successively. The test was stopped when the subject failed to follow the set pace of the "beeps" for two successive shuttles, or stopped voluntarily. EAAfter telling the subjects not to eat anything three hours before the exercise and not to do sport beginning from two days before the exercise, these conditions were then controlled. The procedures followed were in accordance with the ethical standards of the Helsinki Declaration of 1975, as revised in 2008.

2.3. Collection of samples

Blood samples were taken from each subject before, immediately after and one hour after the exercise. The serums were kept on - 80oC until the analysis. Using GH, IGF-1, IGF-bp and INS levels original kits, they were measured with auto analyzer (RocheHitachi Modular DP SystemsCManheim Germany).

2.4. Statistical analysis

All values were transferred into SPSS 15.0 packet programs. The repeated measure ANOVA was used to compare GH, IGF-1, IGF-bp and INS serum levels at measured baseline, immediately and 1-hour after the test. The independent t - test was used to compare values between Field hockey players and boxers. The results were accepted meaningful if they were $P < 0.05$.

3. Results

In this study, GH level increased immediately after exercise for Field hockey players and boxers ($P < 0.05$). This increase is higher in boxers than Field hockey players. A rapid decrease was detected in GH values one hour after the exercise. While GH values one hour after the exercise were lower than the values before the exercise in Field hockey players ($P < 0.05$), they remained high in boxers. While insulin values decreased immediately after and one hour after the exercise respectively in boxers, they increased immediately after the exercise and then decreased again one hour after the exercise in Field hockey players. While IGF-1 values decreased a little immediately after the exercise in boxers, they increased again one hour after the exercise. On the other hand, in Field hockey players, these values increased immediately after the exercise and then decreased one hour later. And, IGF-bp values increased with small changes immediately after the exercise both in boxers and Field hockey players and then decreased again one hour after the exercise (Table 2).

Table 1
Physical features of the subjects.

Variables	Boxer	Field hockey
Age (years)	21,5±1,17	19,5±1,22
Height (cm)	173,1±6,4	176±5,53
Weight (kg)	65,9±7,6	68,78±6,29

Table 2

Changes in some enzymes of boxer and field hockey players observed with exercise.

Variables	Boxer	Field hockey
Before Exercise GH (ng/ml)	0,5±1,2	6±1,6#
Immediately after GH (ng/ml)	19,25±13,5*	18,25±3*
An hour after exercise GH (ng/ml)	1,06±0,63	3,59±0,67*##
Before Exercise INS (μIU/ml)	9,13±5,67	2,31±0,18#
Immediately after exercise INS (μIU/ml)	8,23±7,6	5,09±0,65*
An hour after exercise INS (μIU/ml)	6,96±4,6	2*##
Before Exercise IGF-1 (ng/ml)	272,8±21,92	396±38,69#
Immediately after exercise IGF-1 (ng/ml)	269,9±23,64	445,28±56,2#
An hour after exercise IGF-1 (ng/ml)	354,2±67	416,35±38
Before Exercise IGFbp (ng/ml)	5,01±0,7	5,85±0,55
Immediately after exercise IGFbp (ng/ml)	5,07±1,11	6,38±0,77
An hour after exercise IGFbp (ng/ml)	4,82±0,8	5,98±0,45#

When *p<0,05 is compared with the values before the exercise, when ≠ p<0,05 is compared with the values after the exercise, when # p<0,05 boxer and field hockey values are compared

4. Discussion

In low intensity exercise, no change is seen in GH level (Morton et al., 2010). Together with the increase in exercise intensity, GH level does also increase (Hansen et al., 2012). In the increasing maximal aerobic exercise we applied to elite boxers and Field hockey players, GH serum level increased significantly in both the groups (P<0.05). The GH response of the boxers to the same exercise was greater in the boxers than Field hockey players when compared to GH levels before the exercise, and GH level increased far more. While the insulin amount decreased in boxers during the exercise, it increased in Field hockey players. For short term, high intensity exercises, glucose are preferred as a fuel resource. But, free fat acids become important for long term exercises (Musaro et al., 2001). Their mild levels increase at any rate (Pritzlaff-Roy et al., 2002). GH increases utility chance of fat acids as a fuel resource. While oxygen taking reduces and exercise capacity decreases as the mechanical energy becomes less in Growth Hormone Definitivity (GHD), oxygen taking and exercise capacity mount up with the increase in GH (Giustina et al., 1998).

For boxing, which is an explosive sport, anaerobic effort is at the forefront. In our study, GH level in boxers against the same exercise increases far more than the levels before the exercise when compared to the field hockey players, anaerobic metabolisms of the boxers are more active and the insulin amount decreases in boxers during the exercise, and therefore, utility of glucose decreases. As a response to the decrease in glucose utilization and oxygen taking, GH level increases. With this increase in GH level, the chance of oxygen taking and utility of fat acids does also increase. Thus, we can make such an explanation that insulin amount decreased in boxers during increasing maximal aerobic exercise applied in our study; however, GH level increased and became higher than Field hockey players whose insulin levels increased (Lemmink et al., 2006).

IGF-1 is sensitive to mechanical loads and IGF-1 level in the blood and regional muscles, increases with resistance training (Pritzlaff-Roy et al., 2002; Mitchell et al., 1994; Pierce et al., 2006). However, it may decrease during aerobic exercise (Reeves et al., 2006). In our study, it was observed that while the serum IGF-1 level decreased a little immediately after the exercise, it increased again one hour later. For Field hockey players, while IGF-1 level increased immediately after the exercise, it decreased somewhat one hour after the exercise, although it didn't return the level before the exercise. It is seen that the changes in IGF-1 levels are independent of GH levels. The change in IGF-1 and IGF-bp serum levels remained very limited when compared to the change in GH serum levels both in boxers and Field hockey players. We can say that the responses of IGF-1 and IGF-bp to increasing maximal aerobic exercise are limited.

GH and IGF-1 can be used for evaluation of nutrition, health and body composition. (Reilly et al., 1992). GH and IGF-1 decrease with aging (Sacca et al., 1994). GH level increases together with exercise in the patients with ischemia (Schmitz et al., 2011; Takarada et al., 2000). Oxygen is taking increases in parallel with GH level. GH level is lower in obese than weak people (Thomas et al., 2011). GH level gives response against body composition. IGF-1 may increase tendon-collagen synthesis in human tendon tissue (Jurimae et al., 2007). Thus, it plays a role in body

renewal and repair. GH and IGF-1 increases erythropoiesis (Thomas et al., 2011). And accordingly, it increases oxygen taking. Furthermore, GH and IGF-1 increase capacity of heart contraction due to their anabolic effect on myocardium (Viru et al., 1992). Therefore, they affect the speed of circulation. In this regard, GH and IGF-1 levels were examined in evaluating studies with many chronic illnesses and cancer types (Wang et al., 2012; West et al., 2009; West et al., 2010).

As GH and IGF-1 levels are associated with illnesses, nutrition and body composition, and they increase oxygen taking, tissue repair, blood production and utility of fatty acids, the studies in this field have increased. It was determined that GH and IGF-1 give different responses to different exercise methods. In our study, it was detected that elite sportsmen of different sport branches gave different GH and IGF-1 responses to the same exercise. The determination of these differences may be evaluated to the values of professional sportsmen in addition to selection of sport branch for a healthy life.

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