THE INFLUENCE OF ONE SESSION OF INTENSIVE PHYSICAL ACTIVITY ON THE AMOUNT OF TESTOSTERONE, CORTISOL, INSULIN AND GLUCOSE HORMONE IN ELITE ATHLETES' BLOOD SERUM HEMOSTAT

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Abstract
The aim of this study was to investigate hormonal responses (Testosterone, Cortisol, Insulin) and Glucose density after acute exercise in elite athletes. Methods: 27 elite athletes, who acquired between athletes of the Iranian Premier League, divide into two endurance and speedy group. Before and after the acute exercise, blood samples were drowned to determine serum Testosterone, Cortisol, Insulin and Glucose. The blood samples were analysis in the laboratory with Radio Immuno Assay methods. For statistics analysis of lab data, we used paired sample t-test. Results: Results showed an increase in hormones and Glucose density in both group and decrease Insulin in endurance group. Also Cortisol and Glucose significantly increased in endurance group ($p \leq 0.05$), but in speedy group Testosterone significantly increased after acute exercises ($p \leq 0.05$). Conclusion: Exercises, chiefly, acute exercises is causing an increase of anabolic hormonal change. Therefore, athletes can use these acute exercises to increase sport capacity.

Key words: *physical activity, blood, serum, hormons*

Introduction

In the course of exercise, the body faces many requirements which result in many physiological changes. The rate of energy consumption increases in such circumstances. Excretion metabolic productions begin to accumulate. Water is transferred within different sections of the body and voids through perspiration. In the state of rest, the internal environment of the body involves a stable flow, whereas in the course of exercise it entails a complete disorder. Now we know that homeostasis should be maintained at a stable level to get life continue. The more intense the activity is, the more difficult it is to maintain homeostasis. A great deal of required adjustments in the course of the exercise is committed by nerving system. There is also another system that is truly connected with the entire body cells. This system permanently controls the internal environment of the body. Furthermore, it records the entire changes occurred and responds to them rapidly to ensure absence of disorder on the part of homeostasis. This is the endocrine gland system which commits its control via releasing the hormones (Wilmore & Costill, 2004).

Problem and Aim

Muscular activity necessitates congruous adjustment of plenty of biochemical and physiological systems. Such coordination is merely possible when various tissues and systems in the body can be connected with each other. However nerving system is responsible for many of these connections, the precise adjusting of these body physiological responses against any type of disorder in this balance is the main duty of endocrine glands. Endocrine gland system entails all the tissues and glands that spatter the hormones. This system spills the hormones into the blood too. The hormones act in forms of the chemical messages in the whole body. After hormones reach the destination via blood, they can control the activities of the tissues (Wilmore & Costill, 2004). A good bulk of studies has been conducted in regard to the roles of hormones as well as their connections while doing exercises. In addition to hormones, plasma density of glucose has been investigated in regard to exercise. Although some researchers such as Fahey and his colleagues have investigated changes in testosterone hormones within the males through resistance exercises (Fahey, Rolph, Mungmee, Nagel, & Mortara, 1976). Additionally, other researchers investigated changes in growth hormone and testosterone in terms of their relation with resistance exercises (Kraemer, Kilgore, Kraemer, & Castracane, 1992). Hoogeveen and his colleagues studied the amount of testosterone and cortisol in professional cyclists after one session of intensive exercise (Hoogeveen & Zonderland, 1996). Several other researchers examined several anabolic hormones, hormone systems and density changes of certain hormones in regard to exercising (Ahtiainen, Pakarinen, Kraemer, & Hakkinen, 2004; Bosco, Colli, Bonomi, von Duvillard, & Viru, 2000; Consitt, Copeland, & Tremblay, 2001; Helge et al., 2006; Nindl et al., 2001; Tremblay, Copeland, & Van Helder, 2005).

In all of these studies, the relation between time, intensity and even type of exercise with hormone changes or change in glucose amount of blood was somehow investigated. This study intends to investigate hormone changes and the amount of glucose of blood in a field and tract athletes following one session of intensive physical activity. Testosterone, cortisol, and insulin entail significant hormones in boosting muscular endurance and muscular mass within different majors of the field and tract. Furthermore, this study also endeavors to prove the amount of blood glucose of the issues mentioned above.

Methods

This semi-experimental study was conducted in two phases of pre-test and post-test without any control group. The study participants consisted of 26 track and field elite athletes of the professional league, whose average age was 19.65 ± 3.11 and their average height involved 176.5 ± 5.65 cm. Furthermore, their average weight was 69.68 ± 11.15 kg, their average weight without fat was 60 ± 6.30 kg and finally their average of fat percentage was 12.72% ± 5.96). They were divided into two groups of speed and endurance. Each group was separately justified about the research and received adequate information about research process as well. Then, they registered a testimonial to participate in the research project. Each group was tested separately on the same day and same time.

First, speed group (speed runners) were blooded at 4.00 p.m., while they did not have any breakfast. The participants were required to avoid eating any food for 8 hours before exercising. Before beginning of the test, thickness of participants' skin layer was measured through a caliper (Lange). Moreover, essential information to account for LBW i.e. weight and height were reached. A stethoscope was attached to the athletes to record their heartbeat and their first blood sample was obtained before the exercise. After they participated in the exercise program (repeated runnings with increasing time: each of the first three repetitions lasted 15 minutes, whereas each of the second three repetitions took 20 seconds, one repetition was for 30 seconds and another repetition lasted for 40 seconds and was performed at the most speed and the most distance), the second sample of athletes' blood was collected at once. In order to control intensity rate of the exercise, participants were required to state their heartbeat during the exercise. After gleaning the research samples, to segregate the serum and then analyzing the variables, they were transferred to the laboratory and were scrutinized according to radioimmunoassay method. On the next day, the endurance runners group (two repetitions of 20 minute Fartlek exercise on the hills with slopes of 5 to 15% and the rest between the sets was 15 minutes) was tested in the same way. The T test was utilized to analyze the research data acquired from the experiments.

Results

Comparable amounts of blood hormones and glucose before and after the speed exercise, an increase in all the variables was observed. Generally, considering the average amounts, testosterone, cortisol, insulin, and glucose were increased respectively to 2.1, 277.5, 4.55 and 74.45 units. The study results revealed that the observed t ($p \leq 0.05$) was only significant in regard to cortisol (figure 1) and glucose (figure 2).

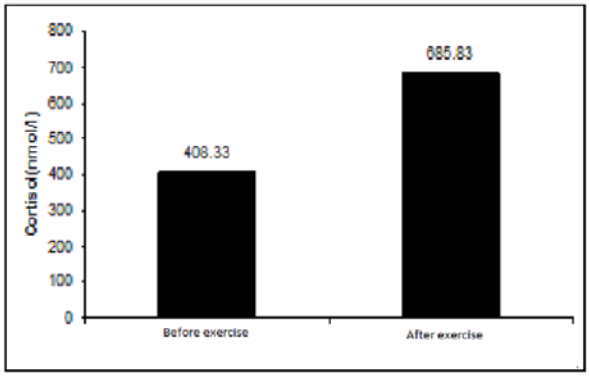

Figure 1: Significant increase of cortisol after one session of acute exercise in speed runners

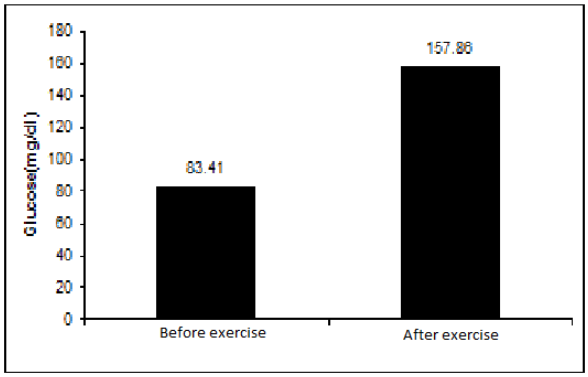

Figure 2: Significant increase of glucose after one session of acute exercise in speed runners

Therefore, there is a significant difference between the average density of cortisol (P= 0.021) and cortisol (P= 0.036) hormones of speed athletes before and after exercise, whereas no significant difference was discovered between average density of testosterone and insulin hormones before and after exercise (Table-1). Also regarding the comparisons between blood amounts of hormones and glucose before and after endurance exercise, testosterone, cortisol, and glucose of blood increased in amount. Furthermore, the increasing amounts were averagely indicated as 3.31 units for testosterone, 19.47 units for cortisol, and 15.69 for glucose, though insulin was decreased to 3.36 units. The observed t ($p \leq 0.05$) was only significant in regard to testosterone (Figure. 3). Therefore, a significant difference was detected in average density of testosterone hormone (P= 0.017) before and after exercise in contrary to other blood factors in which no significant difference was observed.

Table 1: Blood variable changes, before and after acute exercise in speed runners

		Testosterone nmol/l	Cortisol nmol/l	Insulin µlu/ml	Glucose Mg/dl
Before exercise	Mean	29.08	408.33	6.80	83.41
	SD	5.92	162.48	6.38	12.94
After exercise	Mean	31.90	685.83	11.35	157.86
	SD	9.42	250.50	4.11	65.18
T T		1.28	3.31	1.66	2.84
Significance		.254	0.021	0.157	0.036

Table 2: Blood variable changes, before and after acute exercise in endurance runners

		Testosterone nmol/l	Cortisol nmol/l	Insulin µlu/ml	Glucose mg/dl
Before exercise	Mean	18.67	453.0	8.48	81.88
	SD	8.48	149.13	6.87	9.17
After exercise	Mean	21.98	472.42	5.11	97.57
	SD	10.53	168.52	2.74	18.14
T			0.273	1.29	1.94
Significance			0.794	0.242	0.100

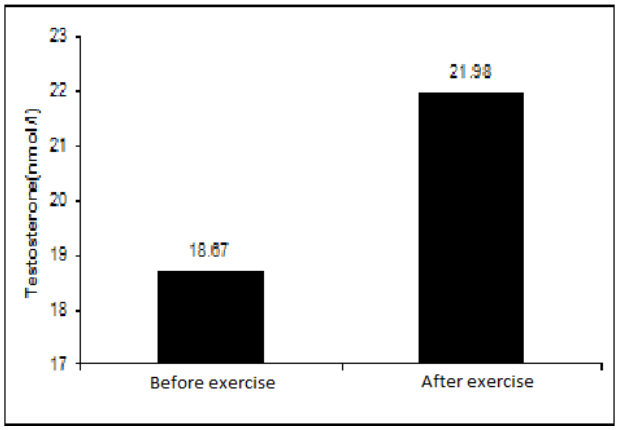

Figure 3: Significant increase of testosterone after one session of acute exercise in endurance runners

Discussion

Physical activities and exercises cause amounts of some hormones to increase or decrease in comparison with their amount during the resting time. Although the physiological significance of these changes has not currently been recognized, the fact that they even react into exercise activities is of great importance.

Since hormones demonstrate a crucial role on metabolism of the whole body and have a direct effect on the improvement of exercise activities, a great deal of studies has been conducted in these grounds. In a study revealed that exercises such as endurance running specially in long distances have ill effects and backwash on the athletes. It reported that high level endurance exercises result in men`s infertility as well as a decrease in the amount of testosterone in comparison to those who do not exercise (Anthony, 1998). According to these studies, speed exercise demonstrated various changes in regard to hormone levels and other blood elements related to the physical activities. Such studies reveal the affectability of these elements by some interferences such as time, intensity, rate of physical fitness, diet, and gender. A great bulk of studies has been performed in these grounds and different findings have been detected. A study stated the significant decrease in amount of density of testosterone hormone in rest time after 1 to 6 months of intensive exercises and another group, after 2 to 3 months of exercise, did not observe any significant changes (Anthony, 1998). Viru in his study demonstrated a decrease in testosterone amount and no change of cortisol in reaction in two-week endurance exercises (Viru, 1992).

Ronkainen and colleagues also proposed that endurance exercises decrease testosterone in the females but speed exercises in the form of jogging made no change in it (Ronkainen, Pakarinen, Kirkinen, & Kauppila, 1985). There exists discordance between the findings of the present study and the results of the studies mentioned which can be due to variation in length of the exercise period. In other words, endurance exercise, during a time period like two weeks or more, decreases the amount of testosterone but immediately after one session of exercise its blood density decreases. Pitkanen reported changes in density of testosterone hormone in speed runners (intensive exercise for one session) in terms of an increase in the density of this hormone (Pitkanen et al., 2002). Slowinska also like Pitkanen observed an increase in testosterone amount and it was 400 m in elite athletes which is in line with the findings of our study, though Slowinska reported a decreasing change in beginner runners (Slowinska-Lisowska & Majda, 2002) which demonstrates affectability of hormonal responses by the level of body preparation. Tremblay proposed increase of testosterone and cortisol during endurance exercises for less than 80 minutes (Tremblay et al., 2005) which confirms the findings of this study**.** Pitkanen introduced speed exercise as a motive for the cortisol spatter (Pitkanen et al., 2002). Leclercg and Viru stated the increase in cortisol amount after physical exercise and activity which confirms the findings of the current study (Leclercg & Poortmans, 1978; Viru, 1992). Helge mentioned that long-time endurance exercise has no significant influence on the amount of glucose and insulin of blood which is in line with the findings of the present study (Helge et al., 2006). Horton and his colleagues revealed that the exercise with intensity of 85% of lactate threshold for 90 minutes can result in a significant decrease in glucose density of course within females in contrary to male group wherein no significant change was detected (Horton, Grunwald, Lavely, & Donahoo, 2006) which demonstrates role gender variability in their affectability by exercise. These findings disprove findings of the current study which may be due to differences in length of the exercise period**.** Viru concluded that intensive exercise up to 50 to 70% of VO2 max along with a fatty and common diet decreases the amount of insulin of blood significantly. Moreover, he also reported that intensive exercise of 10% VO2 max along with a fatty diet leads to a significant decrease of insulin amount either, though with a full-carbohydrate or usual diet no decrease in the insulin amount was observed(Viru, 1992). These study findings reveal the influence of diet in hormone responses to physical exercises and activities**.** As a matter of fact, in this study effect of death has not been controlled but the increase of insulin density in reaction to intensive exercise in virus research is in line with the finding of the current study. At last, regarding the study results and the findings mentioned about previous researches, it is revealed that hormone responses vary according to intensity, time, duration of exercise period etc. and generally, it can be concluded that acute speed and intensive exercises (but not those exercises performed gradually during an exercise duration) might lead to increasing changes in hormones of testosterone, cortisol and insulin specially cortisol and makes a significant increase in the glucose of blood. On the other hand, acute endurance exercises result in increasing changes of density of testosterone, cortisol and glucose of blood specially testosterone. It seems to be essential to conduct other researches in order to investigate the mechanism of the effects and recognition of other influential materials on hormone changes by physical exercise and activity.

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UTJECAJ JEDNE SESIJE INTENZIVNOG TJELESNOG VJEŽBANJA NA KOLIČINU TESTOSTERONA, CORTISOLA, INSULINA I GLUKOZE U KRVNOM SERUMU KOD ELITNIH SPORTAŠA

Sažetak

Cilj ovog rada bio je istražiti hormonalne odgovore (testosteron, kortizol, Inzulin) i gustoću glukoze nakon akutne vježbe kod sportaša. Metode: 27 sportaša, koji se natječu u iranskoj Premier ligi, podijeljeno je na dvije grupe po izdržljivosti i brzini. Prije i nakon akutne vježbe, uzorci krvi su izvađeni kako bi se utvrdio saderžaj testosterona, kortizola, inzulina i glukoze u serumu. Uzorci krvi su analizirani u laboratoriju s Radio Imuno test metodom. Za analizu laboratorijskih podataka, korišten je upareni t-test uzorak. Rezultati: Rezultati su pokazali povećanje hormona i gustoće glukoza u obje skupine i smanjeni inzulin u grupi po izdržljivosti. Također Kortizol i glukoza znatno su povećani u grupi formiranoj po izdržljivosti ($p \leq 0,05$), ali u grupi po brzini je testosteron znatno porastao nakon akutnih vježbi ($p \leq 0,05$). Zaključak: Uglavnom, akutne vježbe uzrokuju povećanje anaboličkih hormona promjene. Dakle, sportaši mogu koristiti ove akutne vježbe za povećanje sportskih kapaciteta.

Ključne riječi: *tjelesna aktivnost, krv, serum, hormoni*

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