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Response of skeletal muscles damage markers to single bout of high intensity interval exercise in professional soccer players

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ABSTRACT: The aim of this study was to examine Response of skeletal muscles damage markers to single bout of high intensity interval exercise in male soccer players of Gol-e-Gohar Sirjan's team. For this purpose eight players (age 23.25±2.31 year, weigh 68.50 ±5.42 kg, height 175.00±12.24 cm) and by full coordination with the club and the coach cadre were selected the availability of voluntary as a sample. Blood samples were collected before and 24 hours after performing test. The subjects conducted 4 times high intense activity (90 to 95%) for a minute along with 4 times low intensity activity (50 to 60%) for 2 minutes among them. Statistical data analysis was conducted using correlated t-test to determine intergroup difference. The results showed that HIE protocol could significantly increase CK ($P<0.001$) and LDH ($P<0.024$). The present research results showed that a session of high intensity interval exercise leads to the muscle damage responses in the body.
Keywords: high intensity interval exercise, skeletal damage, CK, LDH, football.

INTRODUCTION

Participating in physical activities, high intense and long trainings is not essentially without risk and there are risks which exposed the athletes serious damage to the heart, skeletal muscle, and immunity system suppression (Faramarzi,2007). Skeletal muscles include 45% of body mass that provide energy required to body movement by generating ATP and the most important tissue to support body in doing physical activity.

Studies have indicated that skeletal fatigue and cramps following long and high intense trainings were observed that finally lead to membrane damages and reducing training performance H. (Suominen, 1977)

The football having the most sport population in the world, the professional players in which due to long duration involving intense and continuous trainings and neural pressure suffer from these damages more than other athletes, commonly with muscle injury, even it is seen that they missed a half of the season (Dadcan et.al,2002).

Among muscle damages symptoms are appearing intramuscular proteins in the blood and long term drop in muscle operation including reducing productive power, the muscle flexibility and dynamical speed (Amir Sasan et.al ,2011) .Creatine kinase (CK) and lactate dehydrogenase (LDH) are the key enzymes in muscle metabolism that during exercise in specially football, their activity to be highly increases due to providing energy from anaerobic systems. In the other hand their accumulation in the blood is among changes that occur following muscle damages and may be a sign of regional necroses in muscle fibers. Measuring these enzymes serum amounts is a suitable indicator to recognize the muscle damages (Peter A. Farrell, Michael J. Joyner, Vincent J. Caiozzo,2012). Paola Brancaccio et.al (2007) indicated that sarcomary damages cause of the increase creatine kinase in the blood and this amount remain high until 25 h after training. However they believed that the CK rate returns to initial levels at rest but if loading and lack of sufficient rest cause to more damages (Paola Brancaccio ,2007).Most of the studies examining the muscle–cardiac and inflammatory damage indicators during exercise activity have used endurance and resistance trainings and used less the HIIT (high intensity interval training) having similarity to nature of football (Rahnama , Faramarzi , Gaein ,2010).

HIIT is one of the training protocols that recently received the trainers and researchers attention. HIIT includes interval Training with very high intensity and active rest duration with very low intensity and close similarities to football in intensity and alternation, That leads to improve the football players aerobic and anaerobic systems operation (Paola Brancaccio,2007). Researchers indicated that these exercises lead to improve similar and in many cases higher and in less time for some physiological markers (Russell, A. P et al. 2003). Gibala (2006) indicated that two hours performing HIIT is equivalence to 10 hours traditional trainings in gain of aerobic adaptation (9). Similarly Gibala (2008) reported that in long term these trainings create identical physiological adaptation, continuous endurance training (Little, J. P., et al,2010). American college of sports medicine (ACSM) has reported that performing HIIT, leads to athletes saving time in acquiring fitness also due to increasing the base metabolism in 24h after training stage, higher calorie consumption leads to better reducing weigh. And of course due to simultaneous increase in ventricle cavity and the ventricle hypertrophy causes to healthier heart(Zuhl, M. and L. Kravitz,2012. Gibala, M. J,2009. . Gibala, M. J., & Ballantyne, C. 2007. Gibala, M. J et al 2012). Various studies have focused on many advantages of HIIT and its superiority to traditional endurance training and showed that these trainings have different effects compared to traditional endurance training but so far a few study examined its probable dangers and damages. Since the football nature is very similar to HIIT it is necessary to examine the effect of this kind of exercise activity on muscle damage markers in football professional players.

METHODOLOGY

Present study is semi-experimental. The statistical community was the male football player team of Gol-e-gohar, Sirjan who were present in Azadegan's league. They were 8 men (age 23.25+-2.31, weigh 68.50+-5.42 kg, height 175 +-12.24 cm) and were selected by full coordination with the club and the team coach cadre and voluntarily as available and purposeful sample.

Nobodies have cardiovascular diseases, hereditary blood disorders and respiratory problems history and took no drug and specific exercise supplement. A week before doing a HIE, Subjects were familiarized with the test. The subject's anthropometric characteristics were evaluated including height, weight and body mass index a week before test. VO2max was estimated through field test YO-YO specific to the football players (Bravo, D.F., Impellizzeri, F.M., Rampinini, E., Castagna, C., et al. 2008) and anaerobic power using field test RAST (Bravo, D.F., Impellizzeri, F.M., Rampinini, E., Castagna, C., et al. 2008) .At morning , the day of the test, the subjects were present at club camp restaurant's at 7:30 a.m fast and after eating a standard breakfast including 200g wheat bread, 50g vegetable butter, 50g jam and tea after 1.5h rest (Maughan R J. ,2007). did a training program at 9:30 after warming in form of jogging and doing tensile movements including 4 one-minute replicates of running in 50m distance as go and come with intensity higher than 90% VO2max with 2 min rest between each activity with intensity between 50 to 60% VO2max, totally included 4 min activity and 8 min rest. Two blood samples in sitting form was taken 5 min before and 24 h after the exercise protocol. The blood samples immediately were poured into tubes containing anti-coagulant matter (EDTA). Then they were centrifuged at 1000 to 2000 rpm for 10 min in 4℃. At following the obtained plasma was stored in -70℃ for later measuring. To measure the amount of LDH and CK-MM the LIAISON device and the advanced method, chemiluminecence were used (Faramarzi2007).The device determines the variables rate quantitatively in human blood. Evaluation method is based on anti-body. The collected statistical data were analyzed using the statistical software SPSS16. To determine data being natural, the Kolmogorov–Smirnov test was used and since the results indicated data being natural the parametric tests were used.

Then to determine intergroup changes the correlated t-test was used. All statistical tests were considered in significant level, $\alpha = 0.05$.

Findings

The correlated t-test results of the research variables have been shown in table 1. The results showed that after a single bout of short time HIE, variables LDH and CK increased significantly (p= 0.001, p= 0.024) respectively.

Table1. CK and LDH pre and post-test changes in pre and post-test

	Pre-test		post-test				
Variables	SD	Mean	SD	mean	t	Significant level	Degree of freedom
CK-MM (IU/l)	79.16	173.12	96.61	283.12	-5.20	0.001	7
LDH (IU/l)	49.67	246.75	55.18	285.38	-2.86	0.024	7

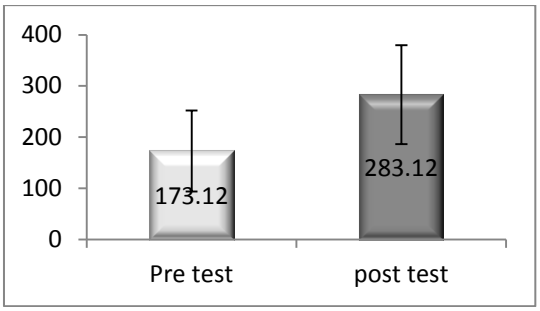

Figure1. CK serum levels changes in pre, post- test

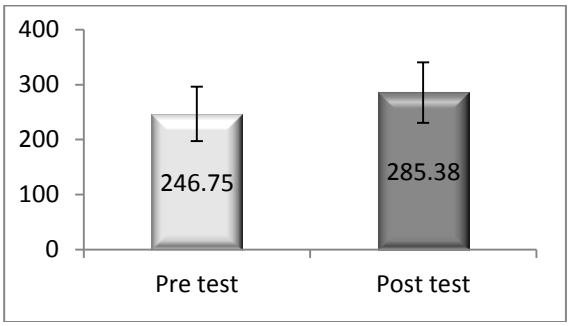

Figure2. LDH serum levels changes in pre, post- test

DISCUSSION AND CONCLUSION

Based on the present research results, it was shown that a single bout of HIE will cause skeletal muscles damage in male professional football player. In this study we observed that a a single bout of HIE although the training time was short, caused to increase muscle damage markers.

Researchers have shown that HIIT are an efficient approach to improve aerobic and anaerobic systems capacities and increase oxidative and glicolytic enzymes (H. Suominen ,1977) but so far a session of implementing these training had not been examined pathologically in terms of muscle damages specially in football professional players therefore, most of the aspects are unknown and can't conclude certainly but based on the study results these training cause to muscle damages.

One the probable reasons the incidence muscle damage following HIIT is these training high intensity. Accordingly, the muscle damages rate relate directly to exercise activity intensity and duration (Hanon, Cet al, 2008. Kim, H.J.Lee, Y.H., Kim, C.K, 2007). The training used in this research is of both high intensity (90 to 95%) and long duration (1 min) and the muscles activities include rather extenteric such as intense and interval running which can cause to increase the muscle damage markers in blood (Magalhães, J, 2010). Based on these results and properties of HIIT, it can be expected that these trainings repetition probably cause damage in people.

Based on existing studies, so far no study has evaluated the effect of response to these trainings on muscle damage markers and this study can be a starting point to future researches to use control group and also test various protocols. Gaeini et.al in examining the effect of a HIIT on oxidative stress in football professional players observed that HIE has been caused to increase oxidative stress.

Gaeeni et.al in examining the effect of a session of intense interval exercise on oxidative stress in the football professional players has observed that HIE has caused to increase the oxidative stress, which is consistent to this study result (.Gaeeni et.al,2013) Also it has been said that 12 week intense training in 8 min paddling on bicycle can't have significant effect on LDH and CK enzymes level. It is maybe because response to an exercise session is different from a training period since it is pointed out that training leads to release these enzymes in serum after a session of Exhaustive activity (Fowler, W.M,1962. . Atland, P.D., Highman, B., Garbus, J, 1964).

The Exhaustive activity session is a good sample to evaluate the effect of oxidative stress on the body and accordingly, it has been shown that after long intense interval exercise activity, the trained subjects gave less increase in LDH and CK levels (Bhagat, A., 2006). It is likely that intensity is more effective on cellular compatibilities related to muscle damage than duration of the exercise activity and can say that the kind of used protocol can influence on the obtained results (Bhagat, A.,2006). Based on this, releasing has direct relation to the exercise activity intensity and duration. Basically there is high correlation between CK and LDH that we observe as well. Although it was attempted to control the subjects feeding, the subject mental conditions was not

controlled in this study. Finally, although these training are of very much time economy than traditional ones, these training high intensity likely causes to damage. However it must be examined in future studies to clear these training effect factors in skeletal muscles and being or not being harmful these training in long term, however it is suggested that the subjects in primary sessions of using these exercises be aware of tiredness result from these training.

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REFERENCES

Atland PD, Highman B, Garbus J.1964. Exercise training and altitude tolerance in rats: blood. tissue enzyme and isoenzyme changes. Aerospace Medicine, vol. 35, pp. 1034–1039.

Bhagat A, Gupta S, Saxena J, Tandon HC, Rastogi D, Bhagat H. 2006. Effect of antioxidant supplementation and exercise training on serum enzymes after acute exhaustive exercise. Indian .Journal of physiology and pharmacology, vol.50, no.2, pp.191.

Brancaccio P.2007. Creatine kinase monitoring in sport medicine , British Medical Bulletin 2007; 81 and 82: 209–230.

Bravo DF, Impellizzeri FM, Rampinini E, Castagna C, et al. 2008. Sprint vs. interval training in football. International journal of sports medicine, vol. 29, no. 8, pp. 668-674

Dadcan, et al.2002.the effect of 8 weeks football trainings on metabolic concentrations of nitric oxide in country universities first rank players.Research in medicine [persion]. 181

Faramarzi.2007. the effect of high-intensity interval training and carbohydrate supplement on biochemical indicators changes specific to cardial cells in football players, Olympic[persion]., 35.

Fowler WM, Chowdhury SR, Pearson CM, Gardner G, et al.1962. Changes in serum enzyme levels after exercise in trained and untrained subjects. Journal of applied physiology, vol.17 no.6, pp.943-946

Gaeeni, et al.2013. The response of anti-oxidation system and lipid oxidation on the football professional players to a HIE. Hormozgan medical magazine[persion].

Gibala MJ, Ballantyne C.2007. High-intensity interval training: New insights. *Sports Science Exchange*, *20*(2), 1-5.

Gibala MJ, Little JP, MacDonald MJ, Hawley JA.2012. Physiological adaptations to low-volume, high-intensity interval training in health and disease. *The Journal of physiology*, *590*(5), 1077-1084.

Gibala MJ, Little JP, Van Essen M, Wilkin GP, Burgomaster KA, Safdar A, Tarnopolsky MA.2006. Short-term sprint interval versus traditional endurance training: similar initial adaptations in human skeletal muscle and exercise performance. *The Journal of physiology*, *575*(3), 901-911.

Gibala MJ, McGee SL, Garnham AP, Howlett KF, Snow RJ, Hargreaves M.2009. Brief intense interval exercise activates AMPK and p38 MAPK signaling and increases the expression of PGC-1α in human skeletal muscle. *Journal of applied physiology*, *106*(3), 929-934.

Hanon C, Leveque JM, Thomas C, Vivier L. 2008. Pacing strategy and VO2 kinetics during a 1500-m race. Pacing strategy and VO2 kinetics during a 1500-m race. International Journal of Sports .Medicine, vol. 29, no. 3, pp. 206–211.

Kim HJ, Lee YH, Kim CK.2007. Biomarkers of muscle and cartilage damage and inflammation during a 200 km run. European Journal of Applied Physiology, vol. 99, no. 4, pp. 443-447.

Little JP, Safdar A, Wilkin GP, Tarnopolsky MA, Gibala MJ.2010. A practical model of low-volume high-intensity interval training induces mitochondrial biogenesis in human skeletal muscle: potential mechanisms. *The Journal of physiology*, *588*(6), 1011-1022.

Magalhães J, Rebelo A, Oliveira E, Silva JR, et al.2010. Impact of Lough borough Intermittent Shuttle Test versus soccer match on physiological, biochemical and neuromuscular parameters. European journal of applied physiology, vol.108, no.1, pp.39-48.

Maughan RJ.2007. Nutrition and Football. Routledge, First published. P: 160-170.

Peter A. Farrell, Michael J. Joyner, Vincent J. Caiozzo.2012.ACSM's Advanced Exercise Physiology: Second Edition.

Rahnama N, Faramarzi M, Gaein AA.2010. Effects of Intermittent Exercise on Cardiac Troponin I and Creatine Kinase-MB, ISC jurnal.

Russell AP, Feilchenfeldt J, Schreiber S, Praz M, Crettenand A, Gobelet C, Dériaz O. 2003. Endurance training in humans leads to fiber type-specific increases in levels of peroxisome proliferator-activated receptor-γ coactivator-1 and peroxisome proliferator-activated receptor-α in skeletal muscle. *Diabetes*, *52*(12), 2874-2881.

Sasan A, et al .2011. The effect of 2 rates of supplementing branchy amino acids on cellular damage serum indicators in wrestlers. Zahedan medical sciences researches magazine[persion].22-28: (8)13.

Suominen H.1977. Effects of 8 Weeks' Endurance Training on Skeletal Muscle Metabolism in 56-70-Year-Old Sedentary Men , Europ. J. appl. Physiol. 37, 173-180

Zuhl M, Kravitz L, HIIT vs. 2012.Continuous Endurance Training: Battle of the Aerobic Titans. IDEA Fitness Journal,: p. 35-40.