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Effect of Exercise on the Interleukin-10, White Blood Cells and Creatine Kinase in Sportsmen and Sedentaries

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In this study planned, it shall be researched there is IL-10 and CK values before and immediately after the exercise according to Bruce protocol. Moreover, the changes in white blood cells shall also be examined.

Those who are convenient for the test were elected from 30 healthy voluntary males in the same age group who do sports amateurly and who don't do sport. The subjects were applied to exercise test on a treadmill according to Bruce protocol, and the blood samples were taken into heparinize tubes before and after the exercise. Evaluations were made in biochemistry and microbiology laboratories.

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While IL-10 levels did not change in sedentaries after the exercise (*P>0,05*), it decreased in sportsmen (*P<0,05*). CK values increased in both of the groups after the (*P<0,01*). No regressional relation was found between IL-10 and CK values in both of the groups.

The Bruce protocol we applied increased CK and leukocyte levels in sportsmen but decreased plasma IL-10 level significantly.

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I. Introduction

In recent studies, it has been emphasized that exercise has a preventive effect on type II diabetes, cardiovascular diseases, cancer, psychological disorders and depression (1, 17). Interleukin-10 (IL-10) is an important anti-inflammatory cytokine increasing with exercise (15). IL-10 is produced not only by other cells in the body but also by the cells belonging to immune system, and the other cytokines affect the production. It is stated that the increase in IL-10 after exercise may be related to the muscle damage (17, 22). IL-10 in exercise; interleukin-1α (IL-1α) inhibits IL1β and TNF-α production (18). The muscle damage relating to intensity of the exercise increases release of pro-inflammatory cytokines; and furthermore, exercise induces release of anti-inflammatory cytokines (16).

Creatine kinase (CK) is a dimeric protein whose plasma level increases especially in muscle pathologies. At the same time, it is known that it increases relating to the muscle damage resulting from exercise (3, 4, 5, 6, 14, 22). Total CK level changes according to age, gender, muscle tissue, physical activity and kinetic state. Very high CK level is found after the activities such as marathon and triathlon. It reaches minimum 300-500 IU/l after the exercise. It was found higher in athletes that sedentaries during rest (2, 3).

In this study planned, it was researched whether there is any relation between IL-10 and CK values before and after the exercise according to Bruce protocol. Moreover, the changes in white blood cells were also examined. Thus IL-10 and muscle injury will be explain between the relationship.

II. Material and Methods

Those who are convenient for the test were elected from 30 healthy voluntary males in the same age group who do sports amateurly (sportsmen) and who don't do sport (sedentary). In the comparison group, the same subjects were used. The subjects were applied to exercise test on a treadmill according to Bruce protocol. Bruce protocol test is the general used incremental graded exercise test to evaluate cardiovascular function (10, 19). The test fatigue was determined when the subjects indicated their desire to stop. Blood samples (5ml) were taken antecubital vein into heparinize tubes before and immediately after the exercise. The plasma were kept at -80 0C until the analysis. IL-10 values were measured by means of ELISA using original kit (AviBion Human IL-6 ELISA Kit). The other samples were analyzed using appropriate procedures in biochemistry and microbiology laboratories. Body composition values of the subjects were determined by bioelectrical impedance analysis (BIA). In order to compare sportsmen and sedentary groups, t-test of differences between independent two groups was used. Matched t-test was used in dependent subjects in order to compare the groups within themselves. İf the values were $P<0.05$, they were regarded meaningful.

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Step	Speed (km/h)	Gradient
1	2.74	10
2	4.02	12
3	5.47	14
4	6.76	16
5	8.05	18
6	8.85	20
7	9.65	22

Table 1 : Bruce Protocol (19)

III. Results

Profile of sedentary and sportsmen subjects is shown in Table 2.

Table 2 : Profile of sedentary and sportsmen subjects

	Sedentary	*Sportsman*
Age (years)	22,40±2,66	23,06±1,98
Height (cm)	176,20±7,63	179,16±4,69
Weight (kg)	66,33±8,28	73,46±8,96
Fat free Mass (kg)	59,37±1,06	64,38±1,09

In sedentaries, while IL-10 values did not change after the exercise, CK values increased ($p<0,01$). Values of the white blood cells did similarly increase after the exercise ($p<0,01$) (Table 3)

Table 3 : IL-10, CK and white blood cell values of treadmill test applied to sedentaries

	Pre exercise	*Post exercise*	*P*
IL-10 (pg/ml)	1,33±0,34	1,35±0,45	$p>0,05$
CK (U/L)	158,53±14,19	194,96±19,26	$p<0,01$
WBC (10^3u/L)	7,46±0,29	11,98±0,49	$p<0,01$
Neutrophil (10^3u/L)	4,44±0,29	6,87±0,46	$p<0,01$
Lymphocyte (10^3L)	2,23±0,097	3,94±0,27	$p<0,01$
Monocyte (10^3u/L)	0,41±0,016	0,56±0,026	$p<0,01$
Eosinophils (10^3u/L)	0,16±0,020	0,20±0,023	$p<0,05$
Basophil (10^3u/L)	0,02±0,005	0,05±0,004	$p<0,01$

While IL-10 values decreased significantly after the exercise in sportsmen ($p<0,05$), CK values increased significantly ($p<0,01$). White blood cell (WBC) values increased significantly both in total and in all other various types ($p<0,01$) (Table 3).

When the values of IL-10, CK and white blood cells obtained after exercise were compared in sportsmen and sedentaries, IL-10 values decreased significantly in sportsmen (Table 3 and 4). However; CK values were significantly higher in sportsmen before and after the exercise (Table 2 and 3). When white blood cells of sportsmen and sedentaries were compared, it was observed that the values after the exercise were meaningfully higher in sedentaries statistically although no difference was observed before the exercise (Table 3 and 4). In regressional analysis, no meaningful relationship was found between IL-10 and CK and white blood cells.

Table 4 : IL-10, CK and white blood cell values of treadmill test applied to sportsmen

	Preexercise	*Post Exercise*	*P*
IL-10 (pg/ml)	1,60±0,74	1,48 ±0,68	$P<0,05$
CK (U/L)	378,56±57,85	416,56±60,40	$p<0,01$
WBC (10^3u/L)	7,44±0,26	9,19±0,39	$p<0,01$
Neutrophil (10^3u/L)	4,42±0,24	5,15±0,33	$p<0,01$
Lymphocyte (10^3L)	2,19±0,10	3,04±0,16	$p<0,01$
Monocyte (10^3u/L)	0,38±0,018	0,43±0,020	$p<0,01$
Eosinophils (10^3u/L)	0,22±0,05	0,26±0,031	$p<0,05$
Basophil (10^3u/L)	0,03±0,002	,0,04±0,003	$p<0,01$

IV. Conclusion

The muscle damage relating to the intensity of the exercise causes IL-10 to increase which is an anti-inflammatory cytokine (16). On the other hand, in lower intense exercises, plasma IL-10 rate decreased as there wasn't higher tiredness and metabolic consumption (11, 21). Nieman et al found an increase in cytokine values after a walking of 30 minutes (13). In our study, while IL-10 values did not change in sedentaries, it decreased significantly in sportsmen. These values showed that Bruce protocol we applied which is a submaximal exercise does not have an important effect on the increase of plasma IL-10 values.

Creatine kinase is an important enzyme which shows muscle damage. Many researchers stated that CK level increases after exercise (3, 22). In this study, plasma CK levels increased after the exercise in both of the groups. Sportsmen showed higher values than sedentaries before and after the exercise (12). This increase observed in sportsmen may have been caused by higher exercise intensity of the sportsmen and resulting muscle damages, and moreover, it may have also been caused by higher muscle volume of sportsmen than sedentaries. The more muscle mass increases, the more CK rate released from muscle increases (3). On the other hand, while CK rate increased 9% in sportsmen after the exercise, it increased 18% in sedentaries. This may have probably been caused by the adaptation at cellular level occurring due to exercise in sportsmen and lack of this adaptation in sedentaries. Furthermore, in order to meet the

increasing energy need, use of creatine stores to create ATP is faster and more efficient in sportsmen than sedentaries (3). CK may have been found higher in sportsmen due to this reason.

A parallel increase was observed in white blood cells together with exercise (7, 20). The reason for this increase may be the increase in leukocyte number attending to the circulation with exercise, and it may also be the damages in muscles resulting from exercise (9). The reason for higher increase in sedentaries than sportsmen may probably be more damages in ill-antrened tissue. This result may show that the responses of muscle damages resulting from exercise develop faster in sedentaries (16).

As a conclusion, the Bruce protocol we applied increased CK and leukocyte levels more in sedentaries, but no changed plasma IL-10 level. While IL-10 values decreased significantly after the exercise in sportsmen, CK and leukocyte values levels increased significantly. There aren't many publications on cytokine changes after short-term exercises. The studies do generally focus on the effect of long term and intense exercises on the cytokines. Our study seems to be important in terms of using Bruce test which is short termed and has high intensity between the steps. In our study, due to the change in IL-10 values after Bruce protocol, we can recommend this test protocol for other studies which will examine the cytokine changes after short term exercise.

References Références Referencias

1. Akyol A, Bilgiç P and Ersoy G (2008). Fiziksel aktivite, beslenme ve sağlıklı yaşam. Sağlık Bakanlığı Yayın No: 729, Klasmat Matbaacılık, Ankara.
2. Baird MF, Graham SM, Baker JS and Bickerstaff GF (2012). Creatine- kinase and exercise related muscle damage implications for muscle performance and recovery. J Nutr and; 960363: 13.
3. Brancaccio P, Maffulli N and Limongelli F M. Creatine kinase monitoring in sport medicine (2007). Brit Med Bull 81 and 82: 209-230.
4. Chen TC and Hsıeh, SS Effects of a-day eccentric training period on muscle damage and inflammation (2001). Med Sci Sport exerc 33(10): 1732-1738.
5. Dousset E, Avela J, Ishıkawa M, Kallıo J, Kuıtunen S, Kyrölaınen H, Lınnamo V. and Komı PV (2007). Bimodal recovery pattern in human skeletal muscle ınduced by exhaustive stretch- shortening cycle exercise. Med Sci Sport exerc; 39(3): 453-460.
6. Halson SL, Lancaster I, Jeukendrup AE and Gleeson M (2003). Immunological responses to overreaching in cyclists. Med Sci Sport exerc 35(5): 854-861.
7. Ho-Park CH, Park TG, Kim TU. and Kwak YS (2008). Change of immunological markers in elite and amateur triathletes. İnt Sport Med J 9 (3); 116-130.
8. Izquierdo,M, Ibanez J, Calbet JA, Navarro-Amezqueta I, Gonzalez-Izal M, Idoate, F, Hakkinen K, Kraemer W J, Palacios-Sarrasqueta M, Almar M and Gorostiaga EM (2009). Cytokine and hormone responses to resistance training. Eur J Appl Physiol 107(4): 397-409.
9. İpek D, Özkaya Ö, Sözen H and Tekat A (2009). Pasif germe hareketlerinin sedanterlerde oluşturulan gecikmiş kas ağrısı üzerine etkileri. Spormetre VII(1): 37-40.
10. Ilse CS, Matthew J B and Lynette DH (2011). Comparison study of treadmill versus arm ergometry. Clin Physiol Funct Imaging 31: 326–331.
11. Markovitch D, Tyrrell R M and Thompson D (2008). Acute moderate-intensity exercise in middle-aged men has neither an anti- nor proinflammatory effect. J Appl Physiol 105(1): 260-5.
12. Nie J, Tong TK, George K, Fu FH, Lin H and Shi Q (2011). Resting and post- exercise seum biomarkers of cardiac and skeletal muscle damage in adolescent runners. Scandinavian Journal of Medicine &Science In Sports 21: 625-629.
13. Nıeman DC, Henson DA, Austın MD and Brown VA (2005). Immune Response to a 30-Minute Walk. Med Sci SportsExerc 3 (1): 57–62.
14. Nosaka K and Clarkson PM (1996). Immune Changes in indicators of inflammation after eccentric exercise of the elbow flexors. Med Sci Sport exerc 28(8): 953-961.
15. Ostrowski K, Rohde T, Asp S, Schjerling P and Pedersen B K (1999). Pro- and anti-inflammatory cytokine balance in strenuous exercise in humans. J. Physiol 515 (1): 287-91.
16. Peake JM, Suzuki K, Wılson G, Hordern M, Nosaka K, Mackınnon L and Coombes J (2005). Exercise-ınduced muscle damage, plasma cytokines, and markers of neutrophil activation. Med Sci Sport exerc 37(5): 737-745.
17. Pedersen B Muscles and their myokines. J Exp Biol 2011; (15): 337-346.
18. Petersen AM and Pedersen BK The anti-inflammatory effect of exercise. J Appl Physiol 2005; 98: 1154-1162.
19. Safrıt MJ. İntroduction to measurement in physical education and exercise science, Times mırror/mosby College Publishıng, Toronto Boston. 1990.
20. Toumi H, F'guyer S and Best TM. The role of neutrophils in injury and repair following muscle stretch. J Anat 2006; 208(4): 459-70.
21. White AT, Light AR, Hughen R W, Bateman L, Martins TB, Hill HR and Light KC. Severity of symptom flare after moderate exercise is linked to cytokine activity in chronic fatigue syndrome. Psychophysiology 2010; 47(4): 615-24

22. Zembron-Lacny A, Slowinska M and Ziemba A. İntegration of the thiol redox status with cytokine response to physical training in Professional basketball players. Physiol Research 2010; 59: 239-245.