

## The effect of aerobic exercise on IL6, CRP and TNF $\alpha$ concentration in elderly men

Ali Besharati<sup>1</sup>, Dr. Seyed Kazem Mousavi Sadati<sup>2</sup>, Mehran Ahadi<sup>3</sup>, Mir Hamid Salehian<sup>4</sup>

1. Faculty of Physical Education and Sport Science, Karaj Branch, Islamic Azad University, Karaj, Iran
2. Faculty of Physical Education and Sports Science, Tehran Shargh branch, Islamic Azad University, Tehran, Iran
3. Faculty of Physical Education and Sports Science, Tehran Shargh branch, Islamic Azad University, Tehran, Iran
4. Department of Physical Education, Tabriz branch, Islamic Azad University, Tabriz, Iran  
[A\\_besharati691@yahoo.com](mailto:A_besharati691@yahoo.com); [mousavisadati@yahoo.com](mailto:mousavisadati@yahoo.com); [Mh\\_salehian@yahoo.com](mailto:Mh_salehian@yahoo.com)

**Abstract:** The purpose of this study was to study the effect of an aerobic exercise on IL6, CRP and TNF $\alpha$  concentration in elderly men. For this object 30 volunteer elderly men (60-80 yrs) were voluntarily selected. They were divided into two different groups: control and experimental group. Experimental group participated in an 8-week course of aerobic exercises; 3 sessions a week for half an hour per session. Forty-eight hours before and after exercising, some blood samples were collected from the individuals to evaluate their CRP, TNF $\alpha$  and IL-6 factors. T-test was used to identify the differences between pre-test and post-test values. The results showed that TNF $\alpha$  factor changed significantly by doing the exercises, that is, the aerobic exercises affected TNF $\alpha$  factor. However, there was no significance difference between CRP levels before and after aerobic activities.

[Ali Besharati, Seyed Kazem Mousavi Sadati, Mehran Ahadi, Mir Hamid Salehian. **The effect of aerobic exercise on IL6, CRP and TNF $\alpha$  concentration in elderly men.** *Life Sci J* 2012;9(4):3664-3668]. (ISSN: 1097-8135). <http://www.lifesciencesite.com>. 543

**Keywords:** aerobic exercise, Interlocin-6, C Reactive protein, Tumor Necrosis Alfa, elderly men

### 1. Introduction

Although development and progress of sport science have progressed compared with other sciences, today human beings found sport various useful effects on different aspects of their life. So that, application of this science results were considered and adopted as an effective tool for health. In recent years, doctors considered it very important for prevention and tried to prevent illness occurrence and control and recognize health treating factors. Physical activities different aspects had various effects over inflammatory cytokins production and then body immunology system, and then it is considered that their recognition could assist us in more accurate interpretation of physiological mechanism and biological reactions (Bruunsgaard et al., 1997). Human body immunology system is an acquired and natural defense network that reacts against infectional factors and tried to decrease these factors. Immunological response decrease could lead to higher infection rate and chronic diseases such as AIDS, cancer, heart and vascular disease (Cohen et al., 1997) chronic disease occurrence among elderly people especially in people over 65 years elderly Increased (Gallistl & Sudi, 2001). That prevailed by increasing over 60 years elderly population and human lifetime increase which allocated very high percent of clinical charges to itself, therefore, finding non-medical and cheap methods considered in order

to increase health in elderly people during life time and perhaps preventing occurrence of elderly diseases (Cohen et al., 1997). On one hand, agedness often accompanied with health and sickness increase (Shephard, 1998) which resulted from genetic and environmental factors (Wang et al., 1996). Therefore, genetic and environmental factors effect on life time increase which consisted of a light nutrition regime for obese people, No smoking, lower air pollution rate and doing high level of physical activities (Selvin et al., 2007). Healthy immunological system is a genetic factor which helps life time. Therefore, both factors of physical activity decrease and immunological cells agedness helps chronic disease increase and its severity (Yeo and Park, 2002). Different researches related to physical activity and weight loss in order to immunity improvement and inflammatory factors loss regarding to exercise severity ( $VO_{2max}$ ) and subjects age, had different results. Evidenced data in elderly and young people showed high level of physical activity with low rate of CRP and IL-6 (Bruunsgaard et al., 1997) in addition, fewer studies, showed effects of aerobic exercise training effects on CRP, IL-6 and other factors lower rate among middle-aged and elderly people (Shephard and Shek, 2002; Ostrowski et al., 1998). Regarding to age increase and other related problems resulted in to disability among people and finally medical services charges rise according to

sport science development and its useful effects on different aspects of life, it is necessary to use different kinds of exercises especially aerobic exercise on Immunological system function and inflammation factors in these group (elderly) of people. Also, according to studies, specially internal ones related to aerobic exercise effect of cytokines as a factor of Immunological system solution which has an effective role on inflammation process and also short-term researches and its contradicted findings, researcher tries to study an aerobic exercise period on mentioned inflammation factors in elderly and accompanied with considerable results in the field of Immunity system function Improvement by using suitable physical activity for aged people. Therefore regarding to mentioned issues, some questions presented that if 8-weeks aerobic sport activity effects on elderly immunity function? If CRP, TNF  $\alpha$  and IL-6 systemic concentration changes elderly? Therefore, in response to above questions, researcher considers to study aerobic selected practice period effects over inflammation factors in 60-80 years elderly men.

## 2. Methods

Study method is semi-experimental and functional type. In this study, elderly men considered and divided into two groups, experimental group and control group and they have given pre and post-test. Exercise period of subjects were 8 weeks that before and after this period, inflammation factors (TNF $\alpha$ , CRP, IL-6) Evaluated and measured. Present study statistical society formulated by 30 elderly men, who prepared voluntarily. They have given medical record questionnaire and preparation for physical activity start that after completing related forms and performing medical examination and medical health certificate issuance, 30 people selected which placed in two experimental and control (15 subjects) groups, randomly. Measurement tools consisted of health record form. In order to collect required information relating to elderly mental status, ensuring about their health and satisfaction of subjects participation in the study and a questionnaire with these contents has been used; cotton, alcohol, 5cc one-time using sterile syringe, syringe head for collecting blood, sterile test tube in order to collect and send blood to lab, Isolated laboratory kit, used for measuring CRP, TNF $\alpha$  and IL-6. In this study, in order to collect information library and field method have been used. In the library method, by using text-reading, voucher-taking, statistic -reading, tables, literature study, issue records and study matter, collected information and in the field method data collected by referring to the subjects and direct relation with them. In this

study, Among two experimental groups and elderly men evidence, experimental group in an exercise program in addition to normal practices, participated for 8 weeks, this exercise program consisted of walking activity three times a week and any session considered 30 minutes with 60-65 storage heart rate severity any exercise program session consisted of 3 exercise stages: 1 warming up 2 Main exercise 3 cooling stage. In warming up stage, subjects, initially, walked for 3 minutes very slowly and softly with 30-35% storage heart rate severity and then performed 5 minutes tensional 5 minutes tensional movements which extended totally 8 minutes. Aerobic exercise program performed about 20 minutes in the first week. Exercise period and severity in exercise program initiated from light style and increased gradually according to extra load rule, then rose to 30 minutes in the next weeks. After exercise ending, cooling stage begins that consisted of 3minutes soft walking and 5 minutes tensional movements which have been taken 8 minutes. 48 hours before and after exercise, blood collected and exercise affects studies over these factors. T-test was used to get the difference between pre and post test results at  $p < 0.05$ .

## 3. Results

**Table 1.** Statistical data related to aerobic exercise effects on elderly men IL6 factor

	N	Mean + St dev	T	Df	T	Sig
Pre Exercise	15	0.47±0.77	-3.72	14	0.02	Sig
post Exercise	15	23.22±23.69				

As it is shown in table 1, test statistics obtained from elderly men equals  $t = -3.72$ . Elderly men IL-6 factor before and after aerobic exercise has significant difference with each other ( $P = 0.02$ ).

**Table 2.** Statistical Data related to aerobic exercise effects on elderly men TNF $\alpha$  factor

	N	Mean + St dev	T	Df	T	Sig
Pre Exercise	15	0.14±0.44	-2.62	14	0.02	sig
post Exercise	15	74.27±109.4				

As it is shown in table 2, elderly men test statistics equal  $t = -2.62$ . TNF $\alpha$  factor in elderly men was different before and after exercise ( $P = 0.02$ ).

**Table 3.** Statistical Data Related to aerobic exercise effects on elderly men CRP factor

	N	Mean + St dev	T	Df	T	Sig
Pre Exercise	15	3.33±1.04	0.61	14	0.55	No sig
post Exercise	15	3.13±0.83				

As it is shown in table 3, elderly men test statistics equal  $t=0.61$ . There is no significant between CRP factor before and after exercise and had no difference with each other ( $P=0.55$ ).

#### 4. Discussion and Conclusion

##### 4.1. IL-6 changes after exercise (Sport)

Based on present study findings and t-test results which have been conducted among group average after test, there was significant difference between elderly men IL-6 factor rate. Some studies confirmed recent research results (Miles & Stephen, 2004; Ostrowski et al., 1998, 2000; Shephard, 1998) including Philips et al (2008) following long term sport on untrained elderly men and women (89-70) and found significant changes in order to decrease of IL-6 concentration (Sharif et al., 2000). Yeo and Park (2004) by performing nutritional diet with sport in obese men after menopause decreased IL-6 level. Also, Gallistl and Sudi (2001) studied obese teenager and children with the effects of nutritional diet and sport which found significant changes in decreasing their IL-6 concentration. Ostroskey et al (2000) reported a significant decrease in IL-6 level two hours after Marathon contest. On the other hand, some studies found different results with present study findings: Philips and Childs (2003) conducted on healthy non-practiced men reported IL-6 level immediately after activity. Cytokines excretion mechanism such as IL-6 during sport was very complex. Lymphocytes mentioned as effective factors in increasing cytokines. Brunngard et al (1997) found a positive correlation between IL-6 increase (2 hours after activity) and blood lymphocytes concentration (20 minutes after activity). In addition, lymphocytes could involve in IL-6 increase, third factor (Hormone factor) could increase both factors (IL-6 and lymphocytes) Also, increasing resource could be existing Macrophages, Endothelial cells and fibroblasts in muscles and or leukocytes penetration from blood. The result was not parallel with Rahimi et al. (2012). One long-term sport period decreased IL-6 production in both rest time and in response to severe exercise. Therefore, IL-6 changes during sport affected by subject's type, while results of trained subjects and athletes necessarily could not be used for trained people.

People who haven't exercised probably experience more muscular damages and cytokines response to running slopes were more (Selvin et al., 2007). About Normal people IL-1, IL-10 and IL-6 cytokines production rise during sport control pre-Inflammatory cytokines such as TNF $\alpha$  (these cytokines production related with low-degree chronic Inflammation and disease such as cardio-vascular diseases and diabetes type II). Finally, cytokines production is important for the health concept. It must be recalled that severity, type and period of exercise, preliminary preparation level of subjects, gender, age, place, and time of sampling nutritional diet, Heredity, characteristics and measuring tools sensitivity are determining factors in cytokines production (Miles & Stephen, 2004; Nicklas, 2008; Petersen & Ostrowskio, 2005; Selvin et al., 2007; Yanh kuroiwa et al., 2001) that could be a reason for sturdy results difference such as present study with other ones.

##### 4.2. TNF $\alpha$ changes after sport:

Based on results of this study, there was a significance difference in TNF $\alpha$  factor among elderly men ( $t=-2.62$  and  $p=0.02$ ). Also based on correlative t-test results, average difference of control group scores to experimental group who performed aerobic exercise ( $p=0.10$ ,  $\alpha<0.05$ ) was significant and this means 8-weeks aerobic exercise caused TNF $\alpha$  level changes. Kasiolima et al (2008) showed that elderly people's TNF $\alpha$  level with diabetes type 2 after exercise increased significantly. Also Pederson and Brunsgard (2003) in reviewing beneficial role of sport in decreasing low-grade inflammation of elderly people, stated that age rise related to low-grade inflammation and preliminary mediators of this inflammatory activity is IL6 and TNF $\alpha$ . In epidemiological study of both cytokines with obesity, related to insulin and atroscleorose strength. Also, stated that TNF $\alpha$  is a stimulator for Resistencia to Insulin (Hosseini & Rabbani, 2005; Petersen & Ostrowskio, 2005)]. Yeo and Park (2002) by applying nutritional diet with sport and exercise in obese men after menopause found that cytokines level specially TNF $\alpha$  had significant decrease. Also in Vahdat research with the title of aerobic exercise period effects on liptin TNF $\alpha$  and IL6 level in thin and fat men found significant changes in variable concentration decrease specially TNF $\alpha$  in thin men (Cosio-lima, 2008). As implied about serum TNF $\alpha$ , severity, type and period of exercise subjects preliminary preparation level, age, place and time of sampling, heredity, drugs, features, measuring tools sensitivity are the factors for determining production (Nicklas, 2008; Petersen & Ostrowskio, 2005; Sharif et al., 2000; Selvin et al., 2007; Wang et al., 1996)

that could be a reason for study results such as present study with other ones.

#### 4.3. CRP changes after exercise:

In the present study, performing aerobic exercise for 30 minutes in elderly men couldn't make significant difference in CRP level according to the time before exercise. Indeed, regarding to correlative t-test results and CRP scores average difference in experimental and control group ( $p=0.62$ ,  $t=0.49$ ), sport had no effects on CRP factor level. In Nicholas et al (2008) studies which investigated long-term exercise effects on IL-6 and CRP factor in 70-89 years elderly men and Men; there was no significant difference in CRP level (Pedersen & Bruunsga, 2003). Also, Mile et al (2004) compared CK, CRP and IL-6 response of men and men in 20-miles race at altitude showed that remarkable difference has not been seen in CRP level of two groups (Ostrowski et al., 2000; Shephard and Shek, 2002) that is similar to present study findings. On the other hand, some studies found different results with present study findings Including Selvin et al (2008) findings. This researcher and his studies which investigated effects of weight loss on CRP, reported significant decrease in CRP level. Okita et al (2009) studies which investigated sport with weight loss in apparently healthy men showed that sport caused lower CRP level. It seems that difference in sport activity severity and its duration, also weight loss and nutritional diet, heredity, using dietary supplements are the effective factors on inflammatory factors level, especially CRP, Which are the possible reasons for the difference of present study findings with above studies. Based on present study findings, an aerobic exercise period caused no sensible changes in elderly men IL6 factor level but changed their TNF $\alpha$  factor level, also had no effects on CRP factor level. Indeed, sport increased TNF $\alpha$  factor level after 8-weeks exercise and this was statistically significant. Totally, Results showed that performing long-term aerobic exercise with middle severity might create a potential for immunity responses increase by means of increasing t-cells production in elderly people. Therefore, performing long-term aerobic activities with average severity controls cytokines synthesis which are necessary for immunity responses regulation and improve immunity function which decreased due to agedness and resulted into elderly lifetime period Increase.

#### References

1. Bruunsgaard, H., Galbo, H., Halkjaer- Kristensen, J., Johansen, T.L., MacLean, D.A., Pedersen, B.K. (1997). Exercise-induced increase in serum

interleukin-6 in humans is related to muscle damage. *The Journal of physiology*, 499 (3):833.

2. Cohen, H.J., Pieper, C.F., Harris, T., Rao, K.M.K., Currie, M.S. (1997). The association of plasma IL-6 levels with functional disability in community-dwelling elderly. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, 52 (4):M201.
3. Cosio-lima, L. (2008). Preliminary study of the effects of age and type 2 diabetes on the release of IL-6, IL-10, TNF and Cortisol in response to acute exercise. *Journal of American Cell Cardiology*, 119 (3).
4. Febbraio, M.A., Pederson, B.K. (2002). Muscle – derived interleukin 6: mechanisms for activation and possible biological roles. *The FASEB Journal*, 16: 1335 – 1347.
5. Gallistl, S., Sudi, K.M. (2001). Changes in serum interleukin-6 concentrations in obese children and adolescents during a weight reduction program. *International Journal of Obesity*, 25:1640-1643.
6. Hosseini, P.K., Rabbani, M. (2005). Tehran: Industrial and scientific studies Organization.
7. Kasapis C, Thompson, P.D. (2005). The effects of physical activity on serum reactive protein and inflammatory markers: asystemic review. *Journal of American Cell Cardiology*, 45: 1563 – 1569.
8. Miles, M.P., Stephen, B. (2004). IL-6, CRP and CK responses to a 20-Mile race at altitude in women verses men, *Medicine Science in Sports Exercise*, 36(5) : PS150.
9. Nicklas, B, 92008). Exercise Training and Plasma CRP and IL-6 in the Elderly. *JAM*. 56:2045-2052.
10. Okita, K. (2009). Can Exercise Training With Weight Loss Lower Serum C-Reactive Protein Levels? *Arterioscler Thromb Vasc Biology*, 8.
11. Ostrowski, K., Rohde, T., Zacho, M. (1998). Long – term muscle activity. *Journal of Physiology*, 508: 949 – 953
12. Ostrowski, K., Schjerling, P., Pedersen, B.K. (2000). Physical activity and plasma interleukin-6 in humans – effect of intensity of exercise. *European Journal of Applied Physiology*. 83:512-515.
13. Pedersen, B.K., Bruunsga, H. (2003). Possible beneficial role of exercise in modulding low-grade inflammation in the elderly. *Scandinavian Journal of Medicine and Science Sports*, 13: 56 – 62.
14. Pedersen, E.W., Ostrowski, K. (2000). Effect of vitamin supplementation on cytokine response and on muscle damage after strenuous exercise.

- American Journal of Physiology*, 280: C1570 – C1575.
15. Phillips, T., Childs, A.C. (2003). A dietary supplement attenuates IL-6 and CRP after eccentric exercise in untrained males. *Medicine Science and Sports Exercise*, 35 (N12).
  16. Peake, J.M., Suzuki, K. (2005). Plasma cytokine changes in relation to exercise intensity and muscle damage. *European Journal of Applied Physiology*.
  17. Petersen, E.W., Ostrowski, K. (2005). Effect of vitamin supplementation on cytokine response and on muscle damage after strenuous exercise. *American Journal of Physiology Cell Physiology*. 280: C1570 – C1575.
  18. Rahimi, A., Hojjat, S., Besharati, A., Shokrgozar, A.R. (2012). The effect of an aerobic exercise on IL6, CRP and TNF $\alpha$  concentration in women, *Annals of Biological Research*, 3 (1):125-131.
  19. Sharif, M., Shepston, L., Elson, C.J. (2000). Increased serum reactive protein may reflect events that precede radiographic progression in osteoarthritis of the knee. *Annals of Rheum Dis*. 59: 71 – 74. [pubmed: 10627432].
  20. Selvin, E., Paynter, P., Erlinger, M.D. (2007). The Effect of Weight Loss on C-Reactive Protein. *Arch International Medicine*, 167:31-39.
  21. Shephard, R.J. (1998). Cytokine responses to physical activity, with particular reference to IL-6: source, action, and clinical implications. *Crit Rev Immunol*, 22(3):165 – 182.
  22. Shephard, R. and Shek, P. (2002). Exercise, aging and immune function. *International Journal of Sports Medicine*. 6(1): PP 1- 6.
  23. Wang, B., Beiqing, L., Chen, M. (1996). Age-related decreases in IL-2 production by Human cells are associated with impaired activation of nuclear transcriptional factors AP-1 and NF-AT-1. *Cellular Immunology*, 162(2): 185-195.
  24. Yanh kuroiwa, A., Tanaka, H., Shindo, M., Kiyonaga, A., Nagayama, A. (2001). Effect of modern exercise on immune senescence in men. *European Journal of Applied Physiology*, 86(2): 105 – 111.
  25. Yeo, E., Park, S. (2002). Age-dependent agonist-specific dysregulation of membrane-mediated signal transduction: emergence of the gate theory of ageing. *Mechanisms of Aging and Development*, 123:PP1563-1578.

9/6/2012