IJBPAS, September, 2015, 4(9): 5749-5758

ISSN: 2277–4998

International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

THE EFFECTS OF THE CONTINUOUS AND INTERMITTENT RESISTANCE TRAININGS ON IL-6 AND CRP OF YOUNG MEN

MARZIEH MOSADEGHI[1*], NARJES NOURIZADEH[2]

1: Department of Exercise Physiology, Islamic Azad University, Shahr-e-Qods Branch, Shahr-e-Qods, Tehran, Iran

2: Department of Physical Education, Islamic Azad University, Shushtar Branch, Khoozestan, Iran

***Corresponding Author: E Mail: m_ mosadeghi@yahoo.com; Ph.: +98 9128164049**

ABSTRACT

The purpose of the present study was investigation of the effects of the two types of continuous and intermittent resistance trainings on relaxation levels of IL-6 and CRP serums of young men, regarding to the shortage of studies about effects of various types of resistance trainings.

Twenty-one examined subjects of this research were divided to three groups of continuous resistance training, intermittent resistance training and control. The two exercises groups were participated in 8 weeks progressive resistance trainings. Blood samples were taken from the subjects, before (24 hrs. prior to the trainings beginning) and after (48 hrs. then the trainings ending) the trainings.

In order to investigate and compare variations of the variables, factorial analysis of variance with repeated measures was applied. IL-6 and CRP varied through resistance exercise (P was 0.001 and 0.004, respectively. Nevertheless, there was no difference between executions of neither continuous nor intermittent resistance trainings (P was 0.86 and 0.35, respectively).

Resistance trainings might probably cause desirable influences on inflammatory factors, regardless of whether type of resistance trainings (either continuous or continuous). However, the issue should be deeper surveyed in future studies, accompany with measurement of other inflammatory indices.

Keywords: IL-6, Resistance Trainings, CRP, Continuous Training, Inflammation

INTRODUCTION

Resistance trainings have been attended by many people of the society for the sake of improvement and maintenance of healthiness. In the other hand, the resistance trainings have various types that can have their common and individual unique influences on physiological systems of the body and specifically the immune system. In this regard, special attention to cytokines and inflammatory factors can be important, for clarifying complicated questions of immunity response to exercise.

Interleukin-6 (IL-6) is a cytokine that have vast various functions. This cytokine stimulates production of acute phase proteins (CRP) through hepatic cells, in inherent immunity, and associate in generation of an inflammation system, which is named the acute-phase. In addition, this cytokine stimulates growth of B-lymphocytes that differentiate to antibodies producer cells, in acquired (adaptive) immunity **[1,2].**

IL-6 amount would remarkably heighten in response to exercise (up to a hundred times) and reduce after activity **[3].** IL-6 can raise lipolysis and stimulate production of cortisol and other regulating cytokines such as IL-10 and IL-1Ra. Besides, IL-6 suppresses production of the pre-inflammatory cytokine TNF-α. Hence, its consequent insulin resistance would be reduced, which could be counted as one of positive benefits of exercise **[4].**

Whereas level of IL-6 rises in muscle fibers following exercise, the level heightening of this cytokine could be due to anti-inflammatory activities, regarding to dual pre-inflammatory and anti-inflammatory hands of IL-6 and its recognition as a cytokine **[5,6].** Effects of moderate intensity exercises on enhancement of muscular levels are reported, yet **[7].**

In the other hand, Timmerman et al (2008) indicated that regular exercise trainings in duration of 12 weeks would lead to decreases in circulation level and production of IL-6 cytokine **[8].** In addition, CRP is mostly made in response to inflammatory cytokines by liver and adipose tissue, and has inflammatory property itself and is a strong risk factor to heart attack, hypertension and cardiovascular diseases **[9,10].** Increment of CRP amounts would lead to arthrosclerosis spread through three mechanisms, at least **[11,12].**

Donges et al (2010) studied effects of aerobic or resistance trainings on CRP and body composition of three groups of aerobic, resistance and control, during 10 weeks. Their results indicated significant reduction

of CRP in both training groups **[10].** In addition, Stewart et al (2007) investigated effects of 12 weeks compound (aerobic and resistance) schedule on CRP among 29 young men (18 to 35 year old) and concluded that CRP decreased through exercise **[13].** Some other researches have denoted exercise schedules do not effect on inflammatory markers (like CRP) **[14,15].**

Nevertheless, comparison of effects of the two types of continuous and intermittent resistance trainings on these inflammatory factors have not been cleared, yet. Therefore, the target of the present study was comparison of the effects of the two types of continuous and intermittent resistance trainings on IL-6 and CRP serums of non-athletic young women.

SUBJECTS AND METHODS

Subjects

Twenty-one healthy 24 to 30 year old male students of Shiraz city of Iran were purposefully chosen and divided to three groups of continuous resistance training, intermittent resistance training and control (7 person for each group), randomly. The whole subjects owned perfect physical healthiness. Impressibility probability of dependent variable had been reduced by homogenizing the subjects, as much as possible. The properties of the subjects of the present research groups were presented in table 1.

Table 1: The subjects' properties

Variable	Continuous group	Intermittent group	Control group
Number	**7**	**7**	**10**
Age (Y.O.)	**27.33±3.11**	**26.78±2.9**	**28.21±2.69**
Height (cm)	**178.31±4.55**	**178.63±5.21**	**179.34±6.83**
Weight (kg)	**76.46±5.76**	**75.86±5.94**	**77.25±6.53**

Data Collecting Method

The subject became familiar with the trainings protocol in justification meeting, one week before the research execution. Beside of introducing resistance movements to the subjects, their properties and their 1RM for each movement were measured. The subjects held in the test session and the blood samples were taken from the three groups, 24 hours before trainings beginning. Thereafter, the subjects performed their trainings schedule progressively, in duration of 8 weeks. Relaxation blood samples were taken from the three groups again, 48 hours after the last exercise session.

Training Schedule

The resistance trainings schedule was held during 8 weeks (three weekly sessions, one day on-one day off), and each session was in span of 68 min and consisted of 10 min warm

up, 52 main exercise and 6 min cold down. The subjects performed their trainings with 20, 25, 30, 35, 40, 45, 50 and 55 percentages of a maximum repetition for the first to the eighth weeks, respectively. Exercise load was the same for both continuous and intermittent trainings. The resistance trainings of each exercise group were designated in circular figure. Each circle involved chest press, legs press, biceps, triceps, forefeet, rear feet and lateral stretch (or length) that had the same execution order, as mentioned here. Spans of stations were considered as 3 min, which performed with different speeds in continuous and intermittent exercises. The rest intervals between each two successive stations and each two successive circles were considered as 1 min and 2 min, respectively. Two circles were considered for each exercise session. The continuous resistance training group performed each its 3 min station with speed of V (V was assigned as 75 BPM). The intermittent trainings group performed its station with span/speed of 10 sec/2V and 20 sec/0.5V, until compilation of the three min of the station training group performed each of their stations with speed of V (V was assigned as 75 BPM). Since execution speed of each movement was controlled by metronome, movement number of each set was the same for the whole movements, and with increment in exercise intensity.

Blood Sampling and Cytokines Analysis

Blood sampling were taken from the middle vein (the basilic vein) of the subjects, in amounts of 5 cc. The gathered samples were poured over sterilized tubes, containing K3EDTR.The heparin tubes and EDTR were settled inside ice and then remained at the room temperature, for some minutes. Thereafter, serum separated from plasma, by means of centrifuge in span of 10 min and with revolution speed of 3500 RPM. The whole blood samples were pr in frozen state and at temperature of -20˚C, and were used at the time of lab examination. IL-6 of each sample was gauged by means of ELISA method utilizing eBioscience kit. CRP of each sample was done by method of Turbidimetric utilizing Cobas Integra 400 device at wavelength of 552 nm.

Statistical Method

At first, values of every under study variables were described by implementing mean and standard deviation, and Kolmogorov-Smirnov test was applied to examine data natural distribution and selection of either parametric or non-parametric test. It was clarified that the data had natural distribution. Factorial ANOVA with repeated measures in a scheme of 3×2 (three groups at two times)

was used, to compare variations of under study variables, in the three groups of continuous, intermittent and control. Significance level was assigned as 0.05, for entire statistical tests. In addition, the statistical software SPSS ver.16 was utilized to carry out statistical calculations.

RESULTS

Statistical descriptions of IL-6 and CRP have been presented in table 2. The values have been reported as mean and standard deviation. In order to compare variations of variables between the four groups, the results of factorial ANOVA with repeated measures have been shown in table 3. Results of Toki Post hoc test have been briefed in table 4. There were significant differences between IL-6 variations patterns of the three groups (P=0.004). In a manner that IL-6 decreased in the two training groups, in comparison to those of control group (P was 0.019 and 0.005 for the continuous and intermittent trainings, respectively), though the difference between the two training groups were not significant (P=0.86). Significant differences were observed between CRP variations patterns of the three group (P=0.001). In a manner that CRP of the two training groups decreased significantly, in comparison to that of control group (P was 0.001 for both continuous and intermittent trainings groups), though the differences between the training groups were not significant (P=0.35).

Table 2: Statistical descriptions of the variables (mean ± standard deviation)

Variables	Sampling Times	Continuous Groups	Intermittent Groups	Control Groups
IL-6	Before Training	4.09 ± 0.74	4.50 ± 0.96	4.009 ± 1.02
	After Training	3.16 ± 0.47	3.40 ± 0.53	4.07 ± 0.86
CRP	Before Training	0.62 ± 0.39	0.89 ± 0.39	0.90 ± 0.49
	After Training	0.47 ± 0.33	0.70 ± 0.33	0.90 ± 0.48

Table 3: Statistical results of factorial ANOVA with repeated measures to compare variations of the variables in the groups

Variables	Factor	F	P
IL-6	Time	2.89	0.001*
	Group	0.95	0.39
	Time*Group	6.83	0.004*
CRP	Time	77.81	0.001*
	Group	1.99	0.15
	Time*Group	21.48	0.001*

**** The mean difference is significant at the 0.05 level***

Table 4: Results of Toki post hoc test to determine location of significant differences

Variables	Pair to pair comparison	P-value
IL-6	Continuous Groups - Intermittent Groups	0.86
	Continuous Groups - Control Groups	0.019*
	Intermittent Groups - Control Groups	0.005*
CRP	Continuous Groups - Intermittent Groups	0.35
	Continuous Groups - Control Groups	0.001*
	Intermittent Groups - Control Groups	0.001*

DISCUSSION

According to the results of the present study, the resistance trainings would lead to decrease in amounts of both IL-6 and CRP, whereas there was not observed any significant difference between the two training groups, about this variable. The observed significant differences were between the trainings groups and the control one. The literature has spare results about effects of continuous and/or intermittent resistance trainings on serum levels of inflammatory related cytokines, and no study could find about the issue. Therefore, previous results about this matter are negligible, and no accurate conclusion can draft, before accomplishment of further studies.

Furthermore, intensity of exercise might be the most substantial variable of training in response to inflammatory factors, and span of training is another important variable, after exercise intensity. Actually, intensity and span of the two types of resistance trainings of the present study were the same, and their distinctions were in continuous execution (moderate intensity and intermittent one (low and high intensity). Based on the results of Nurtjahja-Tjendraputra et al (2007) 16 weeks resistance trainings would lead to decrease in concentrations of pre-inflammatory cytokines and increase in concentrations of anti-inflammatory cytokines **[16].**

Cytokines different responses of various studies could be ascribe to physical situations of subjects, implementing different training schemes and methods (training protocol types), subjects training precedence, span and intensity of pressing stimulant, exercise habits and consistency to trainings. Keller et al (2005) stated IL-6 level increases in comparison to pre-test situation, after 10 weeks trainings **[17].** In the other hand, Conraads et al (2002) indicated that compound endurance-resistance trainings did not have any influence on plasma amount of IL-6 among people with vascular diseases **[18].** In addition, Nicklas et al (2004) investigated effects of an aerobic and resistance trainings schedule, among aged fat

men and women with signs of knee osteoarthritis. They noted the exercise trainings did not have any significant influence on IL-6 **[19].** In contrast, Ryan et al (2004), reported that a weight loss program and aerobic and resistance trainings would lead to decrease in IL-6 of obese women **[20].** Furthermore, Haghighi et al (2005) showed execution of circular type resistance trainings have led to decrease in IL-6 plasma level, among obese men **[21].**

Olson et al (2007) surveyed CRP concentration after one-year execution of resistance trainings among 16 over-weighted women (with ages similar to the male subjects of the present study), and their resistance trainings led to decreases in BMI, body fat percentage and CRP plasma concentration of their participant **[22]**, which is in agreement with the results of the present study. Improvement in endothelial structure and reduction of blood mononuclear cells are some of post-exercise CRP decrease mechanisms **[23].**

There are still many investigation and discussion blank spaces about improvement mechanisms of CRP level. A main potential way can be the interleukins. Regarding the evidences, IL-6 and TNF-α factor are remarkably released from adipose tissue, especially visceral fat. Their release from adipose tissue would increase through sympathetic stimulation. Since regular exercise would cause reductive adjust of sympathetic stimulation, it might probably lead to decrease in TNF-α excretion (that means decrease in strong stimulant of IL-6 production) and IL-6 reduction (which means decrease in strong stimulant of CRP production) **[24].** However, exercise, in an appropriate model for study of inflammatory responses, could be effective in variations of CRP serum values. Most researchers have agreed with probable reduction of CRP relaxation concentration, and in addition, the relative consistencies to long-term physical trainings, in such a way **[25].**

Nevertheless, the results about the two types of continuous and intermittent resistance trainings are not voluminous, and accordingly interpretation of the results should be performed, cautiously. However, significant decreases IL-6 and CRP through the resistance trainings (regardless the type of trainings) has been clarified in the present study.

CONCLUSION

According to the results of the present study, it has been concluded that the 8 weeks resistance trainings would lead to inflammation improvement. There may no difference that the resistance trainings would

be performed by either continuous or intermittent resi9stance trainings, if average intensity and duration of trainings are the same.

REFERENCE

[1] Kamimura D, Ishihara K, Hirano T. 2003. IL-6 signal transduction and its physiological roles: the signal orchestration model. Rev Physiol Biochem Pharmacol, 149: 1-38.

[2] Abul KA, Andrew HL, Shiv P. 2007. Cellular and Molecular Immunology, 6th Edition. W B Saunders Co.

[3] Suzuki K, Nakaji S, Yamada M, Totsuka M, Sato K, Sugawara K. 2002. Systemic inflammatory response to exhaustive exercise. Cytokine kinetics. Exerc Immunol Rev, 8: 6–48.

[4] Pedersen BK. 2007. IL-6 signaling in exercise and disease, A Focus Topic at Life Sciences held at SECC Glasgow, U.K., 9–12 July.

[5] Baum M, Klopping–Menke K, Muller–Steinhardt M, Liesen H, Kirchner H. 1999. Increased concentrations of interleukin 1-β in whole blood cultures supernatants after 12 weeks of moderate endurance exercise. European Journal of Applied Physiology and Occupational Physiology, 79(6): 500-503.

[6] Suzuki K, Nakaji S, Yamada M, Totsuka M, Sato K, Sugawara K. 2002. Systemic inflammatory response to exhaustive exercise, cytokine kinetics. Exercise Immunology Review, 8(1): 6-48.

[7] Fehrenbach E, Niess A, Voelker K, Northoff H, Mooren F. 2005. Exercise intensity and duration affect blood soluble HSP72. International Journal of Sports Medicine, 26(7): 552-557.

[8] Timmerman KL, Flynn MG, Goen PM, Markofski MM, Pence BD. 2008. Exercise training – induced lowering of inflammatory (CD14+ CD16+) monocytes: a role in the anti inflammatory influence of exercise? Journal of leukocyte biology, 84(5): 1271-1278.

[9] Athyros V, Tziomalos K, Karagiannis A, Anagnostis P, Mikhailidis D. 2010. Should adipokines be considered in the choice of the treatment of obesity-related health problems? Current Drug Targets, 11(1): 122-135.

[10] Donges CE, Duffield R, Drinkwater EJ. 2010. Effects of resistance or aerobic exercise training on interleukin-6, C-reactive protein, and body composition. Med Sci Sports Exerc, 42(2): 304-313.

[11] Lagrand W, Visser C, Hermens W, Niessen H, Verheugt F, Wolbink G, et al. 1999. C-reactive protein as a cardiovascular risk factor: more than an epiphenomenon? Circulation, 100(1): 96.

[12] Pasceri V, Willerson J, Yeh E. 2000. Direct pro inflammatory effect of C-reactive protein on human endothelial cells. Circulation, 102(18): 2165.

[13] Stewart LK, Flynn MG, Campbell WW, Craig BA, Robinson JP, Timmerman KL, et al. 2007. The influence of exercise training on inflammatory cytokines and C-reactive protein. Med Sci Sports Exerc, 39(10): 1714-1719.

[14] Marsell TJ, Mcauley KA, Traustadottir T, Reaven PD. 2005. Exercise training is not associated with improved levels of C-reactive protein or adiponectin. Metabolism, 54: 533-541.

[15] Khaodhiar L, Ling PR, Blackburn GL, Bistrian BR. 2004. Serum levels of interleukin-6 and Creactive protein correlate with body mass index across the broad range of obesity. J Parenter Enteral Nutr, 28: 410-415.

[16] Nurtjahja-Tjendraputra E, Ammit AJ, Roufogalis BD, Tran VH. 2003. Effective anti-platelet and COX-1 enzyme inhibitors from pungent constituents of ginger. Thrombosis Research, 111(4-5): 259-265.

[17] Keller C, Steensberg A, Hansen AK, Fischer CP, Plomgaard P, Pedersen BK. 2005. Effect of exercise, training, and glycogen availability on IL-6 receptor expression in human skeletal muscle. J Appl Physiol, 99: 2075-2079.

[18] Conraads VM, Beckers P, Bosmans J, De Clerck LS, Stevens WJ, Vrints CJ, et al. 2002. Combined endurance/resistance training reduces plasma TNF-α receptor levels in patients with chronic heart failure and coronary artery disease. Eur Heart J, 23: 1854-1860.

[19] Nicklas BJ, Ambrosius W, Messier SP, Miller GD, Penninx BW, Loeser RF, et al. 2004. Diet-induced weight loss, exercise, and chronic inflammation in older, obese adults: a randomized controlled clinical trial. Am J Clin Nutr, 79: 544-551.

[20] Ryan AS, Nicklas BJ. 2004. Reductions in plasma cytokine levels with weight loss improve insulin sensitivity in overweight and obese postmenopausal women. Diabetes Care, 27: 1699-1705.

[21] Haghighi AH, Ravassi AA, Gaeini AA, Aminian T, Hamedi-Nia MR. 2005. Effects of resistance training on cytokines mediated inflammation and resistance to insulin in obese. Olympic, 2: 19-29.

[22] Olson TP, Dengel DR, Leon AS, Schmitz KH. 2007. Changes in inflammatory biomarkers following one-year of moderate resistance training in overweight women. Int J Obesity, 31 (6): 996-1003.

[23] Strasser B, Siebert U, Schobersberger W. 2010. Resistance training in the treatment of the metabolic syndrome: a systematic review and meta-analysis of the effect of resistance training on metabolic clustering in patients with abnormal glucose metabolism. Sports Med, 40 (19): 397-415.

[24] Christopherson J. 1999. Effects of exercise detraining on lipid storage in rats: transactions of the Illinois State Academy of Science. 92 (3,4): 203-209.

[25] Gomes F, Telo Daniela F, Souza Heraldo P, Nicolau JC, Halpern A, Serrano CV. 2010. Obesity and coronary artery disease: role of vascular inflammation. Arq Bras Cardiol, 94 (2): 255-261.