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Investigation and Comparison of Short-Term and Long-Term Strength Training on Neutrophils, Lymphocytes and Monocytes Blood Factors in Untrained Male Students

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ABSTRACT

Aim: *The aim of the present study was to evaluate and compare the effects of short-term and long-term strength training increasingly on neutrophils, lymphocytes and monocytes blood factors in untrained male students Khatam University of Behbahan.* ***Methods:*** *For this purpose, 45 male students between 18-22 years were selected. Subjects were categorized into three groups of 15 subjects randomly. These include a control Group 1, Group 2 with short-term strength training increasingly and Group 3 with long-term strength training increasingly. In order to examine data distribution between groups of Kolmogorov-Smirnov test for equality of variances assumption of intra-group study, Levene's test was used. To investigate the effectiveness of the practice of paired t-test was used. In a comparison test between the selected parameters in one-way analysis of variance was used for independent samples and to analyze and compare three groups of variables, Tukey test was used. The significance level for all tests was* $p \geq 0.05$ *and statistical analysis was performed using SPSS statistical software.* ***Results:*** *The results showed that after a strength training, mean difference of the variable Neutrophil percentage in training groups and control group in post-test was significant* $p=0.016$*. Mean difference of the variable lymphocytes percentage in training groups and control group in post-test was not significant* $p=0.217$*. Mean difference of the variable monocytes percentage in training groups and control group in post-test was not significant* $p=0.114$*.* ***Conclusion:*** *These results suggest that cell-mediated immunity in young boys is influenced by the intensity and duration of exercise.*

Keywords: Strength training increasingly, Lymphocytes, Monocytes and neutrophils, Non-athletes.

INTRODUCTION

The negative or positive effects of the physical activity on the immune system of body are one of the topics that attracted the attention of experts in the field of sports medicine. The immune system of body changes affected by exercise and sports activities and the immune system's responses are different under physiological fitness level and the intensity and duration of exercise [1].

There is a significant development in the researches of exercise immunology in recent years and it continues to its trend as each researcher studies the special variables of immune system in peoples with different age according to the type of physical activity and environmental conditions. The results indicate that heavy and short-term training can have a suppressive effect on the immune system temporarily and weakens the immune system against the pathogens probably, if the condition repeated in long-term. It is inhibited the lymphocyte proliferation affected by Severe or prolonged activity. In this regard, the level of physical fitness and physical activity are important variables in lymphocyte proliferation.

It produced a high level of stress hormones during heavy exercises and it is well known that heavy exercises can cause a transient-loss of some immune functions (such as a sudden increase neutrophils and lymphocytes proliferation) that

remain 24 to 30 hours after exercise and depends on the intensity and duration of exercise [2]. The intense training periods for 7 days or more cause the acute fatigue and chronic reduction in immune system`s function. Several studies have shown that flu and sore throat are more common among athletes than other people [3].

The obtained results from epidemiological studies support the idea that athletes are exposed by upper respiratory tract infections during heavy intense exercise periods and also for 1 to 2 weeks after participating in competitive-endurance races [3].

The body is prone to attack from viruses and bacteria and it can be increased the risk of infection during the immune changes that last 3 to 72 hours depend on the intensity of exercise [4].

It might be increased or remain unchanged the concentrations of lymphocyte over 50% of resting values in the short-term and severe sport activities. Intensified exercise leads to a two-phase change in the concentrations of lymphocytes. It has been reported the increase of the current lymphocytes (lymphocytosis) immediately after the exercising and the concentration return to lower contents of pre-exercise levels during the initial steps of recovery and before coming back to the rest levels [5].

It seems that the moderate exercise throughout life increases the resistance against the upper respiratory tract infections (URTI); however, the intense and heavy exercise causes degradation in immune function of body.

Many factors influence on immune system that exercise is one of them; so that the considerable volume of researches is allocated to the effects of exercise on the immune system. The effects of various exercises, and their intensity and duration on different parameters of immune system have been studied in the studies [6]. It is a general agreement in some fields about the effects of exercise activities on immune system; for example, nowadays there are many researches that emphasize on this point that extreme and long-term sport activities lead to weak of the immune system. Sport activities such as marathon, ultra-marathon and triathlons lead to disturb the immune system performance including antibodies and lymphocytes [7]. It has been said that it might be the person doesn't expose against inflammatory even if the exercise level increase gradually but the released hormones due to exercise stress will be enumerated as an annoying factor to immune system [7].

Leukocytosis (increase in the concentrations of white blood cells in the blood) is one of the major and constant changes that occur during exercise. The concentrations of white blood cells may be increased to four-fold compared to rest time and remain in high levels after exercise. Leukocytosis value is directly proportional to the intensity and duration of exercise. In addition, elevated levels of cortisol may be one of the causes of leukocytosis. The lymphocyte concentrations increase with an increase of labor rates, progressively (lymphocytosis) and its level depends on the type and intensity of exercise [8].

Long and heavy exercises are associated with numerous of biochemical and hormonal changes and have the potentially adverse effects on the immune system [5]. It has been noted that even if the exercise level has gradually increased, it may not be at risk of inflammation, but the released hormones due to stress of exercise will induced as annoying factors [9].

The common understanding of the elite athletes and their coaches is that the intense physical activity reduces the resistance of immune system and is a risk factor for URTIs. Recent epidemiological evidences are in compliance with the interpretation [10]. New studies are evaluating the effects of exercise on immune components to gain a better understand about the mechanisms that exercise may affect the immune response against infection [11].

It has been shown that intense exercise has a potential for change or suppress some of immune parameters such as concentrations of circulating leukocytes, plasma cytokine concentrations, the secretion of salivary immunoglobulin A and the phagocytic activity of macrophages and neutrophils [12]. Regular moderate exercise can stimulate the immune system; however, the intensive training leads to immune-suppression and promote the risk of infection [11,13]. Disease or injury occurs when the body's physical needs surpass the ability for recovery between training sessions and competition.

MATERIALS AND METHODS

The present study was the quasi-experimental and carried out by pre-test and post-test of two experimental groups and one control group. The statistical sample of this study was included 45 male students of Khatam Alanbia University of

Behbahan Iran. The participants were realized about nature and how to cooperate with the study, initially. The subjects were participated in the study voluntarily, signed a consent form and completed a questionnaire on physical activity and medical history. The subjects did not have any cardiovascular, musculoskeletal, immunological, hormonal, and other diseases.

The eligible subjects were randomly divided to one of the three groups including,

Group 1: Control

Group 2: Increasing short-term strength training and

Group 3: Increasing the long-term strength training

After statistical sample selection and classification of them, one-step blood test was taken and then the participants according to their practice groups began to exercise regularly elected. At the end of 4 weeks of strength training increasingly, the control group and the short-term strength training groups, blood tests were repeated again. And at the end of 8 weeks of strength training increasingly, of control and increasing the long-term strength training groups, blood tests were repeated again. The results were analyzed and compared.

Plan a training session of strength training increasingly

The participants were familiar with how to do exercises with weights, before the training; then the maximum value of movements was measured in every move by performing one maximum repetition maximum (meaning the maximum weight that can be moved in a repeat (1RM).

The increasing strength training exercise program includes 3 sets of 8 to 10 reps with 60 to 70 percent of the 1RM with 2-minute breaks between movements. Movements were including leg press, leg extension, seated leg curl, bench press, biceps arms and pull down double-sided, involve the large muscles of the upper and lower body. 1RM movements were measured every week and the exercises carried out with 60% to 70% of new 1RM to protect the principle of overload and gradual improvement.

The subjects did stretching for 5 minutes and then jogging for 5 minutes in each training session, initially. After this step, movements of leg press, leg extension, seated leg curl, bench press, biceps arms and pull down double-sided came into force. After this stage to recovery and lower heart rate was 5-10-minute walking.

RESULTS

It is presented the descriptive properties of the research variables including percentage of neutrophils, monocytes and lymphocytes separately for exercise groups (control, increasing short-term strength training and increasing the long-term strength training) in pre-test and post-test (Table 1). Data are presented as mean and standard deviation.

Table 1 Descriptive properties of the research variables in pre-test and post-test

Variable	Group	pre-test			post-test		
		N	M	SD	N	M	SD
Percentage of Neutrophils	Short-Term Strength Training	15	59	5.07	15	56.2	6.08
	Long-Term Strength Training	15	65	4	15	61.6	5.58
	Control	15	64.5	7.94	15	64.5	6.43
Percentage of Monocytes	Short-Term Strength Training	15	3.4	0.69	15	4.4	3.27
	Long-Term Strength Training	15	2.8	1.47	15	2.9	0.99
	Control	15	3.8	1.22	15	3	1.15
Percentage of Lymphocyte	Short-Term Strength Training	15	33.8	6.61	15	37.7	5.12
	Long-Term Strength Training	15	30.1	5.21	15	36.4	6.71
	Control	15	29.5	6.04	15	31.8	7.14

It has been shown the results obtained from ANOVA test in comparison of the mean of variables in control, increasing short-term strength training and increasing the long-term strength training groups in post-test (Table 2). The results show that there is a significant difference between the means of neutrophils at Group 2 and 3 with Group 1 ($p=0.016$, $F(27.2) = 4.85$). The results obtained from Tukey test showed that there is a significant difference between Group 2 and Group 1, also ($p=0.013$). There isn't a significant difference between increasing the long-term strength training

and control groups (p=0.539) and between increasing short-term strength training and increasing the long-term strength training groups (p=0.132). Also, the results indicate that there is not a significant difference between the means of monocytes in control, increasing short-term strength training and increasing the long-term strength training groups (p=0.217, F (27.2) = 1.62). The results show that there is not a significant difference between the means of lymphocytes at control, increasing short-term strength training and increasing the long-term strength training groups (p=0.114, F (27.2) = 2.35).

Table 2 Statistical data of ANOVA for variables

Variable	Source changes	Total square	Degrees of freedom	Mean Square	The F	meaningful
Percentage of neutrophils	Inter-group	354.86	2	177.43	4.85	0.016
	Intra-Group	986.5	27	36.53		
	Total	1341.36	29			
Percentage of monocytes	Inter-group	14.06	2	7.03	1.62	0.217
	Intra-Group	117.3	27	4.34		
	Total	131.36	29			
Percentage of Lymphocyte	Inter-group	192.2	2	96.1	2.35	0.114
	Intra-Group	1102.1	27	40.81		
	Total	1294.3	29			

It has been shown the results of the samples of two-way t test compared to the means of pre-test and post-test in the control, increasing short-term strength training and increasing the long-term strength training groups (Table 3). The results show that there is a significant difference between the means of neutrophils at pre-test and post-test of the increasing the long-term strength training (t(14)=2.96, p=0.016) and increasing the short-term strength training groups (t(14)=0.13, p=0.899). The increasing the long-term strength training and increasing the short-term strength training cause the significant changes in the percentage of neutrophils at the pre-test and post-test of increasing the long-term strength training and increasing the short-term strength training groups. In addition, the results show that there isn't a significant difference between the percentage of monocytes in pre-test and post-test of increasing the long-term strength training (t(14)=0.16, p=0.876) and increasing the short-term strength training (t(14)=0.88, p=0.397) groups. Also, the results indicate that there is a significant difference on the percentage of lymphocytes in pre-test and post-test of increasing the long-term strength training (t(14)=6.09, p=0.001) and increasing the short-term strength training (t (14) = 3.03, p=0.125) groups. The increasing the long-term strength training and increasing the short-term strength training cause the significant changes in lymphocytes percentage at the pre-test and post-test of increasing the long-term strength training and increasing the short-term strength training groups.

Table 3 The results of Two-way t-test of the paired in the mean comparison of variables

Variable	GROUP	Pre-Test		Post-Test		The mean difference	Degrees of freedom	The T	The P
		M	SD	M	SD				
Percentage of neutrophils	Short-Term Strength Training	59	5.07	56.2	6.08	-2.8	14	2.63	0.027
	Long-Term Strength Training	65	4	61.6	5.58	-3.4	14	2.96	0.016
	Control	64.6	7.94	64.5	6.43	-0.1	14	0.13	0.899
Percentage of monocytes	Short-Term Strength Training	3.4	0.69	4.4	3.27	1	14	0.88	0.397
	Long-Term Strength Training	2.8	1.47	2.9	0.99	0.1	14	0.16	0.876
	Control	3.8	1.22	3	1.15	-0.8	14	1.3	0.223
Percentage of Lymphocyte	Short-Term Strength Training	33.8	2.61	37.7	5.12	3.9	14	3.03	0.014
	Long-Term Strength Training	30.1	5.21	36.4	6.71	6.3	14	6.09	0.001
	Control	29.5	6.04	31.8	7.14	2.3	14	1.69	0.125

DISCUSSION

The results of this study showed that cellular immunity in young boys is influenced by the intensity and duration of exercise. It has been reported the weakened or suppression of immune system following on the increasing exercise [14-16].

Observation of the measurable concentrations of immune system function is a reason of chronic inflammation or lasting effects of previous exercises and its releasing after exercise operates as a mediator in damage and repair of

muscles. The past researches have shown that the extreme sports or the sports that has led to muscle injuries are associated with increased concentration of immune system factors.

It could be avoided from the exercises that induce the releasing of the immune system factors by manipulation the practice program, if some of the immune system factors have led to the responses such as accumulation of inflammatory cells in the skeletal muscle [17,18].

It can be effective the manipulation of the releasing of immune system factors in trend of the inflammatory rehabilitation and also it can help to the determinate of injury or the speed of tissue rehabilitation after exercise. Immune system cells that circulate in the blood are mobilized during performing a heavy exercise. So, the suborders of neutrophils and lymphocytes in the blood circulating will called all. However, the lymphocyte concentrations will be reduced to below of baseline after heavy exercise also activity and reduced to below baseline and neutrophil concentrations continue to increase. Also, the secreted IgA from mucus is reduced. It is seen a significant increase in concentrations of anti-inflammatory and pre-inflammatory cytokines in response to heavy physical exercise. All of these factors imply that a strong inflammatory response occurs during heavy exercise.

So, the heavy exercise leads to inflammation and immune system deficiency. Medical results also showed that heavy and frequent training will lead to clinical infections without symptoms.

CONCLUSION

In conclusion, food supplements can be used as protection against the increased risk of infection in post-workout recovery and heavy to be raised. It has been shown that carbohydrate supplementation modulates the immune changes induced by exercise. However, significant clinical evidence in this regard has not been shown.

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