Research Article

The effect of a selected strength training course on the levels of interleukin 6 in active and inactive students

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Abstract

Background: The purpose of this study was the effect of a selected strength training course on interleukin 6 levels of active and inactive students. The current research is semi-experimental.

Materials and Methods: The statistical population includes all students Islamic Azad University of Kerman. Among the volunteers, 12 female physical education students were selected as active students and 12 non-physical education female students who do not do any sports activities daily were selected as inactive students. In order to investigate the effect of strength training , they started a 6-week training program . ¬Using the Kolmo-Smirnov (KS) test, all variables The studied subjects were evaluated in the ¬studied groups to measure the normality of the distributions and homogeneity of the variances, and the correlated t test was used to compare the researched variables among the groups.

Results: In general, the results of the study showed that the average IL-6 index , in both active and inactive groups, decreased due to selected resistance exercises . Also , the effect of selected strength training It is significant on interleukin 6 levels in both groups of active and inactive students. Also, there is a significant difference between the effect of selected strength exercises on interleukin 6 levels of active and inactive students.

Conclusion: According to the results of the research on the lowering of interleukin-6 levels as a risk factor and considering the low level of physical activity in inactive people, which ¬will increase the potential of diseases in these people, selected exercises The strength of the present study is recommended in order to improve people's lives and physical health.

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1. Introduction

System safety It is one of the vital systems whose proper functioning guarantees people's health, and if it does not function properly, survival will be impossible, because our body is constantly exposed to the invasion of bacteria, viruses, fungi , and parasites . All these factors exist even in natural conditions (1) The immune system has a special place among other functional systems of the body. -So that it not only provides suitable grounds for growth and health, but also ¬increases ¬the stability of the body against many disorders and failures and ¬prevents the occurrence of various diseases. Naturally, countless factors They can act to strengthen or weaken this important and vital system of the body. Knowledge of these factors and their impact on the immune system causes more knowledge of its function and helps to increase adaptations against different life conditions. Among these factors, exercise and physical exercise are of particular importance (2). All answers the body's defenses against molecules Foreign and emerging diseases occur in the immune system, which plays an important role in maintaining the homeostasis of the body (3). Immune cells are moving between different lymph tissues by blood circulation and lymphatic system. Lymphocytes can leave the blood circulation and enter different lymph tissues through special capillaries. xenophagous cells (neutrophils and macrophages) by selectively binding to adhesion molecules the special ones that are present on the covering cells are removed from the blood stream and enter different tissues of the body (4). At any moment, 1 to 2% of the body's total lymphocyte reserve is circulating, and most of them remain in the lymph tissues, and during sports activities, the number of these cells increases greatly. Immune cells circulate continuously between body tissues and blood.

It has been estimated that 1 to 2% of lymphocytes go around the whole body every hour (5). in between Different components device safety, Cytokines from Agents solution in This device are cytokines, Peptides Or proteins are by the cells of the immune system ¬are produced and released and -mediate production Safety answers are (6). Cytokines is a general term for soluble intercellular messenger molecules that include interleukins, interferons, colony-stimulating factors (CSFs) and cancer cell death factors (TNFs) (7). Cytokines ¬play a role in regulating immune system responses. Despite extensive studies, the mechanisms of cytokine release during exercise remain unknown. in mode Overall, cytokine I see to two category Y big before and Anti-inflammatory are divided Cytokine Hi before inflammation in create and Progression of inflammation included are Cytokine hi such as interleukin 6, 18 and beta 1 of sentence Cytokines¬ before They are inflammatory. Cytokine Hi anti-inflammatory in answer to inflammation They are secreted and agent limiting and the reverser of -Progressive process Y inflammation are (8). Interleukin 6, which has a metabolic and anti-inflammatory role, increases more than other cytokines during exercise (9). when sports, muscle Y skeletal in now shrinkage Certain amounts of IL- 6 to inside circulation blood Raha does¬ This hypothesis Existence has that IL-6 released done from muscle have role Hi metabolic is Possible IL-6 response is a sign Giver¬ decrease critical reserves Glycogen muscular and support Y more muscles skeletal on Glucose blood to title energy source be (10). found Hi Research Hi many to The role of IL-6 release done from muscle Y skeletal in metabolism reference has done are too Such IL-6 release done from muscle possible is mediator original Effects positive exercise in improvement sensitivity to Insulin be (11) .

therefore, Cytokines Raha done from muscle Y skeletal no only with changes safety Nashi from exercise relationship have but Mediator of changes Metabolic Nashi from exercise acute and Adaptations ¬of exercise also are (12). Interleukins There are a group of cytokines that are made by leukocytes and play a role in message transmission and communication between immune cells. At least 17 interleukin molecules are known so far (13). interleukin 6 free done from cell Hi safety cytokine is that effect before and anti-inflammatory from self Shows ¬and when sports, muscle Y skeletal in now shrinkage Lots of it to inside circulation blood Raha does¬ Based on this, now this question is raised as the main question of the current research, what ¬is the effect of a selected strength training course on interleukin 6 levels of active and inactive students.

2. Materials and Methods

In this semi-experimental research that was conducted in the field, the statistical population of this research includes all students Islamic Azad University of Kerman. We selected 12 physical education st In this semi-experimental research that was conducted in the field, the statistical population of this research includes all students Islamic Azad University of Kerman. We selected 12 physical education students as active students and 12 non - physical education students who had no daily sports activities as inactive students. The tests ¬have arrived. Then, the subjects voluntarily gave a written consent letter and a doctor's health questionnaire They signed the participation in the research stages. Entry criteria including you have from health general, Absence use from the regime food special, Absence consumption medicine and Tobacco was After selecting the measurement

subjects Height, weight, and body mass index were measured the day before blood sampling, and all -subjects were asked not to do vigorous physical activity two days before the test. In order to standardize the nutrition on the day of the implementation of the protocol, considering that the subjects ¬were students, they were asked to go to the self-service of the university at 12/5 and have lunch and to ¬go to the laboratory for the first blood draw by 4 o'clock. They try not to eat anything, but in any case, strict nutrition control was not completely possible before the implementation of the sports protocol.

The tool that was used to collect information in this research is as follows:

1.A preliminary questionnaire to find out about the subjects' general condition, including information about the ¬subjects' physical characteristics, sports history, and medical condition .

2.Digital scale for weighing ¬subjects

3.Meter made by Bahin Andare company, used to measure the height of ¬subjects

4.Kits for measuring interleukin 6 levels made by Bender Medsystem

5.Gym and fitness equipment

In order to investigate the effect of strength training, a 6-week training program was designed as described below, and all ¬active and inactive subjects started to do it. Before starting the main training program, each subject was required to run and do soft activities for 5 minutes to warm up the body. After warming up, each subject performs 5 minutes of stretching exercises, which included static stretching movements in the upper limbs and trunk.

The main training program consists of 30 minutes of strength training, which is repeated three times a week. In order to comply with the overload principle, 3 minutes are added to the training time every 2 weeks. The following table shows the above exercise program.

Table (۱-۳): Training protocol

Course length	The content of the exercise	Session duration	program	
Three sessions a week for weeks ۶	smooth running	۵ minutes	General heating	۱
Three sessions a week for ۶ weeks	Static stretching movements in the upper body and trunk	۵ minutes	soft movements	۲
Three sessions a week for ۶ weeks	exercise resistance with intensity ۷۰% one repetition the maximum with ۱۲ repetition in ۳ sets with one minute rest	۳۰ minutes	strength training	۳

All the studied variables in the studied groups will be evaluated in order to measure the normality of the distributions and homogeneity of the variances, and to compare the studied variables between the groups, the correlated t test and the independent t test were used.

3. Results

Table No. (1-4) shows the descriptive statistics of the research participants. Charts No. (4-1) to (4-4) have displayed this information in the form of a chart *Table number (4-2) and graph (4-5) show the average levels* of IL-6 in both active and inactive groups, in the two stages of pre-test (1) and post-test (2).

Table No. (4-1) descriptive statistics related to age, weight, height and BMI

Standard deviation	average	number	group	
٢/٩١	٢٣/٨٣	١٢	active	**age**
١/٦٠	٢٣/٢٥	١٢	inactive	
٥١/٥	١٦٨/٢٥	١٢	active	**height**
٥٢/٥	١٧١/٢٥	١٢	inactive	
٥/٤٧	٦٥/١٦	١٢	active	**weight**
٥/٨٠	٧٤/٠٨	١٢	inactive	
٢/٠٧	٢٣/٠٥	١٢	active	**BMI**
١/٧٦	٢٥/٢٧	١٢	inactive	

Table number (4-2) and graph (4-5) show the average levels of IL-6 in both active and inactive groups, in the two stages of pre-test (1) and post-test (2).

Table (2-4) statistical description of the research variable

Standard deviation	average	number	test	group	
٠,٣٠	١/٦٠	١٢	pre-test	active	**Interleukin ٦**
٠,١٩	١/٥١	١٢	After the test		
٠,٢٤	٢/٠٦	١٢	pre-test	inactive	
٠,٣٢	١/٧٣	١٢	After the test		

As the results of the study in this section show , the average index of IL-6 , in both active and inactive groups, has decreased due to selected resistance exercises.

Table (3-4): The results of the Kolmogorov-Smirnov (KS) test to check the normality of the -data

After the test	pre-test	
۲۴	۲۴	**number**
۱/۵۲	۱/۸۹	**average**
۰/۲۵	۰/۳۲	**standard deviation**
۲/۱۰	۱/۵۳	**CalculatedZ**
۰/۰۵۴	۰/۰۶	**level of significance**

As Table (3-4) shows, ¬the significance level in all the investigated variables s higher than (0.05) and based on this, the assumption of normality of the data in all the investigated variables is confirmed, and in order to test the hypotheses from the test ¬parametric methods were used.

The test of the first zero hypothesis of the research: selected strength exercises have a significant -effect on the levels of interleukin 6 of active students does not have

Table (4-4): Test results Correlated t to test the first research hypothesis

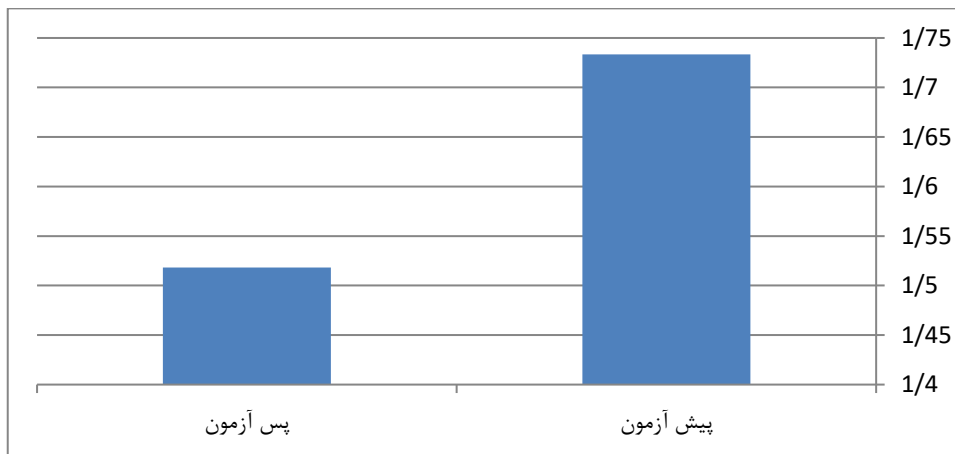| level of significance	df	t	standard deviation	avera ge	Active group
۰/۰۲۵	۱۱	۲/۵۹-	۰/۲۸	۰/۲۱	**Pre-test-post-test**

Figure (6-4): Comparison of interleukin-6 pre-test and post-test levels in the group of active students

As shown in table number (4-4), the P-value in the t- test was calculated as (0.025). Since this value is less than (0.05), the null hypothesis is rejected ¬and the research hypothesis ¬is confirmed. Based on this, it can be concluded that the effect of selected strength exercises It is significant on the levels of interleukin 6 of active students.

The test of the second zero hypothesis of the research : selected strength exercises . There is a significant ¬effect on the levels of interleukin 6 in inactive students does not have Correlated.

Table (4-5): Test results Correlated t to test the second research hypothesis

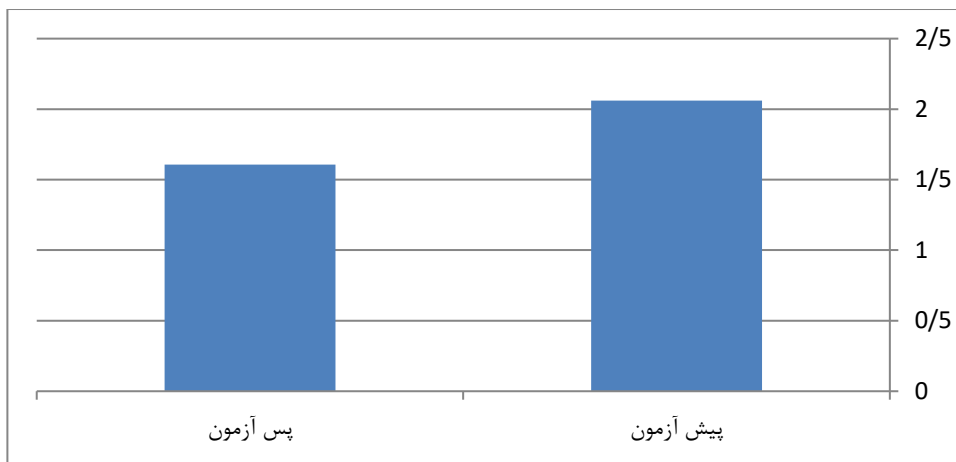| level of significance	df	t	standard deviation	average	Inactive group
٠,٠٠٠	١١	-٠٦/٦	٠,٢٦	٠/۴۵	**Pre-test-post-test**

Figure (4-7): Comparison of pre-test and post-test interleukin-6 levels in the group of inactive students

As shown in table number (4-5), the P-value in the t- test was calculated as (0.000). Since this value ¬is less than (0.05), the null hypothesis is rejected ¬and the research hypothesis is confirmed. Based on this, it can ¬be concluded that the effect of selected strength exercises It is significant on the levels Jof interleukin 6 of inactive students.

The test of Safrosom research hypothesis : selected strength exercises . It has a significant -effect on the levels of interleukin 6 of students Correlatedt.

Table (6-4): Correlated t test results for testing the third research hypothesis

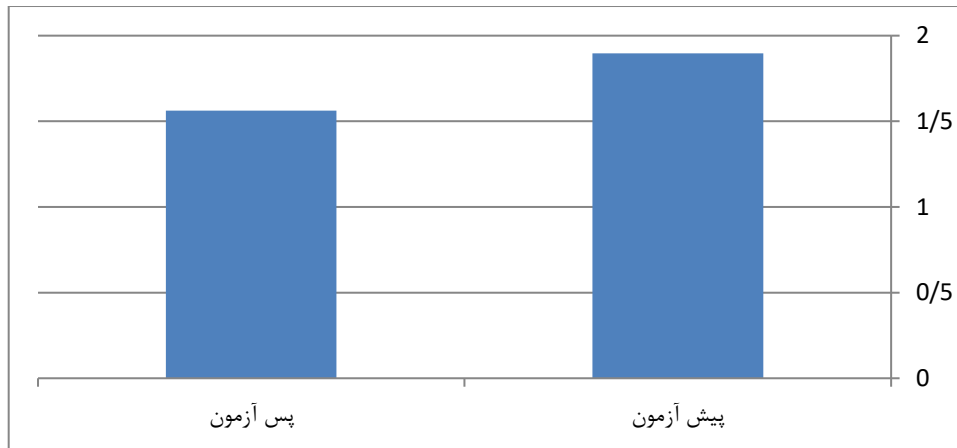| level of significance	df	t	standard deviation	average	Students
۰/۰۰۰	۲۳	۵/۵۷-	۰/۲	۰/۳۳	**Pre-test-post-test**

Figure (8-4): Comparison of interleukin-6 pre-test and post-test levels in the group of students (active and inactive)

As shown in table number (4-6), the P-value in the t- test was calculated as (0.000). Since this value is less than (0.05), the null hypothesis is rejected and the research hypothesis is confirmed. Based on this, it can be concluded that the effect of selected strength exercises It is significant on the interleukin 6 levels of students.

The test of the fourth null hypothesis of the research : the difference in the effect of selected strength exercises on the levels of interleukin 6 of active and inactive students is significant.

Table (4-7): t-test results for testing the fourth hypothesis

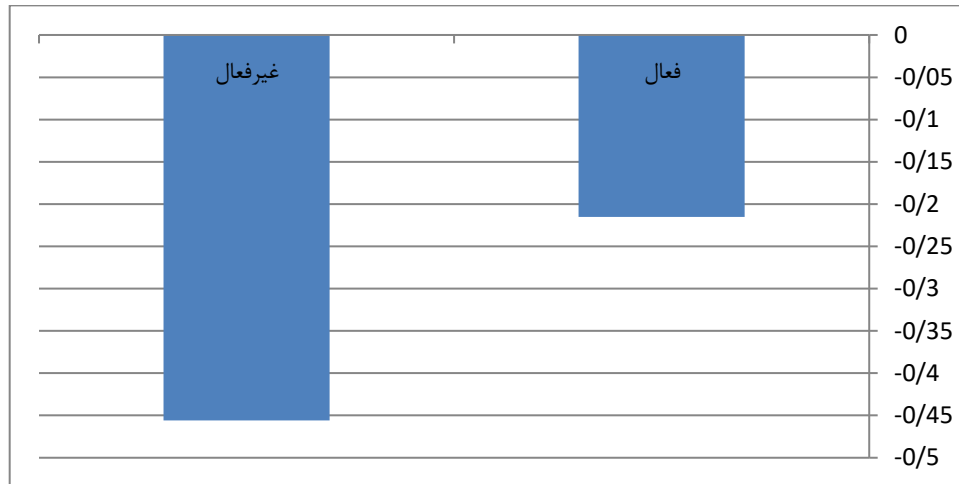| t-test for comparison Averages			test Levin		average	number	group	
Sig	df	T	Sig	F				
۰,۰٤۲	۲۱/۷۹	-۲/۱٥٥	۰,٦٤٤	۰,۲۲۰	۰,۲۱	۱۲	active	Internet connection ٦
					۰,٤٥	۱۲	disabled	

Figure number (9-4): The difference in interleukin 6 levels of students (active and inactive)

As shown in table number (7-4), the P-value in the t- test was calculated as (0.042). Since this value is less than (0.05), the null hypothesis is rejected ¬and the research hypothesis is confirmed. Based on this, it can be concluded that there is a significant difference between the effect of strength training on interleukin 6 levels of active and inactive students .

Conclusion

Discussion and conclusion of the first research hypothesis : The results of this part of the study showed that the effect of selected strength exercises It is significant on the levels of interleukin 6 of active students and the average indices indicate a decrease in this variable, which is with the results of Akbarpour (2012), Safarzadeh et al. (2011), Bije et al . colleagues (2008), is consistent (14, 15, 16, 17) but does not match the results of Abedi et al.'s research (2013) (18) . In this justification of the results of this section, it should be mentioned that in response to intense training, cytokines and hormonal reactions are mainly involved in

metabolism and access to energy in the peripheral mechanisms of the cell . Exercises increase plasma IL- 6 , and in fact, this factor increases in response to exercise and increases (IL-10) and (IL-1) and It causes cortisol as well It goes up and also stops the production of TNF- and causes insulin resistance in humans . In fact, researchers have introduced this muscle-derived factor as a true characteristic of training, which is obviously increased in response to long-term training .

Discussion and conclusion of the second research hypothesis : The results of this part of the study showed that the effect of selected strength exercises It is significant on the levels of interleukin 6 of inactive students, and the average indices indicate an increase in this variable , which is in line with the results of Bijeh et al. (2013), Campbell et al. 19, 20, and 14) but it does not match the results of Abedi et al.'s research (2013) (18) new badge data are which has interleukin-6 effect Anti-obesity is and sensitivity Insulin particle for direct object increase gives Cytokine interleukin-6, such as leptin, Kinase protein active (AMPK) 5`AMP i in The muscle skeletal and texture fat

activates¬ AMPK activation with effect on path message Insulin donor cause increase consumption Glucose can d . effect support exercise regular in equal to Diseases such as disease Hi cardiovascular , diabetes type 2 and Cancers chest and colon to good specific done is effect anti-inflammatory Nashi from exercise regular possible is mediator effect useful exercise on health in people the patient be Concentrations Sarmi Cytokines anti-inflammatory to follow types different Increased exercise It ¬is found that on this basis, it is possible to point out the need to engage in sports activities in inactive people. In fact, considering the low activity of people in this group and the risk of developing cardiovascular diseases in these people as a result of these low levels of activity, selected strength exercises, through reducing the level of interleukin-6 as a cardiovascular risk factor, can Reducing the risk of atherosclerosis and improving cardiovascular health is effective.

Discussion and conclusion of the third research hypothesis : The results of this part of the study showed that the effect of selected strength training It is significant on the levels of interleukin 6 of students, and the average indicators indicate an increase in this variable, which is with the results of Akbarpour (2012), Erickson et al. (2008), Campbell et al. (2009), Eloumi et al.), Christiansen (2010) is consistent (14, 16, 19, 21, 22, and 20) and is in conflict with the results of Abedi et al.'s research (2011) (18) and In relation to the cause of the difference in the results in this section, it can ¬be related to the role of factors such as research groups, age, gender, training period, training duration and training intensity. Decreased levels of interleukin associated withexercise with Possible reduction amount fat the body and ratio the environment waist to pelvis and improvement preparation aerobic Subjects will

accompany was so activity combined can as section basic in manner life people in opinion taken to be.

Discussion and conclusion of the fourth research hypothesis: The results of this part of the study showed that there is a significant difference between the effect of selected strength exercises on the levels of interleukin 6 of active and inactive students, which is consistent with the results of Amani Shamelzadi et al.'s research (24). In connection with the results of this section, it should be mentioned, place production and The scope of effect Cytokines beyond from device safety is sports, Example interesting for badge to give this content is that how cells that origin safety do not have they can Cytokines special production and discharge do when sports, The muscle skeletal in now shrinkage The levels of interleukin- 6 to inside circulation blood Raha does This hypothesis Existence has which release interleukin-6 done from muscle have role Hi metabolic is Interleukin-6 response , possible is badge Giver decrease critical reserves Glycogen muscular and Leaning on more muscles skeletal on Glucose blood to title source energy be d. Findings Researches many to The role of interleukin-6 release done from The muscle skeletal in metabolism reference has done and d. Also Interloginen-6, Raha done from muscle possible is mediator The original works positive exercise in improvement sensitivity to Insulin be therefore, Cytokines Raha done from muscle Y skeletal no alone with changes safety Nashi from exercise relationship have but mediator changes Metabolic Nashi from exercise acute and Compatibility exercise also They are d.

In a general conclusion, the findings of the present study showed that selective strength training, through reducing the level of interleukin-6 as a cardiovascular risk factor, can be effective in reducing the risk of atherosclerosis and improving cardiovascular health. Based on this, performing selected strength exercises can be recommended in a suitable way to prevent related diseases.

Based on ¬research findings and the effect of selected strength training on reducing the levels of interleukin-6 as a cardiovascular risk factor, it is recommended to perform selected strength training to prevent the risk of diseases such as atherosclerosis.

According to the results of the research on the lowering of interleukin-6 levels as a risk factor and considering the low level of physical activity in inactive people, which will increase the potential of diseases in these people, the selected strength exercises of the present study, in It is recommended to improve people's lives and physical health.

Acknowledgements

Funding

Compliance with ethical standards

Conflict of interest None declared.

Ethical approval the research was conducted with regard to the ethical principles.

Informed consent Informed consent was obtained from all participants.

Author contributions

Conceptualization: M.T, H.M, I.N, A.B; Methodology: M.T, H.M, I.N, A.B; Software: M.T, H.M, I.N, A.B; Validation M.T, H.M, I.N, A.B; Formal analysis: M.T, H.M, I.N, A.B; Investigation: M.T, H.M, I.N, A.B; Resources: M.T, H.M, I.N, A.B; Data curation: M.T, H.M, I.N, A.B; Writing - original draft: M.T, H.M, I.N, A.B; Writing - review & editing: M.T, H.M, I.N, A.B; Visualization: M.T, H.M, I.N, A.B; Supervision: M.T, H.M, I.N, A.B; Project administration: M.T, H.M, I.N, A.B; Funding acquisition: M.T, H.M, I.N, A.B.

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