Abstract—Exercise is the strongest stress to which the body is ever exposed. The body response to this stress through a set of physiological changes in its metabolic, hormonal and immunological systems[1]. The purpose of the study was to examine the effect of 2 months endurance training on plasma immune cells and humoral responses. Eighteen active women that were college student, participated in the study. They performed selected endurance training for two months. Before and after training, blood sample were obtained. Data was analyzed using paired sample t-test. Concentration CD4, IgA and CD4 / CD8 increased and CD8 decreased significantly. It was showed that endurance training may induces changes in lymphocyte subsets and CD8, CD4 function adapted in experimental group. We conclude that endurance training may result in significant alteration in T lymphocyte number, but their actual significant for immunity is seen controversially.

Key Words: immune system, exercise, active female

I. INTRODUCTION

The human body constructs different defensive layers to resist against the pathogenic factors. One of these layers is the defensive system that exists in the blood circulation which is known as the leukocytes[2]. The immune system is divided into two general categories: the innate immunity (natural or unspecific) and the adaptive immunity (adaptability or specific). By proliferation the number of the effective factors in this field. By doing an intensive activity, the lymphocyte T subsets concentration of blood circulation solution shows a two-phase response and its symptom is the cell proliferation during and immediately after the activity and a meaningful decrease in their numbers in the recovery period[7,8].

The production of cytokines is only one stage of multi-stage defense process that leads to an increase in the cytotoxic lymphocyte and the increase and decrease in the number of immune cells may occur contrarily[9,10,5]. Besides the total subsets cells in response to the activity may have a normal effect on the lymphocytes operation. Doing a 120 minute treadmill activity with a 65% \( V_{O2\text{max}} \) which was a persistent exhausting activity showed the increase. It is also stated that the light training up to 85% of aerobics threshold in a less than 2 hour period showed a lesser changes in hormonal reaction and immune cell concentration in comparison with an intensive training to 100% aerobics threshold for a 3 hour period. The activity with the maximum amount of oxygen consumption ranging from (75%, 30%, 65%) and in different time periods (120%, 60%, 30%) showed that the highest decrease[10,11].

In another research by Kendal and the colleagues during the study of the activity and the response of blood lymphocytes subsets, the effect of participation, length of performance and physical preparation of tests were checked. Other similar result of the researches done on 11 well prepared cyclists indicate the meaningful increase of IgA, CD4, CD8 and the meaningful decrease of TNF\( \alpha \), CD4, CD8 and the meaningful decrease of IL2, CD4/CD8 which all show the temporary changes of immune system operation[9]. Having done a rowing activity on the ergo meter and studying the blood samples for few times shows an increase in the leukocytes, granulocyte, lymphocyte, TNF\( \alpha \), CD4, CD8 which in the condition of returning to primary state for a few hours all the above cases were in a higher level of resting state[5,3]. Of course doing ergo meter in the Baj study showed a meaningful decrease of CD3, CD4 and decrease of TNF\( \alpha \) recovery[12].

IgA immunoglobulins commonly found in airway and alveolar space secretions, may have diffused from the serum during recovery from prolonged endurance exercise nonspecifically and/or in response to microbial agents and the changes of the energy level and glycogen, the oxidative stresses and the increase of the body central temperature are the effective factors in this field. By doing an intensive activity, the lymphocyte T subsets concentration of blood circulation solution shows a two-phase response and its symptom is the cell proliferation during and immediately after the activity and a meaningful decrease in their numbers in the recovery period[7,8].
antigens introduced into the airways during the exercise bout. Secretory immunoglobulin A (IgA), the predominant immunoglobulin in mucosal secretion, is a major effectors of resistance against pathogenic microorganisms. Hofman and the colleagues studied about immune cells and their subsets responses to the repetitive under maximum activity and before the activity and at the recovery period until 5 days later, they assessed leukocytes, IgA in persons that had a regular physical training. The increase of IgA percentage and meaningful increase of leukocytes are the results of this research.

Checking the effect of two eccentric and concentric sport standard on particular indexes of female athletes immune system and changes comparison showed that the above factors in both group of athletes and non athletes ( before and immediately after the activity on the tread mill ) had a meaningful increase[4,13,3].

The effect of two types of active and passive recovery on indexes changes of immune system of male collegiate athletes due to the intensive sport to exhausting indicated that doing an exhausting sport activity by male collegiate athletes caused the meaningful decrease in amount of neutrophile. But after a 15 min active recovery between 65% to 75%, the heart beat increase in relation to their undergone passive recovery during the lying period some meaningful changes were not seen on the stated indexes and also having a 30 min active or passive recess caused the stated indexes almost return to the levels before the activity[3].

II. MATERIAL AND METHODS

Eighteen recreational active women (age: 21.6 ± 1.7 years, height: 161.45 ± 2.71 cm, weight: 57.25 ± 6.99 kg, Vo2max: 34.18 ± 2 ml.kg⁻¹.min⁻¹) participated in the study. The experimental protocol was approved by the ethics committee. Blood sampling were obtained before exercise into a glass tube EDTA. The tube was kept on ice for 15 min before centrifugation. then they participated in a two months incremental endurance training program. After two months, subjects blood sample were obtained. Plasma was separated from the cells and stored until subsequent analysis for CD4, CD8 and IgA. We used of the flow cytometry three color to perform cell sorting(CD4, CD8). Determination of different subsets of leukocytes was accomplished by flow cytometry with three-color analysis. The method for three-color flow cytometry analysis is based on a high degree of standardization. Cell surface molecule density is expressed as molecules of equivalent soluble fluorochrome. IgA concentration (microgram.ml protein-1) was measured by ELISA. In this research descriptive statistics such as average, standard diversion and diagram were used. Data was analyzed using paired sample t-test.

This basic and semi research by designing a pre test and post test was done on a group before and after the performance of independent variable, the department variables were measured. The statistical union of research includes the female undergraduate of physical education which had a regular collegiate sport activity during the two previous years. The statistical samples were eighteen participants which after filling up the testimonial forms and particular health questionnaires were selected and participated in research. Dependant variable was a selected endurance training. Dependant variables were some of the immune indexes are the acquisitive immune indexes of the blood circulation which have cellular structure.

III. RESULTS

Means showed the mean plasma concentration of CD4, IgA and CD4/CD8 increased after 8 weeks exercise, the mean plasma concentration of CD8 decreased IgA secretion rate did not change significantly after exercise (Figure 1 and 2 and Table 1).

![Graph showing changes of CD4, CD8, and CD4/CD8](image)

Figure 1: Changes of CD4, CD8 and CD4/CD8

<table>
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<tr>
<th>TABLE I. DESCRIPTIVE STATISTICS</th>
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![Graph showing changes of IgA](image)

Figure 2: Changes of IgA

T-test showed IgA response was not significantly but CD4, CD8 and CD4/CD8 response were significantly (Table 2, P≤ 0.05 and 0.01).

TABLE II. THE COMPARISON OF T-EST
neuroendocrine -induced cha mechanisms behind these alterations could be circulating lymphocytes, or, most likely, a combination of circulation, suppression of intracellular mobilization of different leukocytes.

Endurance exercise was associated with a more pronounced change in concentrations of CD4 and CD8 cells. The mechanisms behind these alterations could be neuroendocrine -induced changes in expression of adhesion molecules on both leukocytes and vascular endothelial cells, mobilization of different leukocyte subpopulations into the circulation, suppression of intracellular functions in the circulating lymphocytes, or, most likely, a combination of these factors.


