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Exercise lifestyle as an effective prevention of the immune system disturbance in the elderly

Abstract Immunosenescence is defined as the changes in the immune system associated with age. It is a progressive and irreversible process involving a decrease in the number of naïve T and B cells, NK cells cytotoxic and activity, and disruption of pro and anti-inflammatory balance by altering the production of IL-2, IL-4, IL-6, IL-10, IL-10, TNFα, INFγ and others. With age there is an increase in autoimmunity and generalized inflammation with a simultaneous immunodeficiency, which results in greater susceptibility to infectious diseases, a decrease in reactivity to prophylactic vaccinations, the incidence of autoimmune diseases, and increased risk of infectious injury complications, exacerbation of symptoms of chronic diseases and an insufficient response to the presence of cells cancer. For years, based on the analysis of the frequency of viral and bacterial infections, immunological indicators and inflammation, attempts have been made to develop the immune risk profile (IRP) and effective methods of preventing disorders of the immune system and prolonging the functional capacity of the elderly.

The aim of the study was to review the literature on immunosenescence and assess the immune risk profile based on cytometric analysis of the T-cell population in relation to the level of physical activity.

99 individuals aged 60 to 90 were recruited for this study. Based on the medical interview and the exclusion criteria, the study was conducted with the participation of 54 elderly aged 71.4 ± 5.8 years (women n = 47, men n = 7). The participants were divided into two groups, active and physically inactive, based on the results of the 6-minute walk test (6MWT) and Astrand-Ryhming submaximal cycle test. The physically active group included 34 individuals, aged 70.2 ± 5.8 years, whose walking gait speed ranged from 1.3 to 1.8 m/s and the maximum level of oxygen consumption (VO2max) was >35 mL/kg/min. The physically inactive group included 20 participants aged 73.5 ± 5.4 years, who achieved gait speed <1.3 m/s and VO2max value ≤35 mL/kg/min. Analysis of the T cell subpopulation was performed with an 8-parameter flow cytometer and fluorochrome labeled monoclonal antibodies and immunophenotyped to determine the percentage of naïve and memory T lymphocytes. An assessment of the immune risk profile (IRP) was performed based on the ratio of CD4+ T cells to CD8+ T cells and the level of IgG CMV antibody. Reference ranges of a CD4/CD8 ratio of ≥1 to ≤ 2.5 were taken as normal, while values <1 or > 2.5 (inverted CD4/CD8 ratio or higher CD4/CD8 ratio) were considered an immune risk phenotype.

Fat mass (FM) and free-fat mass (FFM) were assessed with a body composition analyzer based on the bioelectric impedance method.

The percentage of naïve T lymphocytes phenotype: CD4+CD45RA+ and the CD4CD45RA / CD4CD45RO ratio was significantly higher in physically active elderly participants (gait speed 1.5 ± 0.1 m/s) compared to inactive individuals (gait speed 1.0 ± 0.1 m/s). IRP analysis, expressed as the ratio of CD4+ to CD8+ T lymphocytes, showed values in the reference range of ≥1 and ≤2.5 in 60% of physically active seniors, while an inverted CD4/CD8 ratio (values <1) was observed mainly in the group of physically inactive. Physically active elderly participants were characterized by a lower FM content compared to inactive group. Significant relationships were found between FM and the number of T lymphocytes, expressed by the Spearman correlation coefficient (FM/CD4+rs= 0.491, $p<0.05$ and FM/CD4+CD45RO+rs = 0.636, $p<0.01$) in the group of physically inactive seniors. Due to the fact that 93% of elderly were seropositive CMV the relationship between CMV infection and changes in the CD4/CD8 ratio has not been established.

Based on a review of the literature and conducted research, it has been showed that maintaining and lifestyle exercise strengthens the immune system by increasing the percentage of naïve T lymphocytes, and the assessment of the changes in the number of CD4+ T helper lymphocytes to cytotoxic CD8+ lymphocytes observed with age may be important in forecasting the occurrence of metabolic disorders or the intensification of symptoms of comorbidities.