PHYSICAL ACTIVITY AND THE IMMUNE SYSTEM – A BRIEF REVIEW

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Abstract

Background. Physical activity is an essential element in maintaining optimal health. Studies on this topic shows that the physical condition of the body can influence the evolution of a disease, such as viral infections. Very recent research supports the idea that regular exercise could be effective in prevention and could reduce the risk of severe lung complications, including the disease of 2020 - Covid 19. (Yan, Z., Spaulding, H.,2020).

Social distancing measures taken to control the current COVID-19 pandemic have led to limited physical activity options. Many people are in quarantine or self-isolation at home. However, this should not lead us to adopt a sedentary lifestyle, which is associated with decreased immunity.

Studies suggest that the prolonged intense exercise causes immunosuppression, whereas moderate-intensity exercise improves immune function and potentially reduces risk and severity of respiratory viral infections. (Martin, S., Pence, B., Woods, J., 2009).

Objectives. We propose a brief overview of the current global phenomenon, the pandemic Corona virus, which affects the quality of life of people around the world and how it can be combated with physical activity.

Purpose: In the context of the novel coronavirus outbreak, that question has gained urgency and also, thanks to recent research, emergent answers. The purpose of this work is to highlight the influence of physical activity on the immune system. The latest science suggests that being fit boosts our immune systems, and that even a single workout can amplify and improve our ability to fight off germs (Nieman, D., Wentz, L., 2019).

Conclusion. Exercise has a profound effect on the normal functioning of the immune system. It is generally accepted that prolonged periods of intensive exercise training can depress immunity, while regular moderate intensity exercise is beneficial.

Keywords: physical activity, immune system, acute exercise, chronic exercise.

Introduction

The immune system is a set of complex interactions involving various organs, structures and substances, including white blood cells, spinal cord, lymph vessels and organs, specialized cells in certain tissues of the body and specialized substances called serum factors, which are present in the blood. Ideally, all of these components work together to protect the body against disease and infection. Therefore, the immune system represents the totality of defense processes of organisms against pathogens, including intracellular organisms (viruses). This role of defense is very important for maintaining the health of the body.

Exercise has a profound effect on the normal functioning of the immune system. It is generally accepted that prolonged periods of intensive exercise training can depress immunity, while regular moderate intensity exercise is beneficial (Simpson, R.J., Kunz, H., Graff, N.A., 2015).

Doctors recommend exercising to promote a healthy lifestyle and thus to maintain a high immune system. Studies show that acute exercise has a beneficial effect on the immune response against viral respiratory infections. This type of exercise leads to an increase in the number of white cells - neutrophils and NK cells (Natural Killer cells), which are an essential role in the body's innate immunity. They are specific for the innate immune response and quickly block the actions of viruses and tumor cells being active in the first three days after the onset of infection or antigen invasion (Grigore, M., 2003).

Purpose

In the context of the novel coronavirus outbreak, that question has gained urgency and also, thanks to recent research, emergent answers.

The purpose of this work is to highlight the influence of physical activity on the immune system. The latest science suggests that being fit boosts our immune systems, and that even a single workout can amplify and improve our ability to fight off germs (Nieman, D., Wentz, L., 2019).

Objectives

We propose a brief overview of the current global phenomenon, the pandemic Corona virus, which affects the quality of people's life from all around the world and how it can be combated with physical activity.

Content

Researchers (Simson, R., et all, 2015) explain how the acute exercise (maximum 60 min of effort at moderate intensity) represent an important immune system adjuvant to stimulate the highly active immune cell subtypes between the circulation and tissues. In particular, each exercise bout improves the antipathogen activity of tissue macrophages in parallel with an enhanced recirculation of immunoglobulins, anti-inflammatory cytokines, neutrophils and NK cells. Natural killer (NK) cells are lymphocytes of the innate immune system, vital components of human immunity involved in the elimination of microbe-infected cells. With near daily exercise, these acute changes operate through a summation effect to enhance immune defense activity and metabolic health. In contrast, high exercise training workloads, competition events, and the associated physiological, metabolic, and psychological stress are linked with transient immune perturbations, inflammation, oxidative stress, muscle damage, and increased illness risk.

New insights show how intense and prolonged exercise can cause transient immune dysfunction by decreasing immune cell metabolic capacity. People who have a moderate level of daily exercise have up to 40-50% fewer episodes of upper respiratory infection. Exercise is not beneficial, however, to any extent. Both sedentary lifestyle and chronic exercise decrease the immune defense capacity (fig.1). Studies suggest that the prolonged intense exercise causes immunosuppression, whereas moderate-intensity exercise improves immune function and potentially reduces risk and severity of respiratory viral infections. (Martin, S., Pence, B., Woods, J., 2009).



Fig. 1 The influence of the acute and chronic exercises in the immune system (Martin et all, 2009)

Physical activity is an essential element in maintaining optimal health. And in the case of SARS-CoV-2 infection, studies show that the physical condition of the body can influence the evolution of the disease. In this case, the virulent pandemic occurs in the respiratory system with the significant deterioration of lungs activity.

The most recent study in this field reveals the importance of the enzyme named Extracellular Superoxide Dismutase (EcSOD) in the evolution of COVID-19.

Increasing the expression of the only extracellular enzyme with antioxidant properties (EcSOD) in striated muscle tissue or other organs, followed by redistribution of EcSOD to the lung tissue, could be an effective measure to prevent acute respiratory distress syndrome (ARDS) or to decrease its severity (Voinea, A., 2020). The same author believes that regular exercise could be effective in prevention and stimulation of enzyme production could be effective in the treatment of ARD associated COVID-19 (fig. 2).



Fig. 2 EcSOD can prevent ARDS (Voinea, A., 2020)

This syndrome consists of severe inflammation of the lungs, which leads to acute respiratory failure and, consequently, lack of oxygenation of the whole body. ARDS is, according to studies to date, a leading cause of mortality in COVID-19. According to the CDC (US Center for Disease Control), ARDS affects between 3 and 17% of those infected with SARS-CoV-2 and between 65 and 85% of those hospitalized in intensive care.

Overall, EcSOD has recently emerged as a promising therapy for protection of vital tissues/organs under various disease conditions related to oxidative stress. Recent findings suggest that endurance exercise promotes EcSOD expression in skeletal muscle, the largest organ in our body, leading to elevated levels of EcSOD in other peripheral organs. This humoral function of EcSOD induced by exercise training may become effective therapeutics for many disease conditions (fig. 3).



Fig. 3 EcSOD a molecular transducer of health benefits of exercise (Yan, Z., Spaulding, H., 2020)

The facts that EcSOD expression is promoted by endurance exercise in skeletal muscle and can be redistributed to other vital tissues to protect the target tissues against oxidative damage in various pathological processes strongly support exercise-induced EcSOD as an effective therapeutic intervention for prevention and treatment of numerous oxidative stress-related diseases.

In this direction, for the prevention of Sars-CoV-2 disease, the World Health Organization recommends 150 minutes per week of moderate-intensity physical activity or 75 minutes per week of vigorous physical activity. This level of physical activity has been associated with increasing life expectancy.

Also, for a healthy lifestyle we must take into account: a balanced diet, adequate hydration of body and respect the hours of sleep (7-9 hours). Some authors (Pelinski da Silveira et all, 2020) recommend that adopting mitigation practices is an essential strategy to reduce the risks related to the novel coronavirus infection. These interventions include the use of personal protective equipment, adherence to hygiene procedures and social isolation measures, as well as actions that lead to a healthier lifestyle, minimize stress factors and strengthen the immune system, such as regular physical activity.

Conclusions

Regular exercise training has a profound effect on the normal functioning of the immune system and has an overall anti-inflammatory influence mediated through multiple pathways. Also, several epidemiologic studies also suggest that regular physical activity is associated with decreased mortality and incidence rates for influenza and pneumonia.

Among other factors, the researchers are still analyzing how diet, exercise, age, psychological stress influence the body's immune response.

The question remains: how exercise interacts with our immune systems and whether we should plan to remain active, even as the incidence of new virus continues to grow? In this context, we are optimistic that researchers will discover the vaccine for this pandemic as soon as possible.

Among other factors, the researchers are still analyzing how diet, exercise, age, psychological stress influence the body's immune response. Although no direct link between the two has been discovered yet, there is

ample evidence of how these factors influence the proper functioning of the immune system, according to scientists at Harvard Medical School.

Social distancing measures taken to control the current COVID-19 pandemic have led to limited physical activity options. Many people are in quarantine or self-isolation at home. However, this should not lead us to adopt a sedentary lifestyle, which is associated with decreased immunity.

EcSOD is a perfect example of how we can use our understanding of the biological processes of exercise in medicine.

Studies indicate that the modulation of the immune response related to exercise depends on factors such as regularity, intensity, duration and type of effort applied (WHO, 2020).

Faced with the possibility of new pandemics by previously unknown microorganisms, without totally effective prevention measures, the host organism's capacity against infections becomes the most important line of defense, thus emphasizing the importance of investing in lifestyle habits that promote health and well-being, such as the practice of physical activity (Pelinski da Silveira et all, 2020).

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