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Review Article

Physical Activity: A Key to Uphold Immune Functions during COVID-19 Pandemic

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ABSTRACT

The population of industrialized and developing countries has been less physically active during the previous century, either to changes in the type of job or the adoption of new habits owing in part to changes in work demands and the adoption of new sedentary habits. The World Health Organization (WHO) officially proclaimed a pandemic on March 11, 2020, due to the novel coronavirus (SARS-CoV-2), which was discovered in December 2019. Social isolation and/or social distance are among the WHO guidelines that must be implemented by governments globally (with exclusions) in order to prevent the spread of SARS-CoV-2. The sudden onset of a quarantine period, on the other hand, not only implies a rapid change in people's lifestyles, but it can also have an impact on the health of these isolated people, as it favors impairment in dietary habits, changes in psychosocial behaviour, and reduced levels of physical activity in people of all ages. Increases in anti-inflammatory cytokines produced during exercise may help to limit the post-inflammatory reactions that occur as a result of the exercise-induced damage to the skeletal musculature, as well as inhibit the production of pro-inflammatory cytokines linked to the development of pathological conditions. A modest systemic inflammatory response was elicited by moderate-intensity resistance exercises, which was characterized, at least in part, by elevations in blood levels of inflammatory cytokines such as IL-1 and TNF-α. The regular production of muscle-derived anti-inflammatory cytokines (IL-6, IL-7, IL-10, IL-15), along with the suppression of pro-inflammatory cytokines (IL-1, IL-18, TNF-α), is thought to play a key role in the immune-boosting benefits of exercise. Physical activity should be beneficial to one's health on a regular basis; nevertheless, characteristics like as volume and intensity must be considered for the suggested programmes to achieve the greatest outcomes.

Key words: Physical activity, Immune functions, COVID-19, Cytokines, Interleukins.

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INTRODUCTION

The population of industrialized and developing countries has been less physically active during the previous century, either to changes in the type of job or the adoption of new habits owing in part to changes in work demands and the adoption of new sedentary habits. This change has resulted in significant increases in the incidence of chronic diseases such as cardiovascular disease and type 2 diabetes, as well as obesity, musculoskeletal problems, lung diseases, cancer, and neurological disorders. Sedentarism has a negative impact on the quality of life and life expectancy of these groups, regardless of their health status. Exercise-induced reactions alter several immune system components, both acutely and chronically. Moderate-intensity exercise may increase cellular immune parameters, lowering the risk of infection, whereas high-intensity exercise may cause these parameters to drop, increasing the risk of infectious diseases. The World Health Organization (WHO) officially proclaimed a pandemic on March 11, 2020, due to the novel coronavirus (SARS-CoV-2), which was discovered in December 2019 after sequencing clinical samples from a group of patients in Wuhan, China, who had pneumonia-like symptoms.[1] This new coronavirus (nCoV-2019) was assigned to the genus Beta coronavirus by phylogenetic analysis, which also includes SARS-CoV and MERS-CoV, and so the name SARS-CoV2 was coined.[2] It's worth noting that the SARS-CoV-2-caused sickness is now known as 'coronavirus disease-2019,' or simply COVID-19.[2]

Social isolation and/or social distance are among the guidelines that must be implemented by governments globally (with exclusions) in order to prevent the spread of SARS-CoV-2.[3] Currently, there is no question that the quarantine time is critical in controlling the rapid spread of viral illness. The sudden onset of a quarantine period, on the other hand, not only implies a rapid change in people's lifestyles, but it can also have an impact on the health of these isolated people, as it favors impairment in dietary habits, changes in psychosocial behavior, and

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reduced levels of physical activity in people of all ages.[4-6] In this regard, it's worth noting that one of the most affected habits during the recent quarantine was those related to regular exercise.

The scientific literature agrees that keeping an active lifestyle while supplementing with regular physical exercise benefits people of all ages. Because the regular physical exercise is so intimately linked to the formation of a population's favorable health state, it's critical to specify some key points about how folks should use it. In this respect, whereas a single bout of exercise is referred to as acute exercise, repeated bouts of exercise over a period of time are referred to as regular physical exercise, exercise training, or chronic exercise. Furthermore, the advantages of regular physical exercises are depending on exercise intensity, which is characterized as low [40%of maximal oxygen uptake capacity (VO_2max)], moderate (40-69% VO_2max), vigorous, or high (70-90 % VO_2max), extremely high intensity (above 90 % VO_2max).

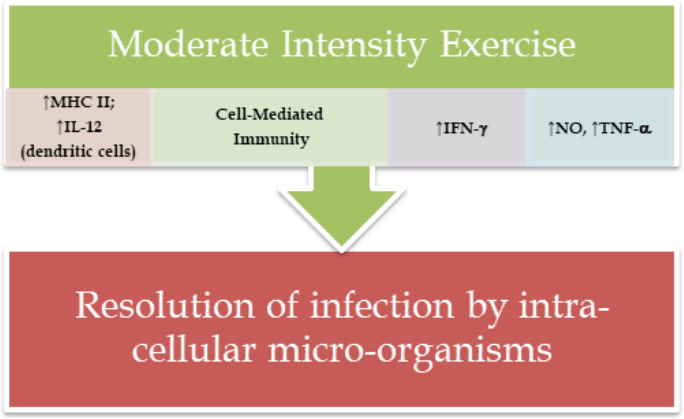

Figure 1: Effect of moderate exercise on immune response.

EFFECT OF EXERCISE ON CYTOKINE PRODUCTION

Exercise has shown to activate various bodily responses in acute phase of the exercise or during regular exercise (Table 1). A variety of factors can influence cytokine production, including hormonal stress, oxidative damage, and strenuous exercise. The first study to imply that physical exercise increased cytokine plasma concentrations was reported in 1983, and it showed that intra-peritoneal injecting plasma from humans after exercise practice into rats resulted in a rise in the rectal temperature of those animals.[7] A 60% change in the plasma concentration of IL-1ra was observed immediately after a performance of moderate intensity exercise (MIE) (1 hr of treadmill running, 60% VO_2max), while downhill running (DR) (45 min [–10 % of gradient], % VO_2max) promoted a 100 increase in the concentration, and a high-intensity run (HIR) (1 hr of treadmill running, 80% of total VO_2max) promoted a percentage increase in the concentration. These values were 1.3 times greater than the pre-exercise plasma concentration in the MIE, 2.4 times higher in the DR, and five times higher in the HIE one hour after the completion of the physical activity. The concentration of IL-10 increased only after the HIE (6.3 times) and one hour after this activity (seven times), whereas the two other types of training, MIE and DR, remained unaltered. IL-12p40 plasma levels were 30% higher immediately after performing HIE, whereas 1 hr after performing the three types of exercise, IL-12p40 plasma levels increased only 10% in the MIE, 15% in the DR, and 25% in HIE.[1]

Increases in anti-inflammatory cytokines produced during exercise may help to limit the post-inflammatory reactions that occur as a result of the exercise-induced damage to the skeletal musculature, as well as inhibit the production of pro-inflammatory cytokines linked to the development of pathological conditions like type 2 diabetes, cardiovascular disease, and metabolic syndrome. A modest systemic inflammatory response was elicited by moderate-intensity resistance exercises, which was characterized, at least in part, by elevations in blood levels of inflammatory cytokines such as IL-1 and TNF-α. The regular production of muscle-derived anti-inflammatory cytokines (IL-6, IL-7, IL-10, IL-15), along with the suppression of pro-inflammatory cytokines (IL-1, IL-18, TNF-α), is thought to play a key role in the immune-boosting benefits of exercise. In general, moderate-intensity exercise protects against infections caused by intracellular bacteria by directing the immune response towards (Type-1 Helper T-cells) Th1 cell predominance (Figure 1).[8] High-intensity activities, on the other hand, generate a rise in anti-inflammatory cytokines type-2 Helper T-cells (Th2 pattern), apparently to reduce damage to muscle tissue caused by inflammation, albeit it may also increase susceptibility to infections.

Table 1: Changes in various markers in response to exercise.

Response observed in Acute exercise	Response observed in Regular exercise
↑ NK cell activity	↑ T-cell proliferative capacity
↑ Circulating neutrophils	↑ Neutrophil phagocytic activity
↑ Intramuscular creatine kinase	↑ NK cell cytotoxic activity
↑ Mobilization of hemopoetic stem cell from bone marrow	↑ Physiological balance of MCV, MCH and MCHC
↑ Circulating antibodies	Maintenance of circulating leucocytes, lymphocytes, platelets and hematocrits
↑ Sex steroids hormones	↓ pro-inflammatory cytokines circulation (TNF-α ; CRP; IL-6)

EXERCISE TO HANDLE AND ALLEVIATE PHYSICAL CONDITIONS

COVID-19 causes a wide range of diseases and symptoms. Most infections are asymptomatic or oligosymptomatic, as has been recognized. COVID-19 transmission by infected, asymptomatic persons has been recorded since the outbreak's early offering significant COVID-19 containment issues.[9] During COVID-19 lockdown/confinement scenarios, exercise has been shown to prevent institutionalized older persons from functional decline.[10,11] Strength training improves both morphological (increasing the number of sarcomeres in parallel, increasing the synthesis of contractile assemblies of actin and myosin, and changing the composition of muscle fibers) and neural (improving neurological system and inter-muscular coordination) factors, as well as regulating the whole body metabolism.[11] Exercise has the potential to behave as a psychoactive substance. Regular exercise has been shown to improve quality of life by reducing psychological stress, managing mood and associated diseases (depression and anxiety), and altering pain perception.[4] Exercise changes the structure and function of the brain, promoting a better neurological phenotype. Exercise triggers neurogenesis and synaptogenesis, especially in the dentate gyrus of the hippocampus, which enhances brain plasticity and prevents cognitive impairment, mostly through contraction-induced myokine release and brain-derived neurotrophic factor (BDNF).[4]

Individualized and focused exercise is highly suggested as a non-pharmaceutical technique for treating persistent pain, muscle weakness, physical restrictions, weariness, and a low tolerance to activity.[12]

Strength training and multicomponent exercise programmes have also been shown to be safe and beneficial in the short and long term in reversing frailty and weakness and restoring functional ability in affected individuals.

CONCLUSION

The COVID-19 epidemic is still running strong, wreaking havoc on physical activity related habits and sedentary lifestyles around the world and creating serious issues for everyone. Physical activity does have a good impact on mental health and shields people from depression and anxiety by causing biochemical and biophysical changes in the brain that can improve their mood. Physical activity should be beneficial to one's health on a regular basis; nevertheless, characteristics like as volume and intensity must be considered for the suggested programmes to achieve the greatest outcomes. New research suggestions in the various stages of the disease are needed, as are all attempts to permit a complete functional recovery and a return to a prior life.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

MIE: Moderate Intensity Exercise; **HIR:** High Intensity Run; **BDNF:** Brain Derived Neurotrophic Factor.

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