

Physical Exercises: Immune System Booster During the COVID-19 Pandemic

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ABSTRACT

COVID-19 pandemic has spread throughout the world and has become the main cause of health problems and global threats. To assist limiting the spread of the disease, many people throughout the world are being asked to stay at home and avoid interaction with other people. Places where people regularly exercise, such as fitness centers and parks, may have been temporarily closed as well. It significantly reduces physical activity, which also reduces physical fitness. The purpose of this review article is to oversee, whether if sufficient amount of physical exercises are necessary to prevent certain diseases, and to boost the overall immune system, especially against the now famous COVID-19 virus. This paper will assess a variety of exercises that are possible to do at home without the help of any special equipments. Physical exercises in this context are acting as modulators of the immune system. Literature researches were collected by using an online through website such as Science Direct, Springer Link, NCBI, Frontiers, Sage Journals, and MDPI. Literatures which is used in this study were published from 2019 to 2021. From those various literatures, it is discovered that regular endurance exercises has been proven to increase proliferation of lymphocytes, by enhancing T and B lymphocytes proliferative response, enhancing macrophage, and cytotoxic cell and increasing production of IL-2 and T cell subsets.

Keywords: *Physical Exercise; Physical Fitness; Immune System; COVID-19; SARS-CoV-2*

1. INTRODUCTION

In late 2019, the world was shaken by the pandemic, which was caused by a virus, later known as COVID-19. The causative virus was initially known as "novel coronavirus 2019" (2019-nCoV) by the WHO, but it was later renamed "severe acute respiratory syndrome coronavirus 2" (SARS-CoV-2) by the international committee of the Coronavirus Study Group (CSG), and the disease was dubbed "coronavirus disease 2019" (COVID-19) by WHO [10]. COVID-19 pandemic has spread throughout the world and has become the main cause of health problems and global threats. According to Wu, Chen, Chan [1] it happened in the Huanan Seafood Wholesale Market in Wuhan, Hubei, China. The first outbreak was observed in the market in December 2019, affecting roughly 66% of the workers [1]. COVID-19 harms the human body by attacking the respiratory system and the immune system, worsening physical conditions and eventually leading to systemic failure, which can lead to death [2]. Infection of COVID-

19 is transmitted often directly by large droplets when

sneezing or coughing through the mucous membranes of the eyes, mouth, and nose, which contain virus particles [3] [10] [12]. Droplets typically cannot traverse more than six feet (almost two meters) and remain in the air for a limited time. However, COVID-19 remains intact and contagious in droplets (less than five microns in diameter) and can be suspended in the air for up to three hours [10]. Besides that, infection of COVID-19 is transmitted not only by symptomatic patients but also asymptomatic patients i.e. patients who have not showed any signs of symptoms, and also by indirect contact through contaminated objects and airborne contagion [3] [10] [12].

According to Suciliyana and Widyastuti [2] and Kaur, Singh, Arya, and Mittal [16], strong immune system is a good defense against COVID-19. The immune system organs such as tonsils and adenoids, lymph nodes and lymphatic veins, thymus, spleen, peyer's patches, and bone marrow protect the body against diseases [8]. The immune system is the greatest line of protection because it promotes the body's natural ability to defend against pathogens, resists, and preventing infections from the new coronavirus and the likely advancement to a severe stage [4] [8]. It also guards against dangerous substances, pathogens (e.g. viruses, bacteria, protozoan, and fungi), and cell mutations (neoplasm) as long

as the immune system is functioning normally [8].

The immune system is separated into two sections. The first one is innate or non-specific immunity, which is the main line of defense. The second one is acquired or adaptive or specific immunity, which, when engaged, produces a reaction and immunological memory to each pathogen [9]. Skin, mucous membranes, special chemical mediators (e.g., complement and interferon) as well as specialized cells (e.g. natural killer cells and phagocyte cells) comprise the innate immune system [9]. The body can create a learning immune response called adaptive (or acquired) immunity if the innate system fails effectively to combat an invading pathogens.

Lymphocytes are the major cells that participate in acquired immunity. Two lymphocytes are present: lymphocytes B and T, which are capable of secreting antibodies and cytokines to regulate the immune response. B lymphocytes and T lymphocytes have different functions [9][14]. B cells can convert into plasmocytes and are responsible for producing antibody (Abs), which in turn, is in charge of destroying invading viruses or bacteria, while T cells attack foreign invaders directly and also produce cytokines, which are biological substances that help other sections of the immune system to activate [9][15].

2. METHOD

Literatures which the authors have used to make this literature review were collected online through databases such as Science Direct, Springer Link, NCBI, Frontiers, Sage Journals, PubMed, Google Scholae, and MDPI. Literatures which were used in this study were published from 2008 to 2021 using keywords “Physical Exercise”, “Immune System”, “Immune Response”, and “COVID-19”. From those keywords, only 26 articles were used by the author. Articles written in English were the only ones which were taken into consideration.

3. RESULTS AND DISCUSSION

Keeping fit and active is an important part of living a healthy lifestyle. Physical activity can have a profound effect on the immune system. Studies have shown that the intensity, frequency, duration, and type of exercise affect the immunological response [19]. According to Nielsen [6], physical activity largely activates the immune system and strengthens protection against infection. There is an evidence, in which untrained people who start exercising on a regular basis, develop a progressively stronger immune system and become less susceptible to infections [9]. It is because regular physical exercise reduces inflammatory reactions and stress hormones while increasing immunity cell, such as lymphocytes, NK cells, immature B cells, and monocytes [14].

Mohamed and Alawna [21] stated that physical exercise can boost the body's immunity by increasing the stage and characteristics of T-lymphocytes, neutrophils,

macrophages, and monocytes, which are important components in the body's defense against infection, as well as increasing levels of immunoglobulins, particularly IgA and IgG, which are important in fighting lung infections. Furthermore, through C-reactive protein regulation, short-term small increases to fight long-term lung viruses, decrease in C-reactive protein to prevent decreased lung function properly through reducing anxiety and depression to increase immunity by rebalancing the relationship T-helper 1 or T-helper 2 [21]. Prompetchara, Ketloy, and Palaga [22]'s analysis proved that the TH1 response is critical for effective control of SARS-CoV and MERS-CoV, as well as SARS-CoV-2 and the same was also stated by 23 [22, 23]. 23 also stated that Strong T cell responses are linked to greater levels of neutralizing antibodies, which prevent the virus from infecting healthy host cells and protect the host from re-infection. [23]

According to the intensity of the activity, it may be categorized into three types [24].

- Light exercise: exercise that is not strenuous and doesn't cause you to sweat.
- Moderate exercise: after doing the activity for around 10 minutes, it increases your heart rate, makes you breathe faster, and makes you feel warm enough to start sweating. Deeper and more frequent breathing occurs.
- Vigorous exercise: causes you to breathe heavily, raises your heart rate significantly, and makes you hot enough to sweat abundantly after 3-5 minutes. Breathing is deep and quick.

In order to boost the immune system, it is vital to engage in regular physical activity of moderate intensity [2]. From the review of the various literatures, it is thought that exercise in a moderate intensity may aid immune function in resolving viral-induced respiratory infections, such as those caused by coronavirus, by stimulating the release of stress hormones (catecholamines and glucocorticoids) that reduce excessive local inflammation within the respiratory tract, and promote a shift from a T helper type 1 (Th1) cell to a T helper type 2 (Th2) cell through secreting the anti-inflammatory cytokines such as interleukin-4 (IL-4) and interleukin-10 (IL-10) [6].

Besides the T cells, the alterations in leukocyte counts in circulating blood are one of the most studied components of exercise and the immune system. The most significant alterations occur in the number of granulocytes (mainly neutrophils). The main sources of circulatory neutrophils during exercise are bone marrow, spleen, lymph nodes, and intestinal tract as well as marginalized neutrophils from the peripheral vein endothelial wall [9].

The following simple exercises are simple to implement, possible to do at home without the help of any special equipments, yet extremely useful for strengthening the immune system during the COVID-19 pandemic.

Stair Climbing

According to Fauzi, Suherman, Safari, and Saptani [20], stair climbing is a simple workout in which you up and down the stair for 10 minutes, followed by 2-3 minutes of resting. Repeat the exercise three times more. Depending on one's skills, the duration of the exercise and the number of repetitions can be raised. There are many possible variations which can be made from this exercise, such as walking sideways up and down the stair, climbing up and down the stair on tiptoe, and climbing up and down the stairs passing two steps at a time [20].

Jumping Jack

According to Baharuddin, Shanmugam, and Choo [25], jumping jacks involves jumping to a posture with legs spread wide and hands contacting overhead, often in clapping motions, and then returning to the starting position with the feet together and arms at your sides. According to Fauzi, Suherman, Safari, and Saptani [20], physical activity is an exercise to strengthen leg muscles, improve coordination, and enhance cardiovascular capabilities. This exercise does not require any equipment. Repeat the movement until 3- 5 sets each exercise [20].

Push up

According to Fauzi, Suherman, Safari, and Saptani [20], if you want to improve your upper body, push ups are the perfect workout [20]. The push-up has long been advocated as a method of assessing upper-body local muscle endurance [13]. Regularly performing this exercise on a daily basis can develop your chest muscles and make you more fit. Repeat the movement 15-20 times for a set, and each exercise should have 4-5 sets [20].

Sit Up

According to Fauzi, Suherman, Safari, and Saptani [20], sitting up is a great workout for strengthening and tightening abdominal muscles. To do sit up, legs should be bent at a 90-degree angle with knees up to promote mobility. During the sit-ups, keep the arms in a comfortable posture, generally beside the ears, crossed over the chest, or held behind the neck. Do the action from lying on your back to sitting up 15-20 times for a round of sit up exercises. Repeat the set 3-5 times in each exercise, taking a 2-minute pause between sets [20].

Plank

According to Fauzi, Suherman, Safari, and Saptani [20], this workout entails holding a plank position for a set amount of time. To perform a plank exercise, place both arms, including the elbows, on the floor. The rest of the body is positioned as though performing a push-up activity. The goal of this exercise is to keep this position. To execute plank exercise, as previously stated, get into a push-up position but bend your elbows at a 90-degree angle so that your arms form a 'L' shape relative to your body [20]. Both forearms remained in contact with the ground, while the hands were made into fists and the elbows were kept 30 cm apart [26]. Hold this position for 20-60 seconds, depending

on your abilities. Each time, repeat the exercise 3-5 times [20]

Lunge

According to Fauzi, Suherman, Safari, and Saptani [20], Exercises that entail a long lunge or lunge leap involve bending the knee of the leg that is walking in order to support the body's weight. In order to maintain balance, the opposite leg is likewise bowed. Stand on one leg and repeat the action with the other leg for a few seconds (the striding leg is now put behind the body and the other leg is now striding). Perform 10-15 lunges on each side. Every time you complete this exercise, do 3-5 sets [20].

Squat

Squats are an excellent workout for strengthening the lower body and core muscles. Regularly performing this exercise will strengthen your thighs and buttocks while also improving intestinal circulation. To do squat, starting from a straight position, press the buttocks backwards before lowering the body. The body should be kept straight during the activity, and the eyes should always be looking forward. Repeat the movement 15-20 times for a set, and each exercise should have 3-5 sets with a 2-minute break in between [20].

According to Wedig, Duelge, and Elmer [1] and also Elmagd [24], regular moderate-intensity physical exercise helps treat and prevent chronic illnesses and "diseases of affluence" e.g. cardiovascular, type 2 diabetes, and obesity. In addition, it may help stimulate the immune system, avoid stress and depression, enhance sleep quality, and treat ailments such as insomnia without the need of pharmaceuticals. It may also help create or maintain positive self-esteem and improve mental health (Figure 1) [7][24]. Regular exercise, according to Elmagd [24], strengthens the heart and improves lung fitness, allowing the cardiovascular system to transport more oxygen to the body with each beating and the pulmonary system to increase the maximum quantity of oxygen that the lungs can take in [24].

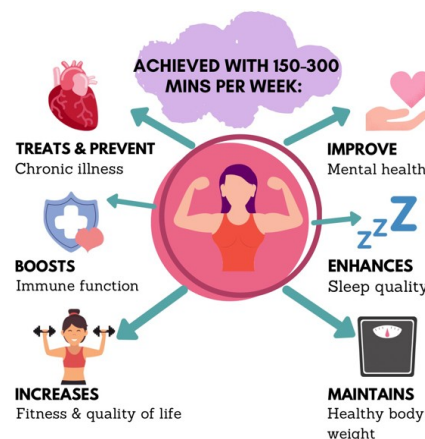


Figure 1. Benefits of doing exercise. *Source:* Wedig, Duelge, and Elmer (2020) [7].

Regular moderate-intensity exercise has already been linked to a lower risk of respiratory infections as compared to sedentary (Figure 2). Extensive physical routines, on the other hand, before or during an infectious disease, such as influenza or COVID-19, can cause severe sickness owing to immune system alterations [14]. According to the conventional WHO recommendations, people should engage in 150 minutes per week (at a moderate effort) or 75 minutes (at a vigorous intensity) of physical activity, as well as two sessions per week of muscle strength training [4][11]. According to Elmagd [24], people should engage in 30-60 minutes of moderate-intensity activity five times a week, 20-60 minutes of vigorous-intensity exercise three times a week, or a mix of the two. It is also permissible to combine one continuous session with many shorter sessions (at least 10 minutes). Nevertheless, prolonged or high-intensity physical exercise without rest might cause a decline in cellular immunity[5][19].

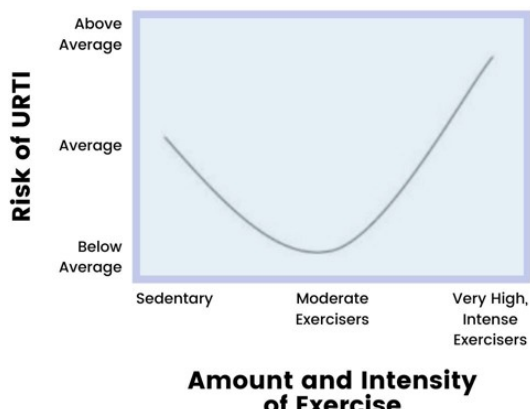


Figure 2. “J-shape” model. The effect of exercise on the risk of respiratory tract infections. *Source:* Martin, Pence, and Woods (2009) [18].

4. CONCLUSION

Strong immune system is a good defense against COVID-19. There are many ways to keep the body in good health without the need of expensive equipments. Regular physical exercise in moderate intensity can boost the body's immunity by increasing the important components in the body's defense against infection. By doing the exercises which have been mentioned above, it is likely that our overall health is kept at its peak.

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