Physiological Effects of Covid-19 and Exercise

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The world has been severely challenged by the Coronavirus Disease (COVID-19 (https://www.who.int/health-topics/coronavirus#tab=tab_1)) outbreak since the early 2020s. Worldwide, there have been more than 66 million cases of infection and over 3,880,450 million deaths caused by this highly contagious disease. All sections of the population including those who are affected, who are not affected and those who have recovered from this disease are suffering physiologically. Physiological effects of COVID-19 may be managed by exercise management as a prevention strategy. Moderate exercise including walking, yoga, and tai-chi to name but a few exercise regimes are critical in preventing COVID-19 and its complications.

Keywords: COVID-19 ; coronavirus disease ; physiological effects ; exercise

1. Physiological Effects of COVID-19

The pandemic has caused physiological complications mostly in elderly populations including (age ≥ 60 years) the obese and overweight people with body mass indexes (BMI) over 25 kg/m^2 or even higher, these individuals contribute to increased risk of infection scores for COVID-19. According to our previous review we have demonstrated that more than 50% of the population with obesity and/or overweight were admitted for critical care and had high mortality [1]. The condition of obesity refers to excess body fat, low-grade chronic inflammation and impaired immunity that is associated with many debilitating and life-threatening diseases. The list includes respiratory dysfunction, cardiovascular disease, diabetes, some cancers, metabolic risk and co-morbidities, some of which have been linked to more severe COVID-19 infections [2]. Additionally, inactivity has now been identified as one of the biggest COVID-19 risk factors. Researchers studied 48,440 adults (a cross-section of the racially diverse Southern California population with an average age of 47 years) between 1 January and 21 October 2020 who were tested positive for COVID-19. The data showed that 6.4 percent of participants were consistently active while 14.4 percent were consistently inactive. Surprisingly, 79.2 percent of respondents were inconsistent exercisers. Study results found that a person who is consistently inactive has higher risk levels for COVID-19 complications. Their risk is comparable to that of people over the age of 60 and those who have undergone organ transplantation. Hospitalization rates for inactive people were twice as high as those for consistently active people. Additionally, these individuals have a 1.73 times greater chance of needing care in the intensive care unit (ICU) and a 2.49 times greater chance of dying from COVID-19 [3]. Narrowing down to the molecular level, Angiotensin-converting enzyme 2(ACE2) has been identified as a receptor for COVID-19 entry. ACE2 appears to be a receptor for COVID-19, and obesity may increase ACE2 expression in lung epithelial cells. Clearly, the more adipocytes present, the more ACE2 receptors there are to spread the virus. Additionally, COVID-19 exhibits hyperactive inflammatory responses. The immune system produces pro-inflammatory cytokines Interleukins (IL-6, IL-1β, IL-2, IL-15, IL-10, IL-13) and tumor necrosis factor- alpha (TNF-alpha) in response to an infection. When a virus attacks the immune system, it damages the parenchyma of the lungs and the bronchi and triggers respiratory discomfort resulting in adverse respiratory disorders. Further, it becomes serious enough to require medication [4][5][6]. Research also suggests that increased levels of IL-15 and a high T-helper 2 response are associated with a fatal outcome related to COVID-19 [6]. Research has established a significant reduction of %T helper 1 cells and %T helper 17 cells with higher activated %T helper 2 cells in COVID-19 patients compared with controls. Senescent T helper 2 cell percentage was observed to be an independent risk factor for death [6].

2. Exercise Benefits related to the Physiological Effects of COVID-19

There are multiple advantages of exercise in relation to human health [1]. These include decreased adipose tissue, improved cardio-respiratory fitness (CRF) and enhancement of metabolic homeostasis and even suppression of inflammation. The most effective way to lose weight is to increase daily energy expenditure through exercise or physical

activity. Exercise, in particular, accelerates the breakdown of glycogen in the muscles and the liver; this results in the breakdown of fat in adipose tissue and muscle; and facilitates the oxidation of fatty acids in the muscles [7]. A higher CRF corresponds to a lower accumulation of visceral adipose tissue (overweight and obesity) [8]. In addition, exercise improves oxygen delivery and uptake in exercising muscles. In studies involving subjects with a low baseline CRF, exercise interventions using different modalities (aerobic and resistance) at moderate intensities significantly improved CRF in overweight, obese middle-aged women and men [9]. In contrast, during physical inactivity, metabolic homeostasis is disrupted, leading to insulin resistance, reduced lipid clearance post-prandially, muscle decline and an increase in visceral adiposity [10]. Moreover, chronic systemic inflammation resulting from metabolic disruption has been linked to persistent physical inactivity [11]. Hence, increased exercise would help prevent metabolic derangements. It has been found that moderate-intensity exercise of at least 150 min per week can lower the prevalence of metabolic syndrome [7]). Additionally, it has been observed in previous studies that inflammation and exercise have a negative relationship. Infection leads to the overproduction of pro-inflammatory cytokines such as interleukins (IL-6, IL-2, IL15 etc.) and TNF-alpha [12]. On the other hand, individuals who perform more frequent and intense physical activity have lower levels of inflammatory biomarkers (IL-6, IL-1β, and TNF-alpha). Through its unique cytokine and hormonal effects, exercise intensity may affect T helper 1/T helper 2 cell balance. Exercises such as walking, tai chi and restorative yoga stimulate the T helper 1 response [13][14][15][16], while more intense workouts and longer durations stimulate T helper 2. Cortisol is lowered by low-intensity exercise and relaxing activities, while it is raised by high-intensity exercise and long-duration workouts. There has been evidence that cortisol increases the development of T helper 2 cells and decreases that of T helper 1. Exercise may also push the body toward a more T helper 2 dominated state (as muscle-derived IL-6 behaves differently from TNF-alpha-associated IL-6) and associated IL-10. Muscle-derived IL-6 and associated IL-10 are anti-inflammatory [3] and enhances the body's immune response. However, low- to medium-intensity high-volume resistive exercise, that is easily implemented at home, will have positive effects, particularly if combined with a 15–25% reduction in daily energy intake. The combination of these regimens seems ideal for preserving neuromuscular, metabolic, and cardiovascular health [3]. Furthermore, individuals have been advised to perform 150 min of moderate intensity exercise per week initially to obtain the necessary amount of exercise. This exercise intensity seems favorable in modifying the effects of COVID-19. A larger amount of exercise should be followed for significant weight loss and to prevent weight gain. Generally, 11,000 steps per day with 64–170 steps/minute and at least 10 min duration is sufficient for healthy adults [1].

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