

Does exercise have healing and preventive roles in COVID-19 pandemic?

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Abstract

The COVID-19 pandemic caused by the SARS-CoV-2 virus, which occurred in Wuhan in China on December 31, 2019, spread rapidly to 6 continents and hundreds of countries. Scientists continue to work on effective treatment protocols and vaccine development to stop the spread of this pandemic. Currently, anti-virus strategies are as important as treatment methods. It is known that physical exercise is one of the pillars of a healthy life and reduces the risk of developing non-infectious diseases which endanger the immune system significantly. Besides, regular moderate intensity exercise has preventive effects against cardiovascular diseases, respiratory tract infections, obesity, and diabetes. In this review, we aimed to discuss whether physical activity has a protective effect and present new information to ameliorate the wellbeing of individuals during the pandemic, so they are less affected by COVID-19. From this point of view, experimental and clinical studies on this subject were analyzed. Literature reviews showed that maintaining physical exercise during the COVID-19 outbreak is crucial for the recovery of patients with obesity, lung, and heart diseases. However, it can be said that asymptomatic young and middle-aged individuals with positive COVID-19 tests can overcome the disease more easily and in a shorter time.

Keywords: COVID-19, Exercise, Pandemic

Introduction

Coronavirus (COVID-19) was detected in Wuhan, China in December 2019 [1]. By 23 March 2020, it had become a pandemic with more than 353,000 cases, 15,000 deaths, and 100,000 cases confirmed [2]. By 23 May 2020, there were 5 million 14 thousand cases worldwide, and 328.462 had perished. The number of individuals recovering has exceeded 2 million [3]. Turkey was also affected by the pandemic. As of 15.06.2020, the total number of cases is 179.831, the number of deaths is 4.825 and the number of recovered patients is 152.364. According to these official figures, the infection spread to Turkey later than the other countries [4]. Effective treatments implemented by specialists and healthcare personnel in the pandemic hospitals and intensive care units with adequate respiratory support equipment have enabled the outbreak to be controlled in our country. Countries have implemented serious isolation measures to prevent the COVID-19 outbreak, which dragged people into a sedentary lifestyle. Anxiety, depressed mood, and boredom make it worse [5]. People can perform physical activity and exercise by maintaining social distance at home or outside to reduce the negative effects of isolation, maintain general health and weight control, prevent chronic illnesses from worsening and eliminate the risk of infection [6].

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COVID-19 infection

Etiology

Coronaviruses (CoV), a large family which can cause disease in humans and animals, are non-segmented positive-sense, single-stranded ribonucleic acid (RNA) viruses which encompass the Orthocoronavirinae subfamily. They have 4 main genera: α (Alpha), β (Beta), γ (Gamma) and δ (Delta). While γ and δ strains infect birds, α and β strains infect mammals and cause respiratory infections in humans and enteritis in animals [1].

In addition to the 6 types of human coronaviruses (HCoV) known to date, the first complete genome of the new genus of coronavirus was identified in bronchoalveolar lavage samples from the first cases of pneumonia observed in Wuhan in addition to three different strains. This isolated new type of coronavirus is the seventh member of the family. The International Committee on Taxonomy of Viruses group recommended that this virus be called Serious Acute Respiratory Distress Syndrome Coronavirus-2 (SARS-CoV-2) [7,8].

Epidemiology

The COVID-19 outbreak caused by the SARS-CoV-2 virus, which occurred in Wuhan, China on December 31, 2019, spread rapidly to 6 continents and hundreds of countries [9]. It was declared as an international public health emergency by the World Health Organization on 30 January 2020. As of January 6, 2021, the total number of COVID 19 cases is 84 474 195, and the total number of deaths is 1 848 704 worldwide [3]. In Turkey, the first case was diagnosed on March 11, 2020. By 29.12.2020, the total number of cases had reached 2.178.580, the number of deaths had reached 20.388 and 2.058.437 individuals had healed [4]. Currently, prevention strategies are at least as important as treatment methods.

Mode of transmission

Although published studies show that various animal species such as pangolin, bat, snake, and turtle may be intermediate hosts in infection, the zoonotic source of SARS-CoV-2 is not known for certain [11]. It is thought that the onset is zoonotic, however, human to human transmission occurs via coughing, sneezing, or speaking. The incubation time of the disease is not yet fully elucidated. Although symptoms often appear within 5 days of virus exposure, the World Health Organization published its status report on February 19, confirming that the average incubation period was extended to 14 days [12]. There are plenty of unknowns in terms of the COVID-19 pandemic.

Clinical

Disease spectrum caused by a coronavirus in humans can range from simple common cold to severe acute respiratory syndrome. It does not have a specific clinical feature that can safely differentiate COVID-19 from other viral respiratory infections. COVID-19 tends to cause more severe disease in the elderly with underlying medical problems. The Epidemiology Working Group of the Center for Disease Control and Prevention in China reported that 81% of patients mildly suffered from the disease (none or non-serious pneumonia), 14% were moderately affected (hypoxia, oxygen saturation $<93\%$ or lung involvement in over 50% of sections as detected by imaging within 24-48 hours), and 5% had severe disease (acute respiratory failure, septic

shock, multiple organ failure). In all cases, the mortality rate ranged between 2.3% and 5% [13]. In a study on 1099 patients with COVID-19 pneumonia in Wuhan, the most common clinical features observed at the beginning of the disease are in order of frequency are fever (88%), dry cough (67%), fatigue (38%), dyspnea (18.7%), and myalgia (14.9%) [14]. The severity of the disease and its mortality are associated with concomitant cardiovascular diseases, diabetes, hypertension, chronic lung, and kidney disease, and cancers [15]. According to the data in China, the mortality rate was 10.5% in patients with cardiovascular disease, 7.3% in those with diabetes, 6.3% in chronic respiratory failure patients, 6.0% in those with hypertension, and 5.6% in patients with malignancy [16]. Among 355 patients who died due to COVID-19 in Italy, the presence of chronic disease was emphasized as the underlying cause in all cases, except for 3 [17].

The effect of physical exercise on immunity

The effects of exercise on immune functions depends on many variables such as the type of exercise, intensity, severity, duration, and physical fitness level of the individual [18]. Generally, the total leukocyte count increases by 50 percent to 100 percent immediately after a high-intensity exercise. Neutrophils and lymphocytes are the main sources of this increase. When the lymphocyte subgroups are analyzed in detail, it is seen that the natural killer (NK) cells are the most responsive to exercise. While it also increases T8 cells, T4 and B cells are not affected [19]. Physical stress induced by exercise also increases blood concentrations of various stress hormones such as adrenaline, noradrenaline, growth hormone, beta-endorphins, cytokines, and cortisol. These increased levels of hormones take part in the regulation of the exercise-induced immune system. Also, physiological factors such as body temperature, oxygen desaturation, metabolic factors such as glutamine, glucose, and free fatty acid levels play an important role in the effects of exercise on the immune system [20]. It seems more appropriate for those who exercise for a healthy life to choose moderate and stressless exercise types.

Can physical exercise prevent the risk of developing COVID-19?

There is no scientific data to examine the effects of exercise on COVID-19. However, physical exercise is one of the pillars of a healthy life, and therefore the primary component of wellness medicine [21]. It has been shown to significantly reduce the risk excess body mass and non-communicable diseases known to cause systemic inflammation and jeopardize immune function [22]. A study on the 1997 Hong Kong flu pandemic showed that patients who regularly perform low and moderate intensity exercises have a significantly lower risk of mortality than patients who do not [23]. According to Ahmed (2020), studies on rodents show that moderate physical exercise reduces susceptibility to respiratory infections and improves antiviral lymphocyte function [24]. Nieman and Wentz (2019) state that the immune system is very sensitive to the duration, intensity, and content of the exercise [25]. Moderate exercises reduce the duration, severity, and incidence of upper respiratory infections [26]. Several epidemiological studies suggest that regular physical exercise causes a decrease in the incidence and mortality of influenza and pneumonia [27]. Studies report that regular participation in moderate and high-intensity physical exercise reduces acute upper

respiratory tract infection by 28% [28, 29]. Significant reductions in the risk of mortality attributed to upper respiratory tract disease, lower respiratory tract disease, and aspiration pneumonia have been reported in athletes, including diabetes mellitus [30]. In the face of this new coronavirus epidemic, the World Health Organization (WHO), Centers for Disease Control and Prevention (CDCP), and other public health advisory organizations (ACSM, AHA) recommend engaging in regular physical activity to maintain physical and mental health and well-being. The health organizations mentioned above state that 150 minutes of moderate-intensity exercises per week can provide a protective effect against viral infections [25-30]. From this point of view, according to exercise scientists, the optimal exercise intensity, frequency, duration, volume, type, and intensity need to be determined.

What should be the exercise model?

During this pandemic, a combined exercise model should be preferred covering basic motor features such as endurance, strength, balance, coordination, and mobility [31, 32]. A 5-day exercise model should aim to preserve strength on 2 days, endurance on 2 days, and balance-coordination on 1 day.

How to determine the intensity of exercise and what should be?

Exercise intensity is determined by how close the heart rate is to the target value, which is best assessed using the maximal heart rate or Karvonen method, as follows:

$$\text{Maximum Heart Rate} = 220 - \text{age}$$

Target Heart Rate = % (Maximum Heart Rate – Resting Heart Rate) + Resting Heart Rate, in which % depends on the intensity of exercise. Exercise intensity can also be determined with tests that measure the maximal oxygen consumption capacity (maxVO₂), such as 6 minutes walking test, Cooper test, Treadmill Balke test, and Harvard step test [2, 8].

What should be the frequency and duration of exercise?

The Royal Australian College of General Practitioners reports that 150 minutes of exercise per week, 30 minutes of daily moderate intensity exercise which incorporates 2 days of strength training aids in protecting from chronic diseases [33]. Also, WHO and ACSM state that 150 minutes of moderate-intensity exercise per week can be protective against viral infections [33-35].

Exercise program

In Table 1, an exemplary training program was adapted using the opinions of American Sports Medicine [36]. To avoid injuries and perform high-efficiency exercises, warm-ups should be performed at the beginning of each exercise and cooling, at the end.

Warm-Up Exercises: 10 min walking or jog, 5 min stretching

Cooling Exercises: 5 min walking or jog, 5 min stretching

Table 1: Exercise Program [35]

	Aerobic Exercises	Strength Exercises	Balance and Coordination Exercises
Exercise Frequency	2 days a week	2 days in a week	1 day in a week
Exercise Intensity	Moderate Intensity (KAHmax %40-60)	Initial, Strength exercises using body weight and then with light weights	Static and dynamic stretching exercises for 8-10 seconds
Exercise Type	Endurance exercises that appeal to large muscle groups such as walking, jog, cycling	Exercises that appeal to large muscle groups with their body weight, elastic bands, and light weights (sit-ups, push-ups, squats)	Static and dynamic stretching exercises for large muscle groups in the lower and upper extremities (stretching)
Exercise Duration	2x3 sets 8-10 reps	2x3 sets 8-10 reps	8-10 sec and 2 x 3 sets for each exercise
Exercise Volume	60 minutes of exercise in a week	60 minutes of exercise in a week	30 minutes exercise in a week

Conclusion

Unfortunately, there is currently no standard treatment or vaccine for COVID-19. Therefore, virus prevention strategies should be as important as researching for treatment methods in limiting and preventing the spread of the disease. Maintaining the physical activity levels of individuals during the COVID-19 epidemic will be of great importance for the recovery of patients with additional comorbidities, such as the elderly or obese patients, those with lung and heart diseases, both before and after the infection. Also, it is thought that asymptomatic young and middle-aged people with positive COVID-19 tests can overcome this disease more easily and within a shorter time.

Main Points

- Physical exercise is the mainstay of healthy life, and significantly reduces the development of human non-communicable diseases.
- It is stated that regular moderate intensity exercise has important effects on the prevention of many diseases such as cardiovascular diseases, respiratory tract infections, obesity, and diabetes.
- Maintaining the physical exercise levels of people during the COVID-19 outbreak will be crucial for the recovery of patients with obesity, lung, and heart diseases.
- COVID-19 virus prevention strategies should be at least as important as researching treatment methods in limiting and preventing the spread of the disease.
- Young and middle-aged asymptomatic individuals with positive COVID-19 tests can overcome the disease more easily and in a shorter period

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