

Home Based Physical Exercise for Prevention and Management of COVID-19 Pandemic and for Its Associated Consequences

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Abstract Corona viruses are sort of viruses that are phenotypically and genotypically diverse. The outbreak of COVID-19 starts in December 2019 in Wuhan, China. The research method of this article is a systematic review based on search strategy by used terms in relation with physical activity and Covid-19. The COVID-19 pandemic has forced many people around the world to stay at home and self-isolate for a long period of time. These leads to psychological outcomes such as depression, post-traumatic stress symptoms, panic, confusion, anger, fear, and substance misuse and develops Sedentary Death Syndrome and reduce individuals' functional ability. Increased physical activity levels and fitness help alleviate or relieve Covid-19 associated health problems such as depression, anxiety and stress (mental health) and at this time if an individual follows a physically active lifestyle or participate regularly in home based physical activity, it has been found to be an effective way of improving fitness and overall health of individual. The effect of regular home based exercise training has a significant positive effect on overall health of individuals. Mental and physical well-being are negatively affected by sedentary habits and positively affected by active lifestyle.

Keywords: home-based physical activity, COVID-19, physical inactivity, pandemic, stay at home and regular physical activity

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1. Introduction

Corona viruses are sort of viruses that are phenotypically and genotypically diverse. The outbreak of COVID-19 starts in December 2019 in Wuhan, China. As of 17 March 2020, the widespread human-to-human transmission now had resulted over 20 million people infected. Because the COVID-19 pandemic continues to develop in most countries and various prevention strategies are introduced by the gov't of just about all countries, including the closing of faculties and universities, and bans on travel, cultural and sporting events, and social gatherings [1]. People are ordered or advised to remain reception, and a number of other countries have requested all returning travelers to self-isolate for a fourth-night. Of these actions are considered as an effective measures for preventing the virus spreading and for managing those that do contract the virus. But these actions will negatively affect people's physical activity habits, with longer spent by sitting and watching screens and a subsequent impact on physical health, well-being, sleeping patterns and quality of life. The beneficial effects of normal workout on many health

outcomes are well established [2,3]. Different research has demonstrated specific benefits like improved physical and physiological health parameters and positive health outcomes in areas of psychological state and wellbeing [4,5]. For these reasons, implementing home based physical activity programme during the amount of the pandemic will reduce the negative physiological and psychological state impact of sedentary behaviors. According to the regulations recently set by the Ethiopian government, for instance, it's mandated that each one peoples must remain reception unless required to maneuver for valid reasons, like work, health or for other unavoidable issues like assisting those that are sick or disabled, or purchasing groceries and medications. All sporting activities and competitions are cancelled. However, one important exception has been made to permit people to practice sports and outdoor physical activity, as long as an interpersonal distance of a minimum of 1 m might be maintained. "Sedentary Death Syndrome" If, in fact, quarantine experience increases can cause psychological problems like depression, post-traumatic stress symptoms, panic, confusion, anger, fear, and substance misuse [6], it also can give the thanks to several patho-physiological mechanisms arising from inactivity. Physical inactivity are often defined because the range of situations that, thanks to impossibility of movement

(paralysis) or personal habit (long sitting hours), produce decreased energy expenditure toward basal level [7]. It's important to understand that pathologies or worsening of medical conditions caused by inactivity often show their symptoms and manifestations over the future, and are usually pre-clinically silent. It's estimated that physical inactivity is responsible, worldwide, for between 6% and 10% of non-communicable disease, including, among others, paralysis, strokes, heart diseases, cancers, diabetes, chronic renal disorder, osteoarthritis, osteoporosis, Alzheimer's disease, and Parkinson's disease [8]. Physical inactivity also increases the loss of functional abilities with aging, resulting in decreases in anticipation, with impacts potentially as large as renowned risk factors like smoking and obesity. The term "sedentary death syndrome" was first used to give attention to the present alarming problem, warning about the risks related to the imbalance between calorie intake and output, which may cause hyperinsulinemia and thus adiposity. Overweight, or worse, obesity, are largely related to an increased risk of cardiovascular problems, osteoporosis, osteoarthritis muscle wasting, and overall physical and mental distress [9,10,11].



Figure 1. Mental and physical well-being are negatively affected by sedentary habits and positively affected by active lifestyle

In this context, physical activity doesn't only represent a crucial part of disease prevention but also drugs for inactivity-associated disorders. Physical activity represents a non-pharmacological approach for promoting general health [12].

2. Objectives of the study

- To describe the most effective home-based physical activity during Covid-19 pandemic
- To show the effect of physical activity on Covid-19 pandemic and for its associated consequences

3. Methods

The method of this research is a systematic review research. The review of related literature seeking strategy were used basic terms in relation with physical activity and Covid-19: such as home based physical activity and Covid 19, regular exercise and Covid 19, the effect of physical activity on Covid 19 associated health problems, most effective exercise for Covid 19, physical activity and psychological problems from Google scholar, Scopus, PubMed, Cross-reference, Copernicus, MEDLINE and others.

Search of scientific evidence was conducted in the following bibliographic databases: online research databases, web of knowledge, and science direct, sport discuss, Google scholar, the references of all saved articles and organizations were reviewed for relevant citations.

3.1. Inclusion Criteria

All publications or articles focused in which there were the terms in relation with the effect of physical activity on Covid-19 pandemic and for its associated consequences. Studies based on written in English, between the year 2000 to recent were also included.

3.2. Exclusion Criteria

The criteria such as articles written in other languages rather than English and published before the year 2000.

3.3. Screening of Articles for Eligibility

Based on titles and abstracts, reference the articles were screened for eligibility, i.e. included publications regarding the effect of physical activity on Covid-19. All included articles were read critically and significant information was extracted. From the selected publications, organizations and articles the following data such as year of study, characteristic of analysis, evaluation and results/findings/conclusions were extracted. The electronic databases and the manual search of reference lists identified 125 articles. On the basis of title and abstract, we excluded 32 studies that did not meet inclusion criteria. All information was obtained directly from the articles.

4. Recommendations on Physical Activity

The World Health Organization (WHO) has suggested clear guidelines on the minimal amount of physical activity necessary to take care of health. For instance, it recommend that adults aged between 18 and 64 years, the age bracket most suffering from COVID-19 consistent with recent statistics (i.e. accounting for over 70% of all severe cases), should engage in weekly training of a minimum of 150 min of moderate-intensity physical activity or 75 min of vigorous-intensity physical activity, or a corresponding combination of moderate- and vigorous-intensity activity [13]. Current evidences also support to the benefits of normal physical activity on survival [14,15,16]. Physical Activity and psychological state Obesity and overweight rates among all groups in society, no matter age, sex, race, socioeconomic status, educational level, or geographical area have noticeably increased within the last twenty years [17]. Obesity and overweight aren't just a private matter; it's also public health epidemics that affects education achievement outcomes, economic productivity, state budgets and successively affect students' academic achievement [18,19]. Additionally to disease prevention, studies suggest that physical activity directly benefits cognition and academic achievement. In one study, during which children jogged for thirty minutes two to fourfold per week, researchers measured a rise in activity within the

prefrontal cortex, suggesting greater cognitive function. However, the cognitive gains were only sustained while children maintained the jogging regimen [20,21]. If a private follows a physically active lifestyle, it's been found to be an efficient way of improving fitness and overall health [22]. Conversely, the absence of a physically active lifestyle can adversely affect health and well-being, increasing the danger of somatic health problems like cardiovascular diseases, hypertension, DM, osteoporosis, and a few sorts of cancer [23]. Additionally, regular PA is understood to possess a positive impact on psychological state [24]. variety of meta-analyses of intervention studies of the effect of exercise training have revealed that exercise may have a big moderate to high anti-depressive effect [25,26,27]. In other way if students have poor fitness different problems are appearing additionally to academic achievement problems like apnea, which has been linked to problems with learning and memory, liver problems, orthopedic problems and asthma. If there's apnea problem in children, it can to impair a child's ability to concentrate and stay alert during the day, which could have a negative impact on academic performance [28] also reported, supported their study results, being physically fit reduces the danger of disorder, carcinoma, diabetes, dying prematurely, and obesity. Increased physical activity levels and fitness can improve bone and musculoskeletal function and help alleviate or relieve depression, anxiety and stress (mental health) [28]. Generally the previous research findings from large-scale observational studies indicated that participation in physical activity features a small to moderate effect in prevention and management of the danger of depression and anxiety which successively have effect on academic achievement and psychological state [29-37]. Reductions in physical activity can also affect one's psychological state, which can be experienced as unpleasant emotions like sadness, anger, frustration and /or irritation. During a review on psychological impact of quarantine recently performed by Brooks et al., the authors stated that experiencing disease outbreaks can trigger symptoms of post-traumatic stress, depression and /or confusion among others [38,39,40]. During quarantine, staying active and maintaining a workout routine is going to be essential for mental and physical health. Fortunately, a good range of exercises, like video- or app-guided equipment-free aerobics or strength training, are often performed reception and will be encouraged. We hence encourage national, federal and region al governments round the world to incorporate clear exceptions for physical activity in nationwide lockdowns. These should also leave safe performance of outside physical activities (e.g. walking, running or other individual sports, where an adequate interpersonal distance are often maintained), consistent with [41] are often concluded that workout are often beneficial for the defenses of the entire body and should be counted among preventative measures against the results of tract virus infection, that, on the opposite hand, sedentary habits might be related to increased risk of predisposition to infections.

4.1. Impact of COVID-19 and Physical Inactivity on the Immune System

SARS-CoV-2 may results corona virus disease

(COVID-19) shows the major symptoms of ever, dry cough, myalgia, and fatigue [42,43]. Currently, there are neither vaccines nor clinically proven effective medicines. Convalescent plasma and anti-viral drugs (e.g., Remdesivir) have shown some hopes in treating COVID-19 patients [44], but their widespread use await statistical rigor. Currently the best and only measures to reduce the spread, morbidity and mortality are social distancing and hygiene. As this virus strain is novel to the human immune system, we are dependent on aspects of our innate resistance to deal with the first infection. Like other viral infections, if we resist the infection, over the course of weeks we can develop antibody and cell-mediated immune responses specific to the virus. In most instances, this exposure-related 'training' of our immune systems offers us long-lasting protection from re-infection or, if we are re-infected, disease symptoms are much milder [45].

Physical activity affects the immune system and its anti-viral defenses positively [43,46,47]. Animal experiments administering influenza and herpes simplex viruses 1 (HSV-1) in the respiratory tract, have revealed that moderate exercise, performed before (i.e. training) or after infection (for a few days before symptom onset), improves morbidity and mortality to the infection [48,49,50]. In other way, preclinical studies have also shown that intense exercise leads to poorer outcomes in response to respiratory viral infections [51,52]. Follow-up research findings have concluded on some understanding of the mechanisms responsible for these observations [53-56].

The current epidemiological study has showed that intense, prolonged exercise was correlated with an increase in upper respiratory tract infections [57]. This work leads to the concept of the inverted J theory, where moderate intensity of exercise reduces, and prolonged, high intensity exercise [58] increases susceptibility to infection. Many research findings have supported the theory with respect to individual immune parameters including those specific to viral defense. For example, salivary lactoferrin and its secretion rate increased for up to 2 hours after moderate intensity of physical exercise [59]. Mucosal lactoferrin is very important because it can protect DNA and RNA viruses form infecting cells by binding and blocking host receptors. In other way, low levels or secretion rates of salivary immunoglobulin A, which can bind to viruses and inactivate them, has been shown to be associated with upper respiratory tract infection in some individuals who undergoing intense physical exercise training [44,60]. In addition, because physical exercise leads to profound movement of leukocytes in blood and tissues [61], many researchers conclude that being physically active increases immune surveillance against infectious pathogens including viruses.

4.2. COVID-19, Physical Activity, and the Respiratory System

While the clinical research of the COVID-19 pandemic continues to be investigated, many OVID-19 patients develop respiratory failure and require mechanical ventilation (MV) to maintain adequate pulmonary gas exchange. In this regard, a recent report reveals that ~54% of patients hospitalized thanks to COVID-19 experience respiratory failure and >30% require MV [44,45]. Although MV is

usually a life-saving intervention, an unwanted consequence of prolonged MV is that the rapid development of respiratory muscle weakness thanks to diaphragm muscle atrophy and contractile dysfunction (collectively termed ventilator-induced diaphragm dysfunction, VIDD). VIDD is clinically significant because diaphragmatic weakness may be a major contributor to the lack to wean patients from the ventilator [46]. Many COVID-19 patients often require prolonged time on the ventilator that increases the danger of weaning problems. Patients who experience difficult weaning suffer higher morbidity and mortality than patients weaned quickly on their first attempts to break away the ventilator [49,64] and unfortunately, many COVID-19 patients succumb to ICU-related complications (e.g., sepsis), as long as respiratory muscle weakness may be a primary risk factor for failure to wean from the ventilator, developing strategies to guard the diaphragm against MV-induced weakness has become a priority in critical care medicine. Interestingly, different studies have showed positive impact of endurance exercise training on the systema respiratorium has led the way. Although many organ systems adapt in response to endurance exercise training, the structural and functional properties of the lung and airways aren't altered thanks to exercise [65] training. Specifically, endurance exercise training promotes numerous biochemical alterations in diaphragm muscle leading to a phenotype that's protected against several challenges including prolonged MV [66]. Indeed, as few as 10 consecutive days of endurance exercise training leads to significant protection against VIDD [67,68,69]. Therefore, it's predicted that endurance trained individuals that develop COVID-19 and need ventilator support will enjoy the exercise-induced preconditioning of the diaphragm.

4.3. PA and Exercise Programming during a Pandemic

The effect of regular physical exercise on non-communicable and also have positive impact on the immune system and modern lifestyle behaviors promote physical inactivity which leads peoples become sedentary [70,71,72,73]. These poor lifestyle behaviors are intensified by social distancing and self-imposed or authorities mandated quarantine measures intended to reduce COVID-19 spread. These circumstances pose significant challenges for remaining physically active. during times of isolation, all socioeconomic groups, ethnicities, and ages should maintain healthiness by following the PA recommendations of 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity PA per week, or a mixture of both. Muscle-strengthening activities [75] involving major muscle groups are recommended on two or more days per week. In children/adolescents the recommendations include at least 60 minutes per day of vigorous or [76] moderate intensity PA.

4.4. Starting an Exercise Program during a Pandemic

When starting physical exercise program while in the midst of pandemic, public health recommendations

for social distancing and hygiene practices should be considered. Becoming physically active and reducing sedentary behavior is definitely accomplished by avoiding sitting for while periods, taking short movement or activity breaks, utilizing online exercise classes, and using mobile technologies like telephone applications and wearable sensors to encourage movement. A goal of any beginning PA or exercise program is to progressively work toward completing a minimum of one-half hour of moderate PA a day or a minimum of twenty minutes of vigorous PA every other day of the week. Ideally, strengthening-type activities are included in daily activities a minimum of twice every week [73]. Individuals have chronic diseases like cardiovascular or pulmonary disease should seek advice from health care providers regarding safe exercises [74,75,76]. Recommendations for youngsters and youth aged five to 17 years are the buildup of a minimum of hour of moderate - to vigorous-intensity daily PA. additionally, vigorous-intensity physical activities that strengthen muscle and bone are recommended a minimum of three [74] times per week. If engaged in regular workout and eager to further enhance cardiovascular and muscle fitness, suddenly beginning an intense aerobic and resistance exercise educational program or performing unaccustomed highly intense prolonged exercise isn't prudent, because such PA or exercise training can cause reduced immune function.

4.5. Recommended Home-based and Individualized Physical Activity

There is likely to be very limited opportunity to practice physical activity outside home during this pandemic period, with most of the people advised to remain reception to stop transmission of the virus. It's thus recommended that folks should stay active by exercising at their home. For this purpose promoting physical activity is extremely important, multiple exercise modes are often applied, including aerobics using stationary bikes or rowing ergo meters, weight strength training, dance-based exercise and active gaming. for youngsters and youth (5 -17 yrs), WHO recommends 60 min of daily physical activity with moderate to vigorous aerobic intensity, with muscle and bone strengthening three days per week [77]. For adults and elderly (>17 yrs), recommend physical activity for 75 min/wk with vigorous aerobics intensity or 150 min/wk of moderate aerobic intensity, with muscle and bone strengthening two days per week [77]. The aerobics training types are described in Table 1 below for trained and untrained individuals, with the specific intensity associated with pulse, rating of perceived exertion (RPE) also as intensity with regard to the degree of breathlessness during exercise [78,79,80]. Dancing activities reception, audio-visual-directed gymnastics and aerobics are often recommended for maintenance of cardiovascular, metabolic and musculoskeletal fitness and for reducing the severity of symptoms of depression and anxiety [81-85]. Dance-based workout involves the utilization of body movements which helps to enhance.

Table 1. Exercise Intensity Types of home-based aerobic exercise training for various target groups [86]

Intensity	Active/Trained		Sedentary		Patients/Elderly		Intensity description/definition
	% HRmax	RPE(0-10)	%HRmax	RPE(0-10)	%HRmax	RPE (0-10)	
	65 (50-80)	2 (1-3)	60 (50-75)	2 (1-3)	60 (50-70)	2 (1-3)	Easy, breath is moderate
	80 (70-90)	4 (3-5)	75 (70-85)	4 (3-5)	70 (65-80)	3 (2-4)	Somewhat hard, Breath quickens, talking is possible but not singing
	90 (85-100)	6 (5-10)	85 (80-95)	5 (4-8)	80 (70-90)	5 (3-7)	Challenging, breath is deep and rapid, only few words can be said without pausing for breath

Note: Heart rate in percentage of maximal heart rate (HRmax) and rating of perceived exertion (RPE) during aerobic training with low, moderate and high intensity exercise for trained/active [78] as well as sedentary individuals and patients/elderly [80]. The session RPE 0-10 scale relates to the following intensity anchors; 0: Rest, 2: Easy, 3: Moderate, 5: Hard, 7: Very Hard, 10: Maximal (Foster et al., 2001). Please note that the intensity categories are described as mean values as well as ranges. HRmax can be estimated as 220 minus age (Fox et al., 1971) or 208 minus 0.7 multiplied by age [87].

Strength training, simply stated, is any type of exercise that involves using the body as a means of resistance to perform work against gravity [88]. Examples of body weight exercises for the upper and lower body include push-ups, pull-ups, squats, lunges, box jumps, jump roping, burpees, etc. The benefits of body weight training for musculoskeletal health and functional capacity are well supported by different scientific evidence [89,90]. For example, it has been indicated that plyometric exercise as well as resistance exercise with slow movements can improve physical function in the elderly [91,92]. Moreover, different research findings have shown that 10 weeks of weight training improved selected elements of body composition and components of physical fitness, including strength, flexibility and aerobic capacity, in sedentary 21-23-yr-old women [93]. UNESCO has announced that about 861.7 million students are out of school because of COVID-19. It is likely that this pandemic will increase mental health problems in some children and adolescents. Thus, motivating physical exercise program can be effective strategies to keep young people active at home. Active lifestyle can impact the health and fitness of young people.

5. Conclusion

Generally, home-based regular physical exercise program can provide an opportunity for people to stay physically healthy by practicing simple movements with low-moderate to high intensity in the time of staying at home. The best way to overcome Covid-19 associated problems is to substitute outdoors regular exercise program with home-based/individualized/regular exercise program, such as bodyweight training and dance-based aerobic exercise, and if possible, aerobic high-intensity exercise using different machines, also with self paced protocols. These physical exercises can be combined with, but not substituted by, stretching and active gaming. The great importance of a healthy diet during this pandemic period also should give more attention. Generally, maintaining a regular physical activity raining, carefully in a park setting or safely at home, is a helpful strategy to reduce the consequences of this pandemic, both at the physical and mental level. The time spent at home could therefore be changed into by participating mostly in home based aerobic exercise to build a positive and mindful relationship with the long-term health benefits of exercising.

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