



## Artículo Especial

### Physical activity recommendations during the COVID-19 pandemic: a practical approach for different target groups

#### *Recomendaciones de actividad física durante la pandemia de COVID-19: un enfoque práctico para diferentes grupos objetivo*

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### Abstract

Ensuring health and well-being during this pandemic is essential according to the United Nations Sustainable Development Goals. Physical exercise has an important role in the preservation of the immune system, which is vital to prevent infections. To promote physical exercise and maintain a healthy status, recent studies have suggested general exercise routines to be implemented during the quarantine period. However, to improve the health-related physical fitness components, any specific prescription should include intensity, volume, duration, and mode. Controversy persists about which is the best intensity of physical activity, while performing exercise at a moderate intensity could bring important benefits to asymptomatic people. High intensity or unaccustomed exercise should be restricted for older people, and for people of all ages with chronic diseases or compromised immune system, obesity, or upper respiratory tract infection with limited symptoms. Besides, physical activity guidelines should be particular to each population group, giving special consideration to those vulnerable to COVID-19 who are much more likely to suffer more self-isolation. Therefore, the present study is to provide specific physical activity recommendations for different populations during this pandemic.

#### Keywords:

Exercise prescription.  
Health. Pandemic.  
Immune system.  
SARS-CoV-2.

### Resumen

En este periodo de pandemia es vital garantizar la salud y el bienestar según indican los Objetivos de Desarrollo Sostenible de la ONU. El ejercicio físico desempeña un papel importante en la mejora del sistema inmunológico, siendo vital en la prevención de infecciones. Por todo ello, se recomienda la realización de actividad física de manera regular para preservar la salud mental, neuromuscular, cardiovascular, metabólica y endocrina. Para promover el ejercicio físico y mantener un estado saludable, estudios recientes han sugerido que se apliquen rutinas generales de actividad física durante el periodo de cuarentena. Sin embargo, para mejorar los componentes de la aptitud física relacionados con la salud, la prescripción específica debe matizar la intensidad, el volumen, la duración y el modo. Se ha detectado cierta controversia acerca de cuál es la intensidad adecuada de la actividad física durante el periodo de pandemia, ya que la realización de ejercicios de intensidad moderada podría aportar importantes beneficios. Se debería ser cauteloso con el ejercicio de alta intensidad en las personas no entrenadas o incluso limitarse en los grupos de riesgo. Se deben establecer pautas de actividad física adaptadas para cada grupo de población, prestando especial consideración a los vulnerables a la COVID 19, ya que tienen más probabilidades de volver a aislarse. Por lo tanto, el presente estudio proporciona recomendaciones específicas de actividad física para diferentes poblaciones y su estado de condición física durante esta pandemia.

#### Palabras clave:

Prescripción de ejercicio. Salud. Pandemia. Sistema inmune. SARS-CoV-2.

Received: 23/09/2020 • Accepted: 06/12/2020

*Conflicts of interest: the authors declare no conflicts of interest.*

Baena Morales S, Tauler Riera P, Aguiló Pons A, García Taibo O. Physical activity recommendations during the COVID-19 pandemic: a practical approach for different target groups. *Nutr Hosp* 2021;38(1):194-200

DOI: <http://dx.doi.org/10.20960/nh.03363>

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## INTRODUCTION

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The coronavirus disease 2019 (COVID-19) was detected in December 2019 in China and has become a worldwide pandemic, registering as of September 2020 more than 30 million confirmed cases and nearly one million deaths in 216 countries around the world. Reported rates are increasing every day and many territories are experiencing outbreaks (1). In fact, a resurgence in contagion could occur in the next few years (2). Most affected countries keep imposing or recommending quarantine status, where the population must stay at home to avoid contagion; in other countries self-isolation is also recommended. This situation may produce some psychological health problems such as stress, anxiety, or frustration (3,4), in addition to other health-related problems linked to physical inactivity, such as muscle loss, neuromuscular junction damage and fiber denervation, insulin resistance, decreased aerobic capacity, fat deposition, and low-grade systemic inflammation (5-7). Thus, it is necessary to prevent the unfavorable physical and psychological consequences associated with acute cessation of physical activity (PA) during the COVID-19 pandemic.

One main reason for promoting PA is the improvement of health-related physical fitness components (cardiorespiratory fitness, muscular strength, flexibility, and body composition) it promotes (7-9). These are directly related to the physiological functions of the main organ systems (respiratory, circulatory, muscular, nervous, and skeletal systems), and indirectly involved in the proper functioning of other systems (endocrine, digestive, immune, or renal systems) (10). Some of these benefits include a lower risk of coronary heart disease, hypertension, and type-2 diabetes, which are related to higher vulnerability to SARS-CoV-2 (11-13).

## EFFECTS OF PHYSICAL ACTIVITY ON THE IMMUNE SYSTEM

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Results are consistent in the literature regarding the benefits of PA on the immune system (9). The immune system's response to exercising depends on exercise intensity, volume, and mode (14,15). Hull (16) highlights a "J" shape association between PA and risk of upper respiratory tract infections. This means that lower levels of PA could lead to an increasing risk of respiratory infection. Although PA alone cannot prevent infection, it may reduce the severity and duration of symptoms (17,18).

A positive effect of M-PA exists on the immune response to viral respiratory diseases, as M-PA is recommended if mild symptoms involve the upper respiratory tract (9,14,19). M-PA is associated with an increase in neutrophil counts as well as in salivary IgA concentrations (20,21). Furthermore, Laddu (8) mentions that daily M-PA practice results in a reduction of pathogen load and influx of inflammatory cells into the lungs. These are consequences of an increased anti-pathogenic activity of the macrophages, as well as immunoglobulins and anti-inflammatory cytokines in the blood. Moreover, cardiorespiratory exercise, which involves major muscle

groups, is associated with an improvement in immune function by increasing the number of immune cells with capacity to kill infected cells (18). Therefore, M-PA is related to a lower incidence and mortality of flu and pneumonia (22).

On other hand, regarding the effects of vigorous physical activity (V-PA) on the immune system, a reduction in weekly workout or shorter bouts of exercising have been suggested (12,23). However, it should be considered that unaccustomed V-PA seems to entail immune suppression (21). If V-PA is excessively strenuous it can debilitate the immune system for many hours after the workout, increasing the risk of respiratory infection and susceptibility to infectious pathogens and diseases, thus leading to an open window period (8,9,24). Hull (16) adds that a sudden increase in training load in recreative athletes has been associated with temporary immune disorders, inflammation, oxidative stress, and muscle injury. Nonetheless, it is highlighted that elite athletes can train at the V-PA level if there is no sudden increase in training load. A lack of adaptation to effort could have a negative effect on the immune system activity (25). Finally, eccentric training during the quarantine period is not mentioned in the reviewed investigations. However, it is noteworthy that intensive and excessive eccentric contraction have been associated with an increase in inflammatory processes. Pro-inflammatory states, such as the one induced after unaccustomed and/or eccentric exercise, should be avoided because COVID-19 has been linked to a high cytokine index (26). As a result, we suggest that special attention should be paid to excessive eccentric exercise during confinement. In fact, following the argument from a recent report, the well known anti-inflammatory status induced by a non-strenuous exercise program could attenuate the "cytokine storm" observed in people at high risk from COVID-19 (27,28).

## EXERCISING DURING LOCKDOWN

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Quarantine may negatively affect active lifestyle at all ages, since exercising at home is typically less accessible as compared to outdoor activities (5,7,15). Fortunately, there are many options for exercising at home by means of guides, videos, apps, and diverse equipment, which may contribute to ensure a minimum level of PA (29), reduce sedentarism, and maintain people's health (11,30,31). However, an accurate recommendation and prescription is needed to ensure a safe practice and improve the main health-related physical fitness components (19). Anxiety and the desire to exercise may result in inappropriate PA intensity and an excessive response by the organism, especially among the sedentary population (32). For these reasons, several institutional agencies have suggested awareness approaches such as *BeActive* (33) and physical activity recommendations (32). These guidelines become even more important for people with previous associated diseases and older people, since they are most vulnerable to COVID-19, and exhibit the highest mortality rate according to all epidemiological studies (10,19). Prescription guidelines should specify exercise variables such as intensity, volume, duration, and mode, since these affect differently the

immune system (8,34). Each population should follow specific recommendations, including those with COVID-19 symptoms. Considering that the main current issue in sports medicine is determining specific exercise guidelines during this epidemic (9,35), this study analyzes the current PA recommendations in order to design a practical approach for different target groups during the lockdown by COVID-19.

## **SPECIFIC PHYSICAL ACTIVITY RECOMMENDATIONS ACCORDING TO TARGET GROUP**

Studies on PA and COVID-19 have focused on general recommendations (7,9,24,25,29,33,36), but also on special groups such as the elderly (10,37,38), people with obesity (39-41), children and young people (36,42-44), athletes (16,45-47), patients with diabetes (12) or hypertension (19), and individuals with various fitness levels (48).

### **Group 1. Athletes**

Although high-performance athletes seem to have a higher immunological capacity, anecdotal severe infections by COVID-19 have been reported (45). Elite athletes must maintain their physical fitness level, but training modifications are inevitable. Therefore, daily routines for athletes in quarantine have been suggested (24,47). While performing of M-PA is recommended, some authors are more cautious with V-PA (45,47) than others (16,46). Since physiological adaptation is a reversible process, physical inactivity may cause an important decrease in fitness level, especially in the absence of endurance and resistance training (47). V-PA produces temporary immune disturbances, inflammation, oxidative stress, and muscle damage, effects that bring about a general immune depression (9). In addition, long-term negative effects on lung function and exercise capacity should be considered (45). Studies about SARS found a 52 % decrease in performance after two years as a result of reduced lung diffusion capacity (49).

Thus, we suggest that elite athletes and well-trained people may maintain their usual routine and perform V-PA if avoiding maximal intensity ( $> 90\% \text{VO}_{2R}$ ). In addition, following the general recommendations for preventing contagion is important (45), as is considering quarantine as a period to reflect upon and reorganize personal life and priorities (47). It must be noted that whenever an athlete has a fever or any symptom related to COVID-19, PA must be interrupted (45). If an athlete is positive for COVID-19 without symptoms and with a previous negative test, high intensity exercise is not recommended for at least two weeks (49).

Exercise prescription for this target group will depend on the particular requirements of the sport involved. Exercise requiring extensive muscular damage or unaccustomed exercise should be avoided.

### **Group 2. Asymptomatic children and youth**

Children and young people are the age group that suffers the least from the consequences of COVID-19 (44,50). PA recommendations are similar to those extant before quarantine, excluding playing with other children and in playgrounds (51). The pandemic and quarantine may reduce PA levels, so parents and educators must keep up the healthy habits of their children and youth. In this regard, a recent study shows how physical education teachers have some difficulties in correctly monitoring their students' PA routine (52). Using virtual devices and playing active games with the family could motivate this target group to be more active (29,34,36,42). However, overuse should be avoided, as it may induce poor sleep quality or vision problems (40). An additional problem is to prevent the new normality of being sedentary, because changes towards sedentary daily routines could become well established (53).

To prevent this, encouraging youth care by governments and institutions through a double perspective is essential. First, avoiding long periods of sitting by taking a break every 30-60 minutes. For example, physical education teachers should promote in their online classes the importance of getting up, stretching, and walking around when they have been sitting for a prolonged period of time (43,52). Second, a daily PA guideline should be implemented.

The ACSM (36) recommends exercising, including playing, at least three hours a day at any intensity (low-vigorous) in children aged 3 to 6. In children from 6 to 12 years of age, one hour a day of moderate and vigorous activities is suggested. Games should emphasize the aerobic component through bodyweight activities, which allow to strengthen muscles and bones (42). This set of measures will help children and adolescents to sleep better, avoid the stress related to confinement, and maintain good health (42,43).

### **Group 3. Asymptomatic adults**

This target group usually have a regular and active routine, so confinement has been shown to be mentally damaging (3,54). For this reason, adding a PA routine is highly recommended. Additionally, many healthy adults are working from home, which carries with it an increase in sitting hours, so specific strengthening exercises should be performed (35). In countries where exercising outdoors is forbidden, resistance training at home is very important, for weight control and for physiological and psychological health (7,55).

Individuals from 18 to 65 years of age without symptoms should maintain a daily active routine accumulating a volume of 150 minutes per week of moderate intensity exercise (9,32,34). Although V-PA is not usually recommended, it could be considered according to fitness level in those who were previously active (48). This V-PA should not exceed a weekly volume of approximately 75 minutes. Additionally, it should be performed in alternate days and avoiding extreme weather conditions (19). Sedentary individuals should start their practice progressively and be aware of any

sign or symptom of musculoskeletal injury (34), performing short bouts of exercise with slow intensity increments (35).

The quarantine period is associated with psychological consequences. The fact that this target group had a regular and active routine before the pandemic makes confinement especially damaging to mental health (3,6). For this reason, adding a PA routine is highly recommended. Thus, a proposal of a PA routine is suggested, including strength training through bodyweight exercises or using elastic bands; cardiovascular fitness by climbing stairs; and practicing pilates or yoga to improve balance (19,25,29,34). Online PA classes could be included during this pandemic (34,56); however, ensuring that teachers have appropriate professional qualifications is essential for safe practice.

#### **G4. Asymptomatic older adults (≥ 65)**

Older adults are the most vulnerable age group to COVID-19 (10,37,38). This implies that they are more affected by social isolation and exposed to physical inactivity and mental well-being problems (38). To prevent this, preserving a daily routine of personal care, hygiene, and PA maintenance is essential (57). The preventive effect of PA requires a controlled and strict prescription. Resistance exercises at home are recommended to elderly people (10,37,38). Jiménez Pavón (10) suggests that exercise intensity should not exceed a moderate level and that the weekly volume should range from 200 to 400 minutes through a multi-component exercise program that includes strength training, aerobics, balance, and coordination.

Goethals (38) adds that self-isolation could cause a significant decrease in physical activity. Exercising with a partner could increase adherence, motivation, and improvements in mental health. In this case, disease preventive measures should be particularly present. The exercise approach should promote coordination, mobility, and cognitive aspects. Moreover, Hammami (48) mentions the importance of plyometric and resistance exercises with a slow execution. Simple exercises and adapted, specific daily physical activities including strength, balance, and walking should be considered (57). Older adults should perform simple and safe exercises to allow them to be physically active at home. Therefore, regular PA in the elderly is especially important to maintain a proper immune and muscular system, their independence level, mental health, and well-being.

#### **G5. All ages with chronic diseases or compromised immune system, obesity, or upper respiratory tract infection with limited symptoms**

PA recommendations have been detailed for people with obesity (39,41), diabetes (12), heart disease (58), or hypertension (19). This group of diseases have something in common—physical inactivity is harmful to these patients and COVID-19 is especially aggressive against them (5,12,19,40). As discussed above, physical inactivity has increased during confinement, so we believe that

more specific recommendations are needed depending on each individual and the state their diseases are in. For example, although there is evidence that V-PA has a positive effect on inflammatory factors in people with obesity (23), we believe that during the pandemic it is advisable to avoid it, as high intensity exercise produces high levels of oxidants and a potential suppression of the immune system. Therefore a wiser intervention for obese people is suggested. M-PA (70 % maximum heart rate, 5 times a week) is sufficient to generate a protective immunological effect in obese adults (41). Additionally, special care should be taken with repetitive exercises and jumping to prevent musculoskeletal injuries.

Irfan (19) proposes a program for hypertension that recommends at least 30 minutes a day for 5-7 days/week. The importance of moderate intensity (40-59 %  $VO_2R$ ) is emphasized, as is trying to do exercises that require large muscle groups. On the other hand, Balducci (12) indicates the importance of the initial physical condition in patients with diabetes, differentiating a recommendation of PA for those fit and unfit.

Despite these general considerations, anyone with chronic diseases that could compromise the immune system must be very cautious regarding PA practice (8). Therefore, sedentary people who belong to this group should visit their medical doctor to obtain authorization and recommendations before exercising. In previously active people, we recommend 150 minutes per week of M-PA, avoiding sudden changes in intensity and limiting V-PA.

#### **G6. Symptomatic patients**

Any person with upper respiratory tract infection showing symptoms below the neck (myalgia, fever, gastrointestinal symptoms), pulmonary involvement, loss of the senses of smell or taste, must interrupt PA whatever its type. Fallon (34) highlights that patients who show symptoms of COVID-19 must rest at least 10 days starting at the onset of symptoms, plus 7 days after their resolution. During or following an upper respiratory tract infection the “neck check rule” is applied (14,16,20). However, if the symptoms are below the neck, PA should be prohibited until full recovery. In patients with pneumonia, the return to PA should be slow and gradual during 4 weeks (14). The cardiovascular effects and long-term consequences of COVID-19 are currently unclear. However, it has been suggested that it could lead to cardiomyopathy. In this case, a strict physical exercise prescription should be made for a period of 3-6 months under medical supervision (59).

Additionally, completing the Pre-Exercise Evaluation Questionnaire (PASQ) is suggested, which is designed to detect the main symptoms of COVID-19 and evaluate an individuals’ readiness for physical exercise (60).

### **PRACTICAL APPROACH**

A practical approach for the different target groups is suggested after the literature review. A summary of the PA recommendations is presented in table I. Recommendations are presented according

**Table I.** Recommendations for physical exercise intensity during quarantine by COVID- 19 according to target groups and previous physical activity level

Intensity (VO <sub>2</sub> max)		Intensity, volumen of physical exercise and perception scale						
		Light (20 %-40 %)		Moderate (40 %-60 %)		Vigorous (60 %-90 %)		Maximal (> 90 %)
RPE (6-20)		< 9		9-13		14-17		< 17
Volume (min per week)		75	≥ 150	75	≥ 150	75	≥ 150	
Target group	Fitness level							
<b>G1. Athlete</b>	High							
<b>G2. Healthy young</b>	Active							
	Sedentary							
<b>G3. Healthy adult</b>	Active							
	Sedentary							
<b>G4. Healthy older</b>	Active							
	Sedentary							
<b>G5. Other health conditions I</b>	Active							
	Sedentary							
<b>G6. Other health conditions II</b>	Active							
	Sedentary							
		<b>Recommended</b>	<b>Medical clearance required</b>				<b>Not recommended</b>	

G1: athletes; G2: asymptomatic youth (< 18); G3: asymptomatic adults (< 65); G4: asymptomatic older adults (≥ 65); G5: all ages with chronic diseases or compromised immune system, obesity, or upper respiratory tract infection with limited symptoms; G6: all ages with upper respiratory tract infection with symptoms below the neck (myalgia, fever, and gastrointestinal symptoms), or pulmonary or multi-organ involvement.

to target group, fitness level (active or sedentary) and PA volume and intensity, two key components for exercise prescription.

Based on this proposal, most of the prescriptions cover all health-related physical fitness components, and mainly suggest similar durations of exercise at a moderate intensity. In general, a minimum training volume of 150 minutes per week of M-PA is suggested.

Previous fitness level must be considered, and unusual exercise should be avoided. People who have been active prior to quarantine and athletes may perform V-PA, always considering the general recommendations for preventing infections. However, previously sedentary or vulnerable groups should pay special attention to the intensity and mode of the PA they perform. Moreover, in the presence of chronic diseases or respiratory illness symptoms, medical advice should be required to ensure safe practice. Despite these specific recommendations, individualized training should be conducted by qualified professionals in order to prevent potential problems associated with PA practice.

## CONCLUSIONS

Performing M-PA during the quarantine period involves important preventive, psychological, and physical benefits for asymptomatic people. V-PA is only recommended to well-trained individuals. However, conclusions regarding the preventive benefits of V-PA are not consistent across the reviewed literature. For vulnerable groups such as older people, people with chronic diseases or obesity, and those with a weakened immune system or upper respiratory tract infection with limited symptoms, M-PA is recommended following medical advice. Finally, there is consensus about limiting PA in people with symptoms associated with COVID-19. Further research is required to examine the relationship between fitness level and symptomatology in order to better illustrate whether being more physically active prevents the illness and/or reduces the symptoms and severity of COVID-19.

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