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EVALUATION OF THE PHYSICAL ACTIVITY LEVELS OF COVID-19 PATIENTS IN TURKEY

ORIGINAL ARTICLE

ABSTRACT

Purpose: Covid-19 is a viral infection that affects either the respiratory system or the other systems. Studies about the effects of Covid-19 on physical activity are still scarce. This study aims to compare the changes in the physical activity levels of patients before and six months after Covid-19 in Turkey.

Methods: One hundred and six participants that have been six months after Covid-19 contraction were included in the study. Along with the Patient Assessment Questionnaire, the International Physical Activity Questionnaire Short Form was used to assess physical activity energy consumption (vigorous-intensity physical activities, moderate-intensity physical activities, walking, and total physical activities).

Results: Participants became either less physically active or more sedentary six months after Covid-19 (p=0.019). Vigorous-intensity physical activity levels were significantly decreased (Mean±SD: 341±854 vs. 109±331 Metabolic Equivalent Task minutes/week, p=0.015), and perceived fatigue during exercise was significantly increased between before and six month after infection (Mean±SD: 4.76±2.17 vs 6.17±2.27, p=0.001). Participants who had dyspnea (n=12) during the period of Covid-19, did more moderate-intensity physical activity (p=0.020) and walking (p =0.021) after Covid-19, compared to those who had not.

Conclusion: Particularly changes in vigorous-intensity physical activity levels and perceived fatigue during exercise were seen in Covid-19 infected patients. We recommend supporting gradually increased tailor-based exercise programs by health professionals in public health agencies, not only for protecting the individuals from Covid-19 outcomes, but also for returning to their pre-infection fitness levels.

Key Words: Covid-19, Physical Activity, Questionnaire

COVİD-19 TANISI ALMIŞ KİŞİLERİN FİZİKSEL AKTİVİTE DÜZEYLERİNİN DEĞERLENDİRİLMESİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Covid-19 solunum sistemini veya diğer sistemleri etkileyen viral bir enfeksiyondur. Covid-19'un fiziksel aktivite üzerindeki etkileri ile ilgili çalışmalar halen yetersizdir. Bu çalışmanın amacı Türkiye'de hastaların Covid-19 öncesi ve altı ay sonrası fiziksel aktivite düzeylerindeki değişiklikleri karşılaştırmaktır.

Yöntem: Çalışmaya Covid-19'un üzerinden altı ay geçmiş 106 katılımcı dahil edildi. Hasta Değerlendirme Anketi ile birlikte, fiziksel aktivite enerji tüketimini (şiddetli fiziksel aktiviteler, orta yoğunlukta fiziksel aktiviteler, yürüme ve toplam fiziksel aktiviteler) değerlendirmek için Uluslararası Fiziksel Aktivite Anketi Kısa Formu kullanıldı.

Sonuçlar: Katılımcılar, Covid-19'dan 6 ay sonra ya fiziksel olarak daha az aktif ya da daha sedanter hale geldi (p=0,019). Şiddetli fiziksel aktivite seviyeleri önemli ölçüde azaldı (Ortalama±SS:341±854 vs. 109±331, Metabolik Eşdeğer dakika/ hafta, p=0,015) ve egzersiz sırasında algılanan yorgunluk enfeksiyondan önceki ve sonraki altı ay arasında önemli ölçüde arttı (Ortalama±SS: 4.76±2.17 vs 6.17±2.27, p=0,001). Covid-19 döneminde nefes darlığı (n=12) olan katılımcılar, olmayanlara göre Covid-19 sonrası daha fazla orta yoğunlukta fiziksel aktivite (p=0,020) ve yürüyüş (p=0,021) yaptı.

Tartışma: Covid-19 ile enfekte olan hastalarda özellikle şiddetli fiziksel aktivite seviyelerinde ve egzersiz sırasında algılanan yorgunlukta değişiklikler görüldü. Bireyleri sadece Covid-19 sonuçlarından korumak için değil, aynı zamanda bireylerin enfeksiyon öncesi fiziksel uygunluk seviyelerine geri dönmeleri için, halk sağlığı kurumlarındaki sağlık profesyonelleri tarafından kademeli olarak artırılan kişiye özel egzersiz programlarının desteklenmesini öneriyoruz.

Anahtar Kelimeler: Covid-19, Fiziksel Aktivite, Anket

INTRODUCTION

A novel type of coronavirus-induced Covid-19 infection is a viral infection, which was discovered in Wuhan, China in December 2019, that affects either the respiratory system or the other systems (1,2). Due to its high risk of transmission, it was declared as a global pandemic by the World Health Organization on March 11, 2020, and the first Covid-19 case was announced by the Republic of Turkey Ministry of Health on the same date (3). After an incubation period, some patients show no Covid-19 symptoms and become asymptomatic carriers (4); some patients have signs and symptoms including fever, cough, myalgia, fatigue, dyspnea, sputum production, and pneumonia (1,4). These patients are prone to develop diffuse myopathy, decreased pulmonary function and inspiratory muscle strength, deteriorated functional capacity, and decreased muscle mass due to immobilization (5). Changes in the hemoglobin structure may result in less oxygen and carbon dioxide transportation (3).

The coronavirus affects the immune system response. It has been reported that Covid-19 affected patients have higher levels of pro-inflammatory cytokines, such as TNF-α, IFN-γ, IL-1β, and IL-6compared to healthy subjects. It has been revealed that the expression levels of these cytokines are directly related to disease severity.In all recovery phases of Covid-19 infected patients, the administration of moderate and adapted physical activity improves physical and psychological well-being by alleviating the release of pro-inflammatory cytokines through the modulation of anti-inflammatory cytokines, such as IL-1Ra, IL-6, and IL-10. Thus, it can be said that physical activity could play an important role in countering the imbalance in antiviral immunity (6). On the other hand, it is well-known that physical activity is strongly recommended for health promotion and disease prevention (7). Moderate and adapted physical activity also protects the individuals against inflammation induced by Covid-19 (6).

To reduce the spread of the disease, governments advocated for social distancing, quarantine, and business closures. It will be important to gauge adherence to these measures and their effect on physical activity (8). Further, the management of Covid-19 is the patient's isolation and supportive medical care, as recommended by the National Institutes of Health of the United States (2). Due to the effects of Covid-19 on the immune system and isolation of Covid-19 patients for a certain period of time, we thought that the physical activity levels of the infected patients might change. To the best of our knowledge, there is no information about the physical activity levels of Covid-19 patients in Turkey. Therefore, we aimed to compare the changes in the physical activity levels before and six months after Covid-19 infection.

METHODS

Design

The current online study was realized through Google online survey platform (Google LLC, Mountain View, CA, United States) and communicated via WhatsApp (WhatsApp Inc, California, United States) due to the Covid-19 pandemic between March 2021 and May 2021. Patient Assessment Questionnaire and International Physical Activity Questionnaire-Short Form were instructed to all participants in a single form. The introduction of this online questionnaire included a description and purpose of the study, and the anonymity and confidentiality declarations as "We invite you to a scientific research on Covid-19 to compare your physical activity level before Covid-19 with your current physical activity level. The data are anonymous, confidential, and confidentiality will be guaranteed. Participation is completely voluntary, and you can withdraw at any time after participating. You will not be charged or paid any fees for your participation. The information will be used for research purposes only, and your personal information will be kept strictly confidential. The questionnaire will be saved only after clicking the 'submit' button". The Ethics Committee of Gazi University provided ethical approval (2021-239/05.03.2021). All participants in the study gave their informed consent before participation according to the principles of the Declaration of Helsinki. The rights of the participants were fully protected during the study procedures.

Participants

The inclusion criteria were (a) aged between 18 and 65 years, (b) positive real-time polymerase-chain-reaction (PCR) test, and (c) have

been six months after Covid-19. The sample size was determined by using G*Power software (version 3.1, Universitat Düsseldorf, Germany) based on results of the International Physical Activity Questionnaire-Short Form of Bertheussen et al (2013) (9). With a power of 95%, 95% confidence interval, and effect size of 0.33, the power analysis resulted in 106 participants.

Questionnaires

Patient Assessment Questionnaire: Demographic characteristics of the patients were recorded, including gender (female/male), age (years), height (cm), weight (kg), and body mass index (kg/m^2). All patients were asked about smoking status; the presence of other chronic diseases; Covid-19 signs and symptoms and pneumonia; the use of medication and hospitalization (service, intensive care unit) status during the treatment of Covid-19; and exercise parameters (frequency, type, duration) and perceived fatigue during exercise before and six months after Covid-19. The question of perceived fatigue during exercise was scored from 0-10. 0 means no fatigue, and 10 means more fatigue (10).

International Physical Activity Questionnaire-Short Form (IPAQ-SF): The International Physical Activity Questionnaire is an instrument that assesses individuals' physical activity (vigorous-intensity physical activities, moderate-intensity physical activities, walking, and total physical activities) and energy consumption in Metabolic Equivalent Task minutes per week (7). In this current study, the participants were asked to consider physical activities they did, not only the current time they are in but also six months before Covid-19. The IPAQ-SF which consists of seven questions is designed to assess the physical activity levels of individuals between the ages of 15 and 69 (11). They reported the frequency and duration of different types of activities including vigorous-intensity physical activities (i.e.carrying/moving a heavy load [>20 kg], performing intense aerobic exercises that increase the breathing rate more frequently than normal); moderate-intensity physical activities (i.e.carrying a light load, working in the garden, performing aerobic exercises at a modest intensity, not out of breath and could hold a conversation); and walking activities in the last week (12). The intensity of activities is converted to Metabolic Equivalent of Task minutes per week (MET minute/week) despite the scoring of the IPAQ-SF. Standard MET values are established for all activities (walking=3.3 MET, moderate-intensity physical activity=4.0 MET, and vigorous-intensity physical Activity=8.0 MET). Physical activity levels are categorized as "low active (<600 MET-minute/week)", "minimal active (600-3000 MET-minute/week)", and "high active (>3000 MET-minute/week)" (13). The Turkish validity and reliability of the short and long versions of this questionnaire were performed by Saglam et al. (2010) (12).

Statistical Analysis

Statistical analysis was performed using the IBM SPSS (Statistical Package for the Social Sciences) (BM Corp., Armonk, New York, United States) software version 26.0. The variables were investigated using visual (histograms, probability plots) and analytical methods (Kolmogorov-Smirnov/Shapiro-Wilk's tests) to determine whether or not they are normally distributed. Descriptive analyses were presented using tables of frequencies for the ordinal variables and using medians and interquartile range (IQR) for the non-normally distributed and ordinal variables. Dependent groups were compared with the Wilcoxon test, and independent groups were compared with the Mann-Whitney *U* test since the measurements were the ordinal variables or not normally distributed numeric variables. A p-value of less than 0.050 was considered to show a statistically significant result.

RESULTS

General Descriptives and Clinical Characteristics of Participants

Descriptives and clinical characteristics of participants are shown in Table 1. The study sample (n=106) comprised 65.1% of females and 34.9% of males. The mean±SD age was 34.95±10.53, and the mean±SD height was 167.22±8.33 cm. Body Mass Index (BMI) was 25.25±4.57 kg/m^2. The BMI was then divided into two categories: normal weight (BMI: 18.5–24.9 kg/m^2) and abnormal weight (underweight BMI<18.5 kg/m^2, overweight BMI: 25.0–29.9 kg/m^2, and obese BMI: ≥30 kg/m^2). As shown in Table 1, 53.8% of participants are classified as normal-weight participants. 85 participants (80.2%) were non-smokers. The mean±SD

Table 1. Descriptives and Clinical Characteristics of Participants (n=106)

		Mean±SD	Median (IQR)
Age (year)		34.95±10.53	34.00 (25-43)
Height (cm)		167.22±8.33	165.50 (160.00-172.00)
Weight (kg)		70.92±15.08	70.00 (58.00-80.00)
BMI (kg/m²)*		25.25±4.57	24.49 (22.06-27.28)
		n (%)	
Gender	Female	69 (65.10)	
	Male	37 (34.90)	
BMI*	Normal Weight	57 (53.80)	
	Abnormal Weight (Underweight, Overweight, Obese)	49 (46.20)	
Marital Status	Married	66 (62.30)	
	Unmarried	40 (37.70)	
Education Level	Undergraduate	60 (56.60)	
	High School	21 (19.80)	
	Associate Degree	11 (10.40)	
	Elementary School	7 (6.60)	
	Post Graduate	7 (6.60)	
Job	Public	78 (73.60)	
	No Job	10 (9.40)	
	Private	8 (7.50)	
	Student	8 (7.50)	
	Retired	2 (1.90)	
Chronic Diseases	No	73 (68.90)	
	Yes	33 (31.10)	
Smoking	No	85 (80.20)	
	Yes	21 (19.80)	

*BMI: Body Mass Index

smoking of 21 participants was 13.41±5.75 per day and 159.55±93.88 months.

Covid-19 Signs and Symptoms of Participants

While 103 participants (97.2%) had Covid-19 symptoms, 3 participants (2.8%) did not. The duration of symptoms lasted less than a week in 38 (35.8%), between one week and ten days in 38 (35.8%), and more than ten days in 27 (25.5%) participants. Covid-19 was accompanied by pneumonia in 5 participants (4.7%). 4 participants (3.8%) were hospitalized in the service. Mean±SD day of hospitalization was 8.50±5.80. There was no hospitalization in the intensive care unit. The distribution of signs and symptoms is shown in Table 2.

Using of Medication during the Treatment of Covid-19

While 86 participants (81.1%) used medications for the treatment of Covid-19, 20 participants (18.9%) did not. The Mean±SD day of using medication was 5.44±1.96. The most used medication was Favipiravir, with 42 participants (39.6%).

Changes in Exercise Parameters (Frequency, Type, Duration) and Perceived Fatigue During Exercise before and Six Months after Covid-19

Changes in exercise frequency, type, and duration before and six months after Covid-19 was not statistically significant (p=0.538, p=0.379, p=0.932). Perceived fatigue during exercise before Covid-19 was 4.76±2.17, and after six months,

it was 6.17±2.27. This increase in perceived fatigue during exercise was statistically significant (p=0.001), particularly in females as compared to males (p=0.026).

Table 2. Covid-19 Signs and Symptoms of Participants

		n (%)
Signs/ Symptoms	Fatigue	82 (77.40)
	Arthralgia	74 (69.80)
	Loss of Smell	59 (55.70)
	Headache	57 (53.80)
	Loss of Taste	49 (46.20)
	Cough	33 (31.10)
	Sore throat	32 (30.20)
	Fever	32 (30.20)
	Diarrhea	22 (20.80)
	Dyspnea	12 (11.30)
	Dizziness	12 (11.30)
	Corneal Infection	1 (0.90)

Changes in IPAQ-SF Category and Scores before and Six Months after Covid-19

The IPAQ-SF category results demonstrated that before Covid-19 infection, 59.4% of participants were low active, 29.2% were minimal active, and 11.3% were highly active. Six months after Covid-19, the percentage of low active and minimal active participants expanded up to 66.0% and 30.2% respectively, while highly active participants dropped to 3.8%. These changes in physical activity levels before and Six months after Covid-19 was statistically significant (p=0.019). Vigorous-intensity physical activity in MET-minute/week also illustrated a statistically significant difference between before and after Covid-19 infection (Mean±SD: 341±854 vs. 109±331 MET–minute/week, p=0.015) (Table 3).

Changes in IPAQ-SF Scores according to Gender before and Six Months after Covid-19

With respect to gender classifications, before Covid-19, vigorousintensity physical activity IPAQ-SF scores were 235±760 in females, 537±987 in males, and was statistically different in MET–minute/week (p=0.039).

Table 3. Classification of Participants according to IPAQ-SF Category and Scores before and Six Months after Covid-19 (n=106)

IPAQ-SF Category	**Before Covid-19**		**Six Month After Covid-19 (Current Status)**		p
	n (%)		n (%)		
Low Active (<600 MET-minute/week)	63 (59.40)		70 (66.0)		**0.019***
Minimal Active (600-3000 MET-minute/week)	31 (29.20)		32 (30.20)		
High Active (>3000 MET-minute/week)	12 (11.30)		4 (3.80)		
IPAQ-SF Scores (MET-minute/week)	**Before Covid-19**		**Six Month After Covid-19 (Current Status)**		
	Mean±SD	**Median (IQR)**	**Mean±SD**	**Median (IQR)**	
Vigorous-intensity Physical Activity IPAQ-SF Score	341±854	0 (0-160)	109±331	0 (0-0)	**0.015***
Moderate-intensity Physical Activity IPAQ-SF Score	218±475	0 (0-240)	176±405	0 (0-160)	0.224
Walking IPAQ-SF Score	459±653	231 (0-578)	398±490	231 (0-528)	0.240
Total Physical Activity IPAQ-SF Score	1012±1452	471 (0-1035)	714±943	396 (116-935)	0.094

Table 4. IPAQ-SF Scores According to Dyspnea and Fatigue During the Period of Covid-19*p<0.05

IPAQ-SF Scores According to Dyspnea During the Period of Covid-19 (MET-minute/week)	Had Dyspnea (n=12)		No Dyspnea (n=94)		p
	Mean±SD	Median (IQR)	Mean±SD	Median (IQR)	
Vigorousintensity Physical Activity IPAQ-SF Score	33±115	0 (0-0)	119±349	0 (0-0)	0.299
Moderate-intensity Physical Activity IPAQ-SF Score	328±424	220 (0-510)	157±401	0 (0-120)	**0.020***
Walking IPAQ-SF Score	707±554	644 (215-1386)	358±470	231 (0-495)	**0.021***
Total Physical Activity IPAQ-SF Score	1068±920	1034 (215-1806)	669±941	396 (83-693)	0.107
IPAQ-SF Scores According to Fatigue During the Period of Covid-19 (MET-minute/week)	**Had Fatigue (n=82)**		**No Fatigue (n=24)**		**p**
	Mean±SD	**Median (IQR)**	**Mean±SD**	**Median (IQR)**	
Vigorous-intensity Physical Activity IPAQ-SF Score	42±133	0 (0-0)	338±607	0 (0-440)	**0.001***
Modarate-intensity Physical Activity IPAQ-SF Score	144±315	0 (0-120)	286±620	20 (0-290)	0.159
Walking IPAQ-SF Score	371±441	248 (0-495)	488±633	231 (42-619)	0.711
Total Physical Activity IPAQ-SF Score	596±668	396 (160-792)	1119±1504	342 (91-2050)	0.674

Changes in IPAQ-SF Scores according to Marital Status before and Six Months after Covid-19

According to marital status, the median IPAQ-SF scores before Covid-19 was 815±1287 for married participants and 1338±1655 for unmarried. The difference between this value was statistically significant (p=0.039). The difference between post-Covid-19 total IPAQ-SF scores (p=0.011) and walking IPAQ-SF scores (p=0.001) between married and unmarried participants was also statistically significant.

Changes in IPAQ-SF Scores according to the Use of Medication before and Six Months after Covid-19

The use of medication during the Covid-19 treatment process did not affect the IPAQ-SF scores after recovery (p>0.050).

IPAQ-SF Scores according to Covid-19 Symptoms Six Months after Covid-19

Changes in the IPAQ-SF scores of the participants after Covid-19, who had symptoms of dyspnea and fatigue during the period of Covid-19 are shown in Table 4.

DISCUSSION

This study involved one hundred and six participants with a diagnosis of Covid-19 to determine the changes in the physical activity levels before and six months after Covid-19 infection. Our findings indicated that vigorous-intensity physical activity levels were significantly decreased, and perceived fatigue during exercise was significantly increased between before and six months after Covid-19 infection.

The relationship between physical inactivity and Covid-19 has already been demonstrated in previous studies (14,15). Recently, it has been investigated that physical inactivity was significantly associated with the severity of Covid-19. Patients with lower levels of physical activity were affected by a more severe form of Covid-19 (14). Sallis et al. (2021) found that Covid-19 patients who were consistently inactive during the two years were more likely to be hospitalized, admitted to the intensive care unit, and physical inactivity was the strongest risk factor for severe Covid-19 outcomes (15). In addition, hospitalization of athletes with regular sports was 33% lower than the nonathletic group (16). It has also been reported that social distancing and long stays at home due to the closure of indoor and outdoor sports and recreation facilities

encourage less time spent on physical activity by the healthy, uninfected population. (8,17-22). Meiring et al (2021) reported that participants were not able to maintain their usual level of physical activity due to the closure of their gym facilities (19). The physical activity level during the period of social distancing was lower than prior to the pandemic period as stated in Puccinelli et al.'s study (21). As in the previous studies, Robinson et al (2021) indicated that a large number of participants reported negative changes in physical activity behavior (20). Tison (2020) also found that within 30 days of the Covid-19 declaration, there was a 27.3% decrease in mean steps in healthy adults due to social distancing (8). Therefore, it can be said that the Covid-19 pandemic has a negative impact on physical activity (21).

It is well-known that regular physical activity diminishes the risk of systemic inflammation by improving immune function (15), and has preventative effects on severe Covid-19 symptoms (23); however, even after a mild suspected Covid-19, individuals experience a prolonged recovery, particularly when trying to return to exercise (24). In this present study, participants became either less physically active or more sedentary six months after Covid-19. Previously, Lesser et al (2020) indicated that 40.5% of inactive healthy individuals became less active during the Covid-19 period (18). Castañeda-Babarro et al (2020) found that vigorous physical activities decreased by 16.8%, whereas sedentary time increased by 23.8% in healthy adults during Covid-19 confinement, either (17). If physical activity decreases even in healthy people, we think that this is inevitable in people who have been infected with Covid-19. Whereas physical activity levels were mostly insufficient before the Covid-19 pandemic in Turkey (25), Covid-19 infection has likely had more of the potentially unintended results of reduced physical activity levels.

Sincelong-term effects of Covid-19 are not currently known, several key concerns are highlighted to return to physical activity for Covid-19 patients. Potential risks includingviral myocarditis and thromboembolic complications (i.e pulmonary emboli); also the psychology of the person lead to caution when advising a return to physical activity after an asymptomatic period of infection at least seven days (24). Previously it has been shown that excessive amounts of prolonged, high-intensity exercise may impair immune function, while engaging in moderate activity may enhance immune function above sedentary levels (26). If the patient had common symptoms of Covid-19 like dyspnea and fatigue during the Covid-19 period (1), low-intensity activities such as breathing, stretching, and light strengthening activities, then further moderate-intensity physical activities can be suggested (24). In this current study, participants who had dyspnea during the period of Covid-19, did more moderate-intensity physical activity and walking six months after Covid-19, compared to those who did not. Possibly the main sources of physical activity (i.e physical activity guidelines and tools, social media) may have guided participants to return to physical activity after Covid-19 (24). Therewithal, it was stated that patients felt extremely fatigued when doing the smallest amount of exercise (24), or any physical activity resulted in the onset of fatigue (27). Our findings confirmed these statements that participants did lower vigorous-intensity physical activity after Covid-19, and perceived fatigue during exercise was significantly increased between before and six months after Covid-19, particularly in females. For this reason, gradual physical activity support should be provided by exercise specialists to those who experience dyspnea and/or fatigue after infection.

Gender and marital status differences in exercise habits have been already indicated with previous studies (28,29). It has been stated that females were generally more prone to do low-intensity activities (28). In a study by Castañeda-Babarro et al (2020), during Covid-19 confinement healthy men reported a higher decrease in vigorous activities (17). López-Bueno et al (2020) also showed reductions in weekly minutes of physical activity especially in healthy men (22). In this current study, it was observed that the infected male group showed significantly higher vigorous-intensity physical activity levels before Covid-19 as compared to the female group. Lower vigorous-intensity physical activity levels found in the female group is possibly due to a higher amount of housework physical activities (30). Dlugonski& Motl (2013) stated that unmarried mothers were less physically active when compared to married mothers and non-moth-

ers (29). In contrast to this study, our findings suggested that unmarried participants lead a more active lifestyle before and after Covid-19 possibly due to the lack of childcare (24).

The limitations of this article should be mentioned. Firstly, although the IPAQ short form is about the last seven days, due to the unprecedented situation, we asked participants to remember the level of their physical activity six months before the Covid-19 infection. Secondly, we used the shorter form of IPAQ instead of the longer form. Since we sent the questionnaire over the internet, we thought that it would be difficult for participants to read the longer form. Another limitation could be the cross-sectional design of the study since we did not conduct a comparative study with a randomized controlled group.

In conclusion, studies have shown that quarantine negatively affects the physical activity levels of healthy individuals. The results of this current study also showed that a particularly lower level of vigorous-intensity physical activity and fatigue during exercise were seen among Covid-19 infected patients. Using Covid-19 medications in the treatment process did not affect the level of physical activity after recovery. In the light of the literature, we recommend supporting gradually increased tailor-based exercise programs by health professionals in public health agencies, not only for protecting the individuals from Covid-19 outcomes, but also for returning to their pre-infection fitness levels. Since the long-term effects of Covid-19 are not currently known, studies with longer-term results are needed for further conclusions and recommendations.

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