



Relationship of Physical Activity Level with Quality of Life and General Health Among COVID-19 Recovered Individuals

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Abstract

Background: New coronavirus (COVID-19) has a major impact on the individual's physical activity level (PAL). The COVID-19 outbreak caused a decrease in the PAL, which might also affect the general health and quality of life (QoL).

Objectives: This study aimed to evaluate the relationship of PAL with QoL and general health (GH) among COVID-19 recovered individuals (CRI).

Methods: This is a descriptive-analytical study in which 890 CRI (men [n = 438] and women [n = 452]) were recruited from volunteers of different COVID-19 testing centers in Kermanshah Province. The participants were chosen by the multi-stage (Cluster) sampling techniques. The consent form and questionnaires (PAL, GH, and QoL) were filled out, and demographic information was evaluated. The short form of international physical activity questionnaire (IPAQ-SF), GHQ, and the short-form-SF-12 QoL questionnaires were used to appraise the PAL, GH, and QoL. Data were analyzed by independent *t*-test and Pearson correlation coefficient using SPSS version 24.0 at a significance level of $P < 0.05$.

Results: The findings of the present study showed that men and women with COVID-19 had inadequate PAL (876.11 ± 40.23 and 739.08 ± 27.02 , respectively), insufficient GH (50.13 ± 3.11 and 54.15 ± 4.28 , respectively), and poor QoL (22.02 ± 2.28 and 19.23 ± 1.87 , respectively). The results also showed that men had significantly higher PAL ($P = 0.035$), GH ($P = 0.047$), and QoL ($P = 0.023$) compared to women. Also, the results showed a significant inverse relationship between PAL and GH (men: $r = -0.589$, $P = 0.038$ and women: $r = -0.685$, $P = 0.029$) and a significant positive relationship between PAL and QoL (men: $r = 0.792$, $P = 0.018$ and women: $r = 0.824$, $P = 0.001$) in COVID-19 recovered individuals.

Conclusions: Considering the prevalence of COVID-19 and its negative impact on GH and QoL, maintaining adequate PAL can be considered as one of the effective strategies for improving QoL and GH.

Keywords: Exercise, Mental Health, COVID-19, Quality of Life, General Health

1. Background

After the identification of the first cases of coronavirus (COVID-19) in December 2019, the disease spread around the world quickly, leading to serious global challenges. However, extensive efforts have been made to find the best vaccine or treatment for COVID-19. Following hygiene principles and maintaining social distancing seem the best ways to prevent and control COVID-19 (1), which have caused changes to behavioral patterns and impeded the daily activity habits (1). Although these steps may be critical in reducing the prevalence of this disease, they will undoubtedly have long-term consequences on physical and general health (GH) (2, 3). These adverse health consequences are so significant that they require immediate

and comprehensive efforts to prevent and counteract the adverse effects of the COVID-19 pandemic on the quality of life (QoL) and GH of individuals.

In Kermanshah Province, according to the latest updates from Kermanshah University of Medical Sciences (March 1, 2021), of 7000 cases of infection, 650 died and 6450 recovered. Strengthening the immune system is one of the approaches to prevent COVID-19 until definitive treatment is found (4). Immune cells are easily affected by a variety of factors, including diet, hormone activity, and exercise (4, 5). Regular exercise reduces the risk of non-communicable diseases and viral and bacterial infections (6, 7). Exercise, in addition to having a profound effect on the phenotypic arrangement and functional capacity of the immune system, promotes persistent improve-

ment of the immune system by creating long-term health. The reaction of almost all immune cells in the bloodstream changes during and after exercise (8, 9). However, impaired exercise routines, increased stress and anxiety due to the COVID-19 outbreak, and staying home restrictions and quarantines attenuate the immune system and reduce the QoL and GH (10, 11).

2. Objectives

According to the results of studies, increasing physical activity level (PAL) is likely to improve GH and QoL. However, due to the prevalence of coronavirus and social restrictions, PAL has decreased among the general population. Therefore, this study aimed to investigate the relationship of PAL with QoL and GH among COVID-19 recovered individuals (CRI) in Kermanshah.

3. Methods

3.1. Study Design

According to the latest statistics from Kermanshah University of Medical Sciences until early February 2021, a total of 7,000 COVID-19 cases were approved by COVID-19 testing centers, 990 (men and women) of who were randomly selected from different COVID-19 testing centers in Kermanshah Province by the multi-stage (Cluster) sampling techniques. For this purpose, Kermanshah city was divided into five regions, including north, south, east, west, and center. The sample size was estimated at 168 CRI from each testing center in each region. Considering the possible loss of sample size, 30 more CRI were considered from each region, of which a total of 990 CRI (198 in each region) was randomly selected for the study. The selection method was based on the blocks of each area, and the individuals were studied based on the random division of the blocks. After the final investigations, 100 subjects were excluded from the study due to incomplete answers to the questionnaires, and finally, 890 subjects (438 men and 452 women) were analyzed. The inclusion criteria included: 20-70 years of age, approved COVID-19, finishing the recovery period of COVID-19 (21 days after COVID-19 test), and complete improvement (having no signs or symptoms). The subjects were informed of the confidentiality of the information and the purpose of the study. The Ethics Committee of Razi University of Kermanshah approved this study (IR.RAZI.REC.1399.064).

3.2. Tools

This study used self-reported questionnaires to collect data from the subjects.

3.2.1. Demographic Information

The demographics form on the first section consisted of seven questions about age, sex, weight, height, educational stage, employment, and marital status.

3.2.2. COVID-19 Symptoms

The second part was a self-assessment of COVID-19 symptoms, which included three categories of COVID-19 symptoms based on the World Health Organization. These symptoms, along with the approved COVID-19 test, complemented the diagnosis (considering the false-negative and false-positive test results). The first category included questions about less-common COVID-19 symptoms, including bruising and pain, sore throat, diarrhea and vomiting, swelling, headache, loss of smell or taste, skin rash, or pale fingers. The second category was related to questions about common COVID-19 symptoms, such as fever, dry cough, and fatigue, and the third category was related to questions about serious COVID-19 symptoms, that is, pain or pressure on the chest, difficulty breathing, or shortness of breath, and loss of the ability to move or speak.

3.2.3. PAL

Physical activity level was assessed using the short edition of the International Physical Activity Questionnaire (IPAQ-SF). The questionnaire was sent electronically to the subjects and they were asked to answer all the questions carefully, giving each four days to complete the questionnaire (12). This questionnaire consisted of seven questions that were organized into the four sections of intense PA, moderate PA, walking, and sitting (13). The intensity and duration of PA were questioned for a week, and activities lasting more than 10 minutes were recorded (12, 13). Intense PA included heavy weight training, prolonged aerobic exercise, and intense cycling and running. Moderate PA included lightweight training, regular steady-state cycling, and tennis. Walking included walking at home, at work, leisure time walking and planned walking. Sitting was considered the amount of time spent sitting at home, at work, reading, watching TV, and meeting friends (14, 15). The validity and reliability of the questionnaire for the Iranian population have been confirmed by Kelishadi et al. (16). Based on the scoring method of the IPAQ questionnaire, the individual's PAL during the past week is calculated in terms of met/minute/week; walking intensity was

3.3 METS, moderate PA 4 METS, and intense PA were considered 8 METS. To calculate the total amount of PAL, the amount of walking (METS. min. day), the amount of moderate PA (METS. min. day), and the amount of intense PA (METS. min. day) were measured during the past week (17). Physical activity level scores below 600 were considered as low, between 600 to 3000 as moderate, and above 3000 as high.

3.2.4. QoL

The QoL was determined using short-form-SF-12 QoL questionnaire, which consists of 12 questions in eight subscales about physical, mental, and emotional health and status with a score ranging from 0-100 and a higher score indicating a better QoL. Rohani et al. evaluated the adaptability and validity of this questionnaire for the Iranian population (18).

3.2.5. GH Questions

The GHQ-28 questionnaire was considered to determine GH among the subjects. This questionnaire was developed in 1972 by Goldberg for screening mental disease (18). The 28-item model of this questionnaire has four subscales, including physical symptoms, anxiety and insomnia, depression, and social functioning.

The questionnaire is rated based on a 4-point Likert scale, with much lower than the regular level scored zero, lower than the regular level scored one, the regular level scored two, and more than the regular level scored three. The maximum score in each subscale will be 21, and the total score will range from 0 to 84, with a higher score showing lower GH (19). Various studies have evaluated the adaptability and validity of this questionnaire for the Iranian population (20, 21).

3.3. Statistical analysis

The Shapiro-Wilk's test was run for evaluating the normality of distribution, the independent samples *t*-test was used to compare the means of variables between men and women, and the Pearson's correlation coefficient test was used to evaluate the relationship between variables using SPSS version 24 at a significant level of $P < 0.05$.

4. Results

The results of demographic characteristics, PAL, QoL, and GH are presented in Table 1. As the results show, PAL, QoL, and GH in women were lower than in men (Table 1).

Also, Table 2 presents the frequency and percentage of symptoms in CRI in three categories (less-common, more-common, and serious symptoms). Based on the results, almost all subjects reported having all of the symptoms in the first (less-common symptoms; 49.09% of men and 44.25% of women) and second categories (common symptoms; 36.53% of men and 41.82% of women), while difficulty breathing was the most reported symptom in the third category (30.14% of men and 37.38% of women).

The results of the present study showed a significant inverse relationship between PAL and GH and a significant positive relationship between PAL and QoL in both men and women who recovered from COVID-19. In other words, increasing PAL improves GH and QoL in men and women recovered from COVID-19 (Table 3).

5. Discussion

This study investigated the relationship of PAL with QoL and GH among men and women recovered from COVID-19. The results of the present study showed that CRI had inadequate PAL and insufficient levels of GH. The results also indicated a significant inverse relationship between PAL and GH in CRI. Considering that lower GHQ scores mean better GH. Furthermore, the results of the study showed that subjects with lower GH levels had higher PAL. Based on the results of studies, increasing PAL among CRI can improve GH among men and women through positively affecting GH components (physical symptoms, anxiety, insomnia, social dysfunction, and depression) (20, 21). However, our knowledge of the impact of PA on improving the GH of CRI is limited due to the novelty of the subject.

In line with the present study, the results of studies conducted on other infectious diseases indicated that adequate PAL could improve GH (22, 23). Besides, the results of the present study showed that COVID-19 recovered men had higher PAL than women. This might probably explain the better GH in men. Although the exact mechanism of exercise-induced changes in GH is not fully understood, the effect of exercise in promoting and enhancing GH is clear. The benefits of PA in improving GH in CRI may be related to exercise-induced improvements in the immune system (24, 25). In general, it can be concluded that maintaining PAL might have positive effects on GH.

The alteration of almost all bloodstream immune cell behaviors during and after exercise is well established. According to studies, the positive effect of regular exercise

Table 1. The Demographic Characteristics, Physical Activity Level, Quality of Life, and General Health Among Subjects ^a

Variable	Men (n = 438)	Women (n = 452)	P-Value
Age (y)	43.10 ± 12.11	41.20 ± 9.08	0.051
Height (cm)	177.02 ± 8.06	167.01 ± 6.04	0.001 ^b
Weight (kg)	83.01 ± 12.02	78.04 ± 11.03	0.011 ^b
BMI (kg/m ²)	26.49 ± 3.03	27.96 ± 4.09	0.031 ^b
PAL (MET)	876.11 ± 40.23	739.08 ± 27.02	0.035 ^b
QoL (Score)	22.02 ± 2.28	19.23 ± 1.87	0.023 ^b
GH (Score)	50.13 ± 3.11	54.15 ± 4.28	0.047 ^b
Married	357 (83.78)	385 (85.17)	0.001 ^b
Single	81 (16.22)	67 (14.83)	0.001 ^b
Education rate			
High school	84 (19.17)	80 (17.70)	0.062
Diploma	116 (26.48)	106 (23.45)	0.045 ^b
Associate Degree	64 (14.62)	66 (14.61)	0.331
BSc	136 (31.05)	157 (34.74)	0.001 ^b
MSc	33 (7.54)	39 (8.62)	0.059
PhD	5 (1.14)	4 (0.88)	0.463
Job Status			
Employee	173 (39.49)	147 (32.53)	0.001 ^b
Unemployed	123 (28.08)	191 (42.25)	0.001 ^b
Student	99 (22.61)	82 (18.14)	0.018 ^b
Retired	21 (4.80)	6 (1.32)	0.012 ^b
Part-time	22 (5.02)	26 (5.76)	0.331

^aValues are expressed as No. (%).^bIndicate significant differences between groups

on chronic inflammation-related diseases is due to the reduction of abdominal fat and obesity and the subsequent anti-inflammatory effects (26). On the one hand, it increases the immune vaccine response, reduces the number of worn and aged T cells (27), increases T cell proliferation, decreases circulating inflammatory cytokines levels, increases neutrophil phagocytic activity, cytotoxic activity, and the production of muscle cytokines such as IL-12 (27, 28). On the other hand, one of the theoretical models for psychosocial changes (relief or relaxation) due to PA is probably the activation of the central nervous system and the secretion of endorphins. Releasing endorphins following PA could impact the blood circulation, basal metabolic rate, mood, and excess calories usage (29). Also, Kandola et al. (2019) believed that COVID-19 patients are more prone to depression which prevents them from engaging in PA (30). Additionally, due to the widespread prevalence of COVID-19, group PA is not possible, and CRI are suggested to en-

gage in home-based exercise in their daily routine to improve their GH as well as immune system by increasing their PAL.

The results of the present study also showed a significant positive relationship between PAL and QoL among patients with COVID-19 (men and women). In other words, an increase in the QoL was observed with increasing PAL in CRI. The results also showed a significant difference in QoL between men and women. The higher PAL in men is probably one of the reasons for the higher QoL in COVID-19 recovered men. However, it should be noted that both COVID-19 recovered men and women had poor QoL. In the same vein, various studies have observed that exercise increases the QoL, especially in vulnerable individuals (31, 32). One of the possible mechanisms of the effect of exercise on improving the QoL of CRI is through reducing stress and anxiety (31). Participating in PA has been shown to be associated with physical and psychological benefits due to reducing

Table 2. The Frequency and Percentage of COVID-19 Symptoms Among COVID-19 Recovered Individuals During Their Infection ^a

Categories	Men (438)	Women (452)	P-Value
Less-common symptoms			
Soreness and pain	47 (10.73)	55 (12.17)	0.048 ^b
Sore throat	40 (9.13)	37 (8.19)	0.281
Diarrhea and Vomiting	24 (5.47)	38 (8.41)	0.027 ^b
Inflation	8 (1.82)	12 (2.66)	0.062
Headache	76 (17.36)	79 (17.47)	0.286
Loss of smell or taste	21 (4.80)	26 (5.75)	0.064
Pimples or paleness of the fingers and toes	7 (1.60)	5 (1.10)	0.341
All	215 (49.09)	200 (44.25)	0.023 ^b
More-common symptoms			
Fever	106 (24.21)	122 (26.99)	0.021 ^b
Dry cough	89 (20.32)	76 (16.81)	0.036 ^b
Fatigue	83 (18.94)	65 (14.38)	0.001 ^b
All	160 (36.53)	189 (41.82)	0.001 ^b
Serious Symptoms			
Difficulty breathing	132 (30.14)	169 (37.38)	0.001 ^b
Chest pain or pressure	117 (26.71)	103 (22.79)	0.025 ^b
Losing the Ability to Move or Speak	69 (15.75)	66 (14.60)	0.279
All	26 (5.94)	25 (5.53)	0.336
None	94 (21.46)	89 (19.70)	0.057

^aValues are expressed as No. (%).^bIndicate significant differences between groups.**Table 3.** The Relationship of PAL with QoL and GH Among Subjects

PAL	GH	QoL
Gender		
Men	$r = -0.589, P = 0.038$ ^a	$r = 0.792, P = 0.018$ ^a
Women	$r = -0.685, P = 0.029$ ^a	$r = 0.824, P = 0.001$ ^a

^aSignificant relationship with PAL among subjects; using the Pearson's Correlation Coefficient test.

the risk of illness by improving physical fitness and mental stimulation (33, 34). However, it is still not clear which one might affect the other. For example, improved QoL might arise from engaging in PA considering the association between QoL and PA. These might occur due to the biological mechanisms (increased endorphin levels as a result of PA), increased social participation (group training or outdoor activities), and enhanced self-esteem (boding the positive perceptions). Further studies are desired to comprehend the exact relationship between PA and QoL.

The limitation of the present study was the inability to measure physical fitness level with physical tests due to the

prevalence of COVID-19.

5.1. Conclusion

In general, the findings of the present study showed that men and women with COVID-19 had inadequate PAL, insufficient GH, and poor QoL. The low GH and QoL of CRI in the present study might be due to low PAL and increased stress and anxiety caused by COVID-19. Therefore, exercising regularly and maintaining adequate PAL along with following hygiene protocols are among the effective approaches to increase the QoL and GH in CRI.

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Footnotes

Authors' Contribution: Rastegar Hoseini participated in designing the study. Mahnaz Azmodeh participated in manuscript writing and data collection. Ehsan Amiri participated in data analysis. All authors read and approved the final manuscript.

Conflict of Interests: The authors declare no competing interests.

Data Reproducibility: The data presented in this study are openly available in one of the repositories or will be available on request from the corresponding author by this journal representative at any time during submission or after publication. Otherwise, all consequences of possible withdrawal or future retraction will be with the corresponding author.

Ethical Approval: This study was approved by the Ethics Committee of Razi University of Kermanshah (IR.RAZI.REC.1399.064).

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Informed Consent: The written informed consent was obtained from the participants first - degree relatives or legal guardians.

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