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EFFECT OF COVID-19 ON PAIN, FALL FREQUENCY, FEAR OF FALLING, AND PHYSICAL ACTIVITY LEVEL IN OLDER PEOPLE: A CROSS-SECTIONAL STUDY

ORIGINAL ARTICLE

ABSTRACT

Purpose: People who have recovered from COVID-19 may experience a range of symptoms. These symptoms are linked to negative changes in pain, falls, fear of falling, and physical activity. The current study aimed to investigate the effect of COVID-19 on pain, fall frequency, fear of falling, and physical activity level in older people, as well as identify associated factors with these variables.

Methods: Participants were divided into two groups for this cross-sectional study: COVID-19 (n=48) and healthy control (n=66). Pain, number of falls, fear of falling, and physical activity level of the participants were assessed. Multiple linear regression analysis was also used to identify factors associated with these variables. Participants were also asked about their demographics, illnesses, post-COVID-19 symptoms, smoking habits, who they lived with, how long they had been infected with COVID-19, hospitalization due to COVID-19, and the doses of the vaccine.

Results: Pain, fatigue, and cognitive impairment were found to be significantly more prevalent in the COVID-19 group (p=0.001, p=0.021, p=0.011, respectively). When compared to the control group, the COVID-19 group showed worse results in terms of pain intensity, the number of falls, fear of falling, and physical activity level (p=0.009, p=0.030, p=0.005, p<0.001, respectively). It was found that COVID-19 infection significantly predicted pain intensity and physical activity level (β=-0.273, p=0.007; β=0.416, p=0.003, respectively).

Conclusion: Older adults who have had COVID-19 experience more pain, falls, fear of falling, and reduced physical activity compared to their peers. COVID-19 affects pain severity and physical activity in older individuals after recovery. It is important to assess long-term symptoms, falls, and physical activity in older adults who have had COVID-19 and provide necessary treatments.

Keywords: Aging, COVID-19, Falling, Pain, Physical Activity

COVID-19'UN YAŞLILARDA AĞRI, DÜŞME SIKLIĞI, DÜŞME KORKUSU VE FİZİKSEL AKTİVİTE SEVİYESİ ÜZERİNE ETKİSİ: KESİTSEL BİR ÇALIŞMA

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ÖZ

Amaç: COVID-19'a yakalanmış kişiler hastalık sonrası çeşitli semptomlara sahip olabilirler. Bu semptomlar ağrı, düşme, düşme korkusu ve fiziksel aktivite seviyesindeki olumsuz değişiklikler ile ilişkilidir. Bu çalışmada COVID-19'un yaşlılarda ağrı, düşme sıklığı, düşme korkusu ve fiziksel aktivite seviyesi üzerine etkisini araştırmak ve bu değişkenlerle ilişkili faktörleri belirlenmek amaçlanmıştır.

Yöntem: Katılımcılar bu kesitsel çalışma için COVID-19 (n=48) ve sağlıklı kontrol (n=66) olmak üzere iki gruba ayrıldı. Katılımcıların ağrı, düşme sayısı, düşme korkusu ve fiziksel aktivite seviyeleri değerlendirildi. Bu faktörlerle ilişkili değişkenler çoklu lineer regresyon analizi kullanılarak belirlendi. Ayrıca katılımcıların demografik bilgileri, hastalık bilgileri, COVID-19 sonrası semptomları, sigara içme durumları, kimle birlikte yaşadıkları, COVID-19 hastalığına yakalandıktan sonra geçen süre, COVID-19 nedeniyle hastaneye yatış durumları ve COVID-19 aşı dozları sorgulandı.

Sonuçlar: Ağrı, yorgunluk ve bilişsel bozuklukların COVID-19 grubunda anlamlı şekilde daha yaygın olduğu görüldü (p=0,001, p=0,021, p=0,011, sırasıyla). COVID-19 grubu kontrol grubuyla karşılaştırıldığında ağrı şiddeti, düşme sayısı, düşme korkusu ve fiziksel aktivite seviyesinde daha kötü sonuçlar gösterdi (p=0,009, p=0,030, p=0,005, p<0,001, sırasıyla). COVID-19'un ağrı şiddeti ve fiziksel aktivite seviyesini önemli ölçüde etkileyen bir faktör olduğu tespit edildi (β=-0,273, p=0,007; β=0,416, p=0,003, sırasıyla).

Tartışma: COVID-19 geçirmiş yaşlı bireylerde ağrı, düşme sıklığı, düşme korkusu ve fiziksel aktivite seviyesi kendi yaş grubundaki kişilere göre daha kötüdür. Hastalık sonrası dönemde COVID-19, yaşlılarda ağrı şiddeti ve fiziksel aktivite seviyesini etkilemektedir. COVID-19'a yakalanan yaşlı bireylerin hastalık sonrası uzun süreli semptomlar, düşme ve fiziksel aktivite açısından değerlendirilmesi ve gerektiğinde uygun tedavinin uygulanması önemlidir.

Anahtar Kelimeler: Yaşlanma, COVID-19, Düşme, Ağrı, Fiziksel Aktivite

INTRODUCTION

The outbreak of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has become a global health problem, starting in the city of Wuhan, China, during the latter part of 2019 (1). The World Health Organization has named the outbreak COVID-19 and declared it a global pandemic as of March 2020 (2).

Following an infection with COVID-19, the majority of individuals encounter symptoms in the early stages, with these symptoms and their repercussions potentially persisting for an extended period (3). There are a variety of symptoms following COVID-19, including respiratory, cardiovascular, neurological, psychological, and musculoskeletal symptoms (4).

After the COVID-19 infection, pain has become one of the most common symptoms. Pain after COVID-19 can occur in various forms, such as chest pain, headaches, abdominal pain, and muscle and joint pain (5). The primary source of pain caused by COVID-19 is the inflammatory response. The inflammatory response causes an increase in pro-inflammatory cytokines by activating the immune system (6). However, it has been demonstrated that pain can persist even after the infection has ended (7).

Another condition caused by COVID-19 symptoms is a reduction in physical activity level (8). Individuals recovering from COVID-19 may encounter respiratory problems, loss of muscle mass, nerve damage, pain, fragility, or worsening of existing medical conditions due to persistent symptoms affecting systems such as the cardiovascular, respiratory, and musculoskeletal systems. Consequently, the occurrence of falls may increase during the post-COVID-19 period, posing a significant risk to the elderly. This leads to an elevated fear of falling and a decrease in physical activity levels (9). Elderly individuals who have previously experienced falls may suffer from various adverse health outcomes, including fractures and other morbidities (10). Research has shown that these fall-related health issues have long-term effects on physical condition and functioning (11). Approximately one-third of individuals aged 65 years or older living in the community experience at least one fall per year (4). Older adults may develop a fear of falling, which is one of the most significant effects of falls. The restriction of activity resulting from the fear of falling can lead to physical deconditioning, alterations in gait and balance, loss of muscle mass and strength, as well as the emergence of frailty and impairment (12). Additionally, it has been observed that fear of falling is linked to mortality and cognitive impairment (13). Fear of falling has also been identified as a significant risk factor associated with a decrease in physical activity levels (10,14,15) and fall risk (14)**.** Tinetti et al. discovered that fifty percent of all individuals who experienced falls and expressed fear admitted to evading activities that were previously executed (16). Another study found that fear was linked to lower attendance at social events, which serves as a critical indicator of the functioning of older individuals in the community (17). Physical condition deteriorates with advancing age and can lead to disabilities. Furthermore, it has been discovered that decreased function is linked to a higher risk of falling and a higher fear of falling (10). The decline in physical activity levels has also been exacerbated by limitations on movement to prevent symptoms like pain, dyspnea, and fatigue (18).

At the beginning of the pandemic, the primary goal was to prevent deaths, and the older population faced a higher risk of death concerning COVID-19 (19). However, it is now known that people who survive COVID-19 confront an increased risk of experiencing various symptoms over a long period after the illness (4). Also, the older population is one of the groups with the highest risk for complications following COVID-19 (20). Understanding the long-term conditions that should be taken into account in older adults requires the identification of these effects and associations with COVID-19. Furthermore, comparing the symptoms observed after COVID-19 with those observed in the healthy population of the same age group can provide a clearer understanding of the adverse effects of the disease, as the general older population may also encounter such symptoms. The purpose of this

study was to examine how COVID-19 affected the pain, falls, fear of falling, and physical activity of older participants. Additionally, the associations between these parameters were investigated.

METHODS

Study Design

This cross-sectional study was conducted with a total of 114 people from March 2023 to May 2023, with people aged 65 or older who resided in Kırklareli province, Turkey. Before assessments, all participants in the trial signed an Informed Consent Form. This study was performed in line with the principles of the Declaration of Helsinki. Ethical approval was obtained from the Kırklareli University Scientific Research and Publication Ethics Committee (Date: 23.01.2023/ No: E-35523585-302.99-75492). This study registered on 10.04.2023 with the number NCT05808348 to the ClinicalTrials.gov.

Participants

Depending on whether or not the individuals had contracted a COVID-19 infection within a one year, they were separated into two groups: the COVID-19 group and the control group.

To be included in the study, the following criteria needed to be met:

1. The participants had to be aged 65 or older.

2. The individuals needed to demonstrate cooperation by comprehending the questions posed and providing appropriate responses.

On the other hand, the following criteria were used to exclude individuals from the study:

1. Individuals with significant hearing impairments. 2. Individuals with substantial vision impairments.

Measurements

Participants were asked about their demographic characteristics, pain, frequency of falls, fear of falling, physical activity level, information about their illnesses, post-COVID-19 symptoms, smoking habits, who they lived with, the time they had been infected with COVID-19, hospitalization due to COVID-19, and the doses of the vaccine in the last year. Face-to-face interviews with participants were used for the assessments.

The Numerical Pain Rating Scale (NPRS) was used to evaluate participants' pain, the Falling Efficacy Scale-International (FES-I) to measure fear of falling, and the Baecke Physical Activity Questionnaire (BPAQ) to assess physical activity level. All questionnaires were used with the required permissions.

Pain measurement

The NPRS was used to assess the intensity of the pain (ICC = 0.67–0.96) (21,22). The participants were instructed to rate their level of pain from zero for the least painful experience to ten for the most painful experience (23). Participants were also recorded in the survey form by asking for the duration of their pain.

Fear of falling measurement

The FES-I was used to measure the fear of falling. Using a Likert-type scale with ratings from 1 to 4, the FES-I measures people's fears of falling during a total of 16 activities in daily life (24). The person's fear of falling increases as the overall score rises. The Turkish validity and reliability study was conducted by Ulus et al. (2012) and found a cut-off score of 24 for fear of falling (ICC: 0.97-0.99) (25).

Physical activity level measurement

The BPAQ was used to evaluate physical activity levels. In 2021, the Turkish validity and reliability study of the BPAQ was conducted by Yazıcı et al. (ICC:0.98-0.99) (26). The survey consists of three sections that evaluate work, sports, and leisure activities. Questions are answered by thinking about activities over the past 12 months. The scores of the three sections are determined by collecting and subtracting specified quantifiers (work and leisure time) or by splitting (sports) the scores obtained by dividing each section by the number of questions. Higher scores indicate higher physical activity levels (26,27).

Statistical analysis

The Statistical Package for Social Sciences (SPSS) version 22.0 (New York, 2013) statistical analysis program was used to analyze the data.

Table 1. Descriptive Characteristics of the Participants

Descriptive Characteristics	Total (n=114)	COVID-19 Group (n=48)	Control Group (n=66)	p (%95 CI)
Age (year) (X±SD)	71±5	70±4	71±5	0.536 (-2.49-1.30)[a]
Sex [n (%)]				0.984[b]
Female	45 (39.5)	19 (39.6)	26 (39.4)	
Male	69 (60.5)	29 (60.4)	40 (60.6)	
Height (cm) (X±SD)	166±8	167±8	166±8	0.484 (-1.99-4.18)[a]
Weight (kg) (X±SD)	76±16	74±15	77±16	0.356 (-8.68-3.14)[a]
BMI (kg/m²) (X±SD)	27.23±4.53	26.41±4.14	27.75±4.72	0.118 (-3.02-0.34)[a]
Illnesses [n (%)]				
Diabetes	21 (18.4)	10 (20.8)	11 (16.7)	0.571[b]
Hipertension	46 (40.4)	19 (39.6)	27 (40.9)	0.887[b]
Otoimmune Disease	21 (18.4)	10 (20.8)	11 (16.7)	0.571[b]
High Cholesterol	13 (11.4)	7 (14.6)	6 (9.1)	0.362[b]
Thyroid Disease	14 (12.3)	5 (10.4)	9 (13.6)	0.605[b]
Heart Disease	16 (14.0)	9 (18.8)	7 (10.6)	0.216[b]
Chronic Kidney Disease	10 (8.8)	6 (12.5)	4 (6.1)	0.230[b]
Chronic Pulmonary Disease	11 (9.6)	3 (6.3)	8 (12.1)	0.295[b]
Cerebrovascular disease	5 (4.4)	1 (2.1)	4 (6.1)	0.306[b]
Symptoms [n (%)]				
Pain	50 (43.9)	30 (62.5)	20 (30.3)	0.001[**, b]
Fatigue	43 (37.7)	24 (50)	19 (28.8)	0.021[*, b]
Dyspnea	37 (32.5)	20 (41.7)	17 (25.8)	0.073[b]
Cough	19 (16.7)	7 (14.6)	12 (18.2)	0.611[b]
Cognitive Disorder	19 (16.7)	13 (27.1)	6 (9.1)	0.011[*, b]
Smell and Taste Disorders	11 (9.6)	4 (8.3)	7 (10.6)	0.685[b]
Smoking [n (%)]				0.321[b]
Yes	48 (42.1)	19 (39.6)	29 (43.9)	
Former User	15 (13.2)	9 (18.8)	6 (9.1)	
No	51 (44.7)	20 (41.7)	31 (47.0)	
Living With Someone [n (%)]				0.940[b]
Child	11 (9.6)	5 (10.4)	6 (9.1)	
Spouse	78 (68.4)	32 (66.7)	46 (69.7)	
Alone	25 (21.9)	11 (22.9)	14 (21.2)	
Time Elapsed Since COVID-19 Disease (Month) (X±SD)		9±2	-	-
Hospitalization Due to COVID-19 [n (%)]				-
Yes		5 (10.4)	-	
No		42 (89.6)	-	
Number of COVID-19 Vaccine Doses [n (%)]				0.210[b]
0	10 (8.8)	6 (12.5)	4 (6.1)	
1	-	-	-	
2	25 (21.9)	9 (18.8)	16 (24.2)	
3 or higher	79 (69.3)	33 (68.7)	46 (69.7)	
VAS (X±SD)	4.81±1.70	5.31±1.63	4.05±1.68	0.009 (0.33-2.19)[**, a]
Pain Duration (Month) [n (%)]				0.615[b]
<12	23 (20.2)	13 (27.1)	10 (15.2)	
>12	30 (26.3)	19 (39.6)	11 (16.7)	
Number of Falls in One Year [n (%)]				0.030[*, b]
0	77 (67.5)	26 (54.2)	51 (77.3)	
1	24 (21.1)	15 (31.3)	9 (13.6)	
2 or higher	13 (11.4)	7 (14.6)	6 (9.1)	
FES-I (X±SD)	29.52±11.45	33.24±12.61	26.92±9.84	0.005 (2.00-10.71)[**, a]
BPAQ (X±SD)	5.50±1.54	4.88±1.34	5.95±1.53	<0.001 (-1.61-(-0.52))[***, a]

*p<0.05

**p<0.01

***p<0.001

n: number of participants, CI: confidence interval, X: mean, SD: standard deviation, %: per cent, BMI: body mass index, VAS: Visual Analogue Scale (range 0-10), FES-I: Falls Efficacy Scale-International (range 16-64), BPAQ: Baecke Physical Activity Questionnaire (range 3-15)

[a] Independent-samples t test

[b] x^2 test

Table 2. Multiple Linear Regression for Factors Associated with Pain Intensity

Predictor	B	SE	β	t	p	95% CI	
						LL	UL
COVID-19	-0.969	0.345	-0.273	-2.810	0.007**	-1.66	-0.27
Age	-0.016	0.034	-0.046	-0.472	0.639	-0.08	0.52
Sex	-0.397	0.306	-0.111	-1.296	0.202	-1.01	0.22
Living Alone	0.063	0.262	0.030	0.239	0.812	-0.46	0.59
Number of Falls	0.984	0.238	0.539	4.135	<0.001***	0.50	1.46
Fear of Falling	0.036	0.025	0.233	1.400	0.168	-0.01	0.08
Physical Activity Level	0.308	0.115	0.271	2.677	0.010*	0.07	0.54

*p<0.05

**p<0.01

***p<0.001

R=.824, R^2=.678

F(7, 45)=13.549, p<0.000

The normal distribution of the variables was assessed using kurtosis-skewness values. Percentage (%) for categorical variables and mean and standard deviation (X±SS) for numerical variables were used. Participants were divided into those who had COVID-19 disease and those who did not demonstrate potential effects of the condition. The Student t-test was used for numerical data, and the chi-square test was used for categorical data in the between-group comparisons. The results of the association between the variables were analyzed using the multiple linear regression analysis method. In regression analysis, the R^2 value was used to define the regression model. The R^2 value shows how much the model explains the variance in the dependent variable. In case of missing data, participants were excluded from the study. The statistical significance level was accepted as p<0.05.

RESULTS

Both the COVID-19 group (n=48) and the healthy control group (n=66) had a higher percentage of male participants than female participants. Hypertension was the most prevalent disease in both groups. Pain, fatigue, and cognitive impairment symptoms were found to be significantly higher in the COVID-19 group (p=0.001, p=0.021, and p=0.011, respectively). In the COVID-19 group, five (10.4%) people had previously been hospitalized due to the COVID-19 disease.

Pain severity, number of falls, fear of falling, and physical activity level differed significantly, and the COVID-19 group showed worse results in all of these parameters than the control group (p=0.009, p=0.030, p=0.005, p<0.001, respectively). Notably, almost half of the COVID-19 group experienced at least one fall within a single year (45.8%) whereas this percentage was considerably lower among the older group who had not encountered COVID-19 (22.7%) (Table 1).

A statistically significant regression equation was discovered for the pain intensity (F(7, 45)=13.549, p<0.000), with an R^2 of 0.678. It was found that having caught COVID-19, the number of falls, and physical activity level significantly predicted pain intensity (β=-0.273, p=0.007; β=0.539, p<0.001; β=0.271, p=0.010, respectively) (Table 2).

The overall regression for the number of falls demonstrated statistical significance (F(7, 45)=14.663, p<0.000), R^2=0.695. Pain intensity and fear of falling were significant predictors of the number of falls (β=0.511, p<0.001; β=0.429, p=0.007, respectively) (Table 3).

The overall regression for the fear of falling was statistically significant (F(7, 45)=19.514, p<0.000), R^2=0.752. Living alone and the number of falls added statistically significantly to the prediction (β=0.407, p<0.000; β=0.349, p=0.007, respectively) (Table 4).

Table 3. Multiple Linear Regression for Factors Associated with Number of Falls

Predictor	B	SE	β	t	p	95% CI	
						LL	UL
COVID-19	0.292	0.195	0.151	1.501	0.140	-0.10	0.68
Age	-0.002	0.018	-0.012	-0.129	0.898	-0.03	0.03
Sex	-0.022	0.166	-0.011	-0.132	0.895	-0.35	0.31
Living Alone	-0.001	0.140	0.000	-0.004	0.099	-0.28	0.28
Pain Intensity	0.280	0.068	0.511	4.135	<0.001***	0.14	0.41
Fear of Falling	0.036	0.013	0.429	2.814	0.007**	0.01	0.06
Physical Activity Level	-0.090	0.065	-0.144	-1.390	0.171	-0.22	0.04

*p<0.05

**p<0.01

R=.834, R^2=.695

$F_{(7, 45)}$=14.663, p<0.000

Table 4. Multiple Linear Regression for Factors Associated with Fear of Falling

Predictor	B	SE	β	t	p	95% CI	
						LL	UL
COVID-19	-2.347	2.119	-0.101	-1.107	0.274	-6.61	1.92
Age	0.296	0.190	0.130	1.562	0.125	-0.08	0.67
Sex	1.367	1.780	0.058	0.768	0.446	-2.21	4.95
Living Alone	5.611	1.253	0.407	4.479	<0.001***	3.08	8.13
Pain Intensity	1.173	0.838	0.179	1.400	0.168	-0.51	2.86
Number of Falling	4.167	1.481	0.349	2.814	0.007**	1.18	7.14
Physical Activity Level	-0.786	0.702	-0.106	-1.119	0.269	-2.19	0.62

**p<0.01

***p<0.001

R=.867. R^2=.752

$F_{(7, 45)}$=19.514, p<0.000

A significant regression equation for the physical activity level was found ($F_{(7,45)}$=4.242, p=0.001), with an R^2 of 0.398. The contraction of COVID-19, age, and pain intensity had an impact on physical activity level (β=0.416, p=0.003; β=-0.302, p=0.020; β=0.507, p=0.010, respectively) (Table 5).

DISCUSSION

This study examined how COVID-19 affected older persons' pain intensity, number of falls, fear of falling, and physical activity level. It also investigated how pain, number of falls, fear of falling, and physical activity level affect each other. The study revealed that the COVID-19 group experienced higher pain, fatigue, and cognitive impairment symptoms, as well as more pain intensity. Moreover, this group experienced more falls and had a greater fear of falling while engaging in less physical activity compared to the control group over the previous year.

The number of falls was identified as the most important variable in the explanation of the pain intensity. Contracting COVID-19 was identified as a prominent factor contributing to pain. Another factor that was shown to explain pain intensity was physical activity level. Pain intensity and fear of falling were the variables that specifically contributed to the explanation of the number of falls. The number of falls and living alone were significant explanatory variables for fear of falling. Lastly, contracting COVID-19, age, and pain

Table 5. Multiple Linear Regression for Factors Associated with Physical Activity Level

Predictor	B	SE	β	t	p	95% CI	
						LL	UL
COVID-19	1.295	0.406	0.416	3.186	0.003[**]	0.47	2.11
Age	-0.092	0.038	-0.302	-2.412	0.020[*]	-0.17	-0.01
Sex	0.098	0.375	0.031	-0.262	0.794	-0.65	0.85
Living Alone	0.099	0.315	0.054	0.316	0.754	-0.53	0.73
Pain Intensity	0.446	0.167	0.507	2.677	0.010[*]	0.11	0.78
Number of Falling	-0.458	0.329	-0.285	-1.390	0.171	-1.12	0.20
Fear of Falling	-0.034	0.031	-0.257	-1.119	0.269	-0.09	0.02

*p<0.05

**p<0.01

R=.631. R^2=.398

$F_{(7, 45)}$=4.242, p=0.001

intensity were identified as unique variables that explained the level of physical activity.

Symptoms after COVID-19

Several symptoms may persist for a long time after COVID-19 infection, particularly among older people (28). However, the older population that has not had COVID-19 may also experience problems such as pain, fatigue, and dyspnea due to various diseases (29). According to a study, the three most common symptoms of COVID-19 infection in adults over 65 are pain, fatigue, and dyspnea (29). Similarly, these symptoms were the most common in our study. In the COVID-19 group, pain was present in more than half of the patients and fatigue in half of the patients. Although the COVID-19 group had significantly more frequent pain, fatigue, and cognitive impairment compared to the control group, there were no significant differences between the groups in terms of dyspnea. It was believed that decreased physical activity to ease the discomfort associated with dyspnea may have contributed to this condition. Even though people weren't reported to have dyspnea, they may have managed it by engaging in less physical activity. In comparison to the pain experienced during the infection, the level of pain tends to be lower during the long-term post-COVID-19 period (18,30). However, long-term and chronic pain can lead to serious issues for some people. In a study conducted by Korkut and Ülker with people who had experienced COVID-19, 37.1%

of participants found that the pain continued, and the severity of the pain after COVID-19 was 3.81±3.00 (30). In the study of Bilgin et al., the participants had an average of 4.04±2.33 pain intensity (18). In our study, the pain intensity of COVID-19 subjects was 5.31±1.63. The mean age of the participants in the other studies was significantly lower than that of our study. Due to illnesses and other problems that worsen with age, the severity of pain may be higher in the older population. When considered in this context, it was thought that the reason for the heightened pain severity in our study compared to other studies was that only people aged 65 or older were included in our research. When pain intensity was compared between the groups, the COVID-19 group exhibited considerably higher pain intensity than the control group. The findings indicate that COVID-19 infection may have increased the prevalence of symptoms of pain, fatigue, and cognitive impairment over a long period after infection compared to the same age group.

Pain and fear of falling may lead to an increase in the number of falls after COVID-19 infection, particularly in the older population (10,14). Simsek et al. found that 35.4% of participants aged 80 years of age or older experienced a fall within the previous year (31). Upon examining the occurrence of falls, it was discovered that 22.7% of older adults in the control group had experienced at least one fall in the previous 12

months in our study. This ratio is similar when compared to the fall rate in healthy older people in the study conducted by Simsek et al. However, this rate has significantly increased to 45.9% for individuals aged 65 or over who have experienced COVID-19. As a result, it was thought that COVID-19 may increase the number of falls depending on the effect of pain and fear of falling on people aged 65 or over. Considering that falls are increasing and appear to be a more dangerous condition, particularly in advanced age, more attention should be paid to falls in elderly people who have been infected with COVID-19.

Regardless of the COVID-19 infection, fear of falling is a common condition among the older population. Fear of falling can increase the likelihood of falling, reduce a person's level of physical activity, and cause other serious health issues (10). Numerous studies have demonstrated that long-term symptoms of COVID-19 infection can also exacerbate the fear of falling (9,14). In our study, the mean FOF-I score was 26.91±9.80 in persons aged 65 or older who were not afflicted by COVID-19 infection whereas it was 33.27±12.65 among older adults who had contracted COVID-19. Given that the cut-off value for fear of falling in the Turkish FOF-I survey is 24, it would seem that both groups experience fear of falling (25). However, when the FOF-I scores were examined, it was determined that the COVID-19 group had a significantly higher fear of falling than the control group. As demonstrated by prior research, the persistence of symptoms following COVID-19 can contribute to a rise in falls by developing a fear of falling.

The physical condition frequently gets worse with age. The deterioration in function can lead to fear of falling and fall risk, but symptoms and increased pain after COVID-19 infection, frequency of falls, and fear of falling can also contribute to a further decrease in physical activity levels (10,14). In a study involving patients with severe COVID-19 infection, physical abilities like walking speed, balance, and endurance were significantly affected, and physical impairments persisted in a significant number of participants even after treatment (32). Based on the results of the physical activity level evaluated by the BPAQ in our study, the COVID-19 group had a mean score of 4.88±1.34, while the control group had a mean score of 5.95±1.53. The COVID-19 group had significantly lower levels of physical activity. It was believed that the differences in physical activity levels between the two groups could be attributed to a cumulative effect of the issues caused by COVID-19, particularly the worsened pain, increased number of falls, and heightened fear of falling experienced more by the COVID-19 group.

Associations among pain, number of falls, fear of falling, and physical activity level

According to the results of the multiple linear regression analysis, COVID-19 infection, number of falls, and physical activity level appeared as factors influencing pain intensity. Among these factors, the number of falls emerged as the most important parameter in explaining the intensity of pain.

A study involving community-dwelling older adults aged 80 and over revealed that age, gender, and fear of falling did not have any risk factors associated with falling (31). In another study involving older people, fear of falling was identified as a significant risk factor associated with falling (33). In a study conducted by Anezaki et al., living alone was found to be a risk factor for falling (34). Our investigation found that factors influencing the frequency of falls included pain intensity and fear of falling. According to the factor of living alone in the study by Anezaki et al., the reason our study is different is that the study conducted by Anezaki et al. was carried out during the pandemic period when factors like social isolation were more prominent. Additionally, there was no specific group of older people who had caught COVID-19 in their study, so the participants of the two studies were assumed to show different characteristics.

Tinetti et al., in their study involving community-dwelling older adults, identified age and living alone as factors that influenced fear of falling whereas gender and number of falls had no particular effect on fear of falling (10). In another study with community-dwelling older adults, while the female gender was a significant risk factor

associated with the fear of falling, it was determined that the fear of falling was not uniquely explained by age and number of falls (35). The findings of our study showed that fear of falling was not uniquely explained by COVID-19, age, gender, pain intensity, and physical activity level. However, it has been discovered that living alone and the rise in the number of falls are factors that increase fear of falling. Our study's results were similar to those of Tinetti et al. according to the living alone factor. Elderly adults who live alone may develop a fear of falling due to the belief that potential injuries resulting from falls will make it difficult for them to take care of themselves and carry out their everyday tasks. However, regarding the frequency of falls, our research differed from previous studies. This discrepancy was attributed to the inclusion of older individuals who had contracted COVID-19 in our study whereas prior research only encompassed community-dwelling older adults.

In the study conducted by Atıcı et al., the fear of falling was found to be a factor affecting the physical activity level (15). In our study, it was discovered that not having caught COVID-19 at, younger age, and heightened pain intensity resulted in a higher physical activity level. In this context, it was concluded that the contraction of a COVID-19 infection constituted a variable that reduced the level of physical activity in older persons. Consequently, assessing the amount of physical activity in older people infected with COVID-19 is crucial.

This study had some limitations. Firstly, the data was collected backward based on the statements of the participants. This can lead to recall bias and compromise the accuracy of some data. Also, the fact that study data was collected from only one region may limit the generalizability of study findings.

The results of this study showed that older people who had experienced COVID-19 had more pain, fatigue, and cognitive disorder symptoms; the intensity of pain, the number of falls, and the fear of falling were higher, and physical activity level was lower than that of those who did not have COVID-19. The pain intensity was signifi-

cantly influenced by COVID-19, the number of falls, and physical activity level. Increased pain intensity and fear of falling were identified as two factors influencing the increase in the number of falls. The increased fear of falling was significantly associated with living alone and increased falls. It has been determined that having caught COVID-19, age, and pain intensity are key factors explaining physical activity level. Although COVID-19 did not specifically appear to be a factor influencing the number of falls and fear of falling, it was found to be a significant factor in increasing pain intensity. Considering that pain intensity affects the number of falls, having caught COVID-19 may indirectly contribute to an increase in the number of falls and fear of falling. It is therefore important that older people who have had COVID-19 are examined for the long-term symptoms, number of falls, fear of falling, and physical activity level, and that appropriate treatments are administered as needed.

Author Contributions: OG: Conceptualization, Methodology, Formal analysis, Investigation, Resources, Data Curation, Writing - Original Draft, Writing - Review & Editing, Visualization; SB: Conceptualization, Methodology, Formal analysis, Writing - Review & Editing, Visualization, Supervision

Explanations: None.

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