H.Ü. Sağlık Bilimleri Fakültesi Dergisi
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Özgün araştırma

COVID-19 Döneminde Fiziksel İnaktivite: Belirleyicileri ve Olumsuz Psikolojik Etkilerle Muhtemel İlişkisi

Caner KARARTI[1], Fatih ÖZYURT[2], İsmail ÖZSOY[3]

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Öz

Amaç: Bu çalışmanın amacı birincil olarak COVID-19 döneminde fiziksel inaktivite ile ilişkili olası faktörleri araştırmaktır. İkincil olarak ise sokağa çıkma yasağını takiben fiziksel aktivite (FA) seviyesinin kişisel bildirimli psikolojik bulgulara etkisinin araştırılmasıdır.
Gereç ve Yöntem: Fizyoterapi ve Rehabilitasyon Kliniğinde kesitsel bir çalışma yapıldı. 18-65 yaşları arasında toplam 105 sağlıklı katılımcı dâhil edildi. Klinik ve demografik veriler kaydedildikten sonra katılımcılar, pandemi öncesi ve pandemi dönemi için toplam Uluslararası Fiziksel Aktivite Anketi (IPAQ) puanlarına göre üç gruba ayrıldılar: Grup 1: yüksek FA (≥3000 MET dk/hafta), Grup 2: orta FA (600≤MET<3000 dk/hafta) ve Grup 3: düşük FA (<600 MET dk/hafta). Katılımcıların pandemi öncesi ve sonrası depresyon, anksiyete ve stres düzeylerini değerlendirmek için Depresyon, Kaygı ve Stres Ölçeği (DASS-21) kullanıldı. COVID-19 döneminde FA ile ilişkili olası faktörlerin belirlenmesinde klinik ve demografik veriler değişken olarak kullanılırken, FA seviyeleri ve psikolojik problemlerin ilişkisinde IPAQ ve DASS-21 skorlarının zaman içindeki değişimi ölçüt alındı.
Bulgular: ANCOVA, sırasıyla depresyon, anksiyete ve stres ile ilgili olarak anlamlı bir grup*dönem etkileşim etkisi ortaya çıkardı. Katılımcıların depresyon, kaygı ve stres düzeyleri iki dönem arasında anlamlı farklılık gösterdi [sırasıyla ($p<.001$; $\eta^2_p=.175$); ($p=.033$; $\eta^2_p=.064$); ($p=<.001$; $\eta^2_p=.132$)]. Sonuçlar, her iki dönem açısından düşük FA ile duygusal durumun kötüleşmesi arasında açık bir ilişki olduğunu gösterdi. İki değişkenli analizde, kadın cinsiyet, yüksek ortalama uyku süresi (≥9.2 saat), sigara içmek, daha yüksek depresyon (≥7.3), anksiyete (≥4.9) ve stres (≥9.2) seviyeleri, pandemi dönemindeki düşük FA ile ilişkili bulundu ($p=<.001$-$.049$).
Sonuç: Bu çalışmada, azalmış FA ile duygusal durumun kötüleşmesi arasında açık bir ilişki olduğu saptandı. Belirlenen bu ilişkisel faktörleri göz önünde bulundurmak ve bireylerin farkındalığını artırmak önemli görülmektedir.

Anahtar kelimeler: *Anksiyete, COVID-19, depresyon, fiziksel inaktivite, stres.*

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H.Ü. Sağlık Bilimleri Fakültesi Dergisi
Cilt:10, Sayı:2, 2023
doi:10.21020/husbfd.1088705

Original Research

Physical Inactivity in the COVID-19 Period: Determinants and Possible Relationship with Adverse Psychological Effects

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Abstract

Objectives: The primary aim of this study was to look into the possible factors associated with physical inactivity during the COVID-19 pandemic period. Secondly, it seeks to investigate the effect of physical activity (PA) levels on self-reported psychological outcomes following the curfews.
Materials and Methods: A cross-sectional study was conducted in Physiotherapy and Rehabilitation Outpatient Clinic. A total of 105 healthy participants, aged between 18-65 years, were recruited. For the purposes of characterisation, clinical and demographic data were collected. The participants were divided into three groups based on their total International Physical Activity Questionnaire (IPAQ) scores in pre- and post-pandemic periods: Group 1: high PA (≥3000 MET min/week), Group 2: moderate PA (600≤MET<3000 min/week), and Group 3: low PA (<600 MET min/week). To evaluate the depression, anxiety, and stress levels of the participants, the Depression, Anxiety, and Stress Scale (DASS-21) was used. While clinical and demographic data were used as variables to determine possible factors associated with PA during the COVID-19 period, the change of IPAQ and DASS-21 scores over time was taken as a criterion in the relationship between PA levels and psychological problems.
Results: ANCOVA revealed a significant group*period interaction effect regarding depression, anxiety, and stress, respectively. The depression, anxiety, and stress levels of the participants showed significant differences between the two periods [(p<.001; η^2_p=.175); (p=.033; η^2_p=.064); (p=<.001; η^2_p=.132), respectively]. The results demonstrated a clear association between low PA and deterioration of emotional status in terms of both periods. In bivariate analysis, female sex, higher average hours of sleep (≥9.2 hours), being smoker, higher levels of depression (≥7.3), anxiety (≥4.9), and stress (≥9.2) were associated with a low PA during the pandemic (p=<.001-.049).
Conclusion: A clear association between reduced PA and impaired emotional state was found in this study. It seems necessary to address these factors and increase awareness of individuals.

Keywords: *Anxiety, COVID-19, depression, physical inactivity, stress.*

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H.Ü. Sağlık Bilimleri Fakültesi Dergisi
Cilt:10, Sayı:2, 2023
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Introduction

Physical activity (PA) is defined by Caspersen et al. as "any bodily movement created by skeletal muscles that lead to energy consumption". This can include everything from sports to household, occupational, and other activities (Caspersen et al., 1985). Physical inactivity is the second modifiable risk factor for chronic disease in Western countries and contributes significantly to overall mortality (Mathers et al., 2000; Ding et al., 2016). It also plays a key role in the development of obesity-related chronic diseases (Bull et al., 2020; Foright et al., 2018; Wiklund, 2016).

Identifying the various factors that may influence participation in PA and exercise is critical in enhancing the general public's well-being (Caspersen et al., 1985). These could include personal (such as biological and psychological features), social (family, friends, and work), and environmental (accessibility and availability of various types of PA and facilities), as well as probable genetic influences (Tayfur et al., 2023; Bauman et al., 2012). Multiple personal and environmental factors were described in a systematic review that compiled the findings of 25 published articles investigating the possible variables relevant to PA participation (Choi et al., 2017). Demographics, biological features, behavioural characteristics, social and cultural factors, and psychological, cognitive, and emotional components were all identified as personal variables. Environmental variables included the location, type of community or neighbourhood, availability and safety of fitness facilities, nearby environment, and climate. The researchers highlighted that these particular factors could provide guidance for healthcare and assist local and national leaders in designing plans that may help to increase PA participation and, as a result, improve society's health and wellbeing (Choi et al., 2017).

Some phenomena happen once in hundreds of years and put these plans to the ultimate test and threaten to turn the table upside down. The COVID-19 pandemic is one such phenomenon that has wreaked havoc on the world, killing thousands of people and bringing the PA to a halt (Füzéki et al., 2020; Peçanha et al., 2020). Inadequate PA as a result of social isolation has a detrimental impact on the circulatory, musculoskeletal, and neurological systems (Füzéki et al., 2020). Recognising the associated factors for physical inactivity and identifying evidence-based strategies to combat it is critical for guiding concerted public health efforts to understand and cope with conditions where physical activity is suddenly restricted. Therefore, the aim of this study is to understand the possible factors that associate with physical inactivity in pandemic period. It is also aimed to investigate whether PA level is related to psychological problems by comparing pre-pandemic and during-pandemic time periods.

H.Ü. Sağlık Bilimleri Fakültesi Dergisi
Cilt:10, Sayı:2, 2023
doi:10.21020/husbfd.1088705

Materials and Methods

A cross-sectional study was conducted in Physiotherapy and Rehabilitation Outpatient Clinic from February 2022 to March 2022. A total of 105 healthy volunteers who were aware of the study protocol via brochures announced by the study team, aged 18-65 years, were recruited. The participants were screened based on single-stage sampling. The participants were evaluated by an experienced physiotherapist (CK) for the variables within the scope of the study. The study was approved by a local ethics committee (2022-179). Before the study, written and verbal consent was obtained from all participants.

Inclusion criteria for participants were defined as being healthy, aged between 18 and 65 years, being subjected to some form of social distancing, such as being obliged to work from home due to curfews and self-isolation, no hospital admissions for musculoskeletal disorders within 3 months, and willingness to participate (Islam et al., 2020; Nilsson et al., 2020). The exclusion criteria were set as having a body mass index >30 kg/m^2; habitually exercising; taking medication; or having a neurological, cardiovascular, or respiratory disorder (Islam et al., 2020; Nilsson et al., 2020).

Outcome measures

For the purposes of characterisation, clinical and demographic data were collected. Age, sex, marital status, education, and the number of family members were all recorded as demographics. Questions regarding average hours of sleep, sleep satisfaction (yes/no), and smoking (yes/no) were used to collect lifestyle-related data. Clinical and demographic data were used as variables to determine possible factors associated with PA during the COVID-19 period. The change of IPAQ and DASS-21 scores over time (pre-pandemic period vs during-pandemic period) was taken as a criterion in the relationship between PA levels and psychological problems. The IPAQ and DASS-21 were applied twice. The participants were asked to consider the pre-pandemic period when answering the questions for the first time (Özsoy et al., 2021). For the pre-pandemic period, they were asked to think one day before the start of the pandemic in Turkey.

International Physical Activity Questionnaire (IPAQ), which is validated for the Turkish population, was used to measure PA levels (Saglam et al., 2010). Participants reported their PA intensity (walking, mild, or vigorous), duration, and frequency. The min/week was calculated for each PA intensity. The Metabolic Equivalent of Task (METs)/min/week was calculated by multiplying the average energy expenditure by min/week for each PA intensity (3.3 MET for walking, 4.0 MET for moderate intensity, and 8.0 MET for vigorous intensity PA). The total

H.Ü. Sağlık Bilimleri Fakültesi Dergisi
Cilt:10, Sayı:2, 2023
doi:10.21020/husbfd.1088705

PA in METs/min/week was calculated by adding the results of each type of PA (walking, mild intensity, and vigorous intensity) (Nilsson et al., 2020; Saglam et al., 2010; Abate et al., 2021). The participants were divided into three groups based on their total IPAQ scores in pre- and post-pandemic periods: Group 1: high PA (≥3000 MET min/week), Group 2: moderate PA (600≤MET<3000 min/week), and Group 3: low PA (<600 MET min/week) (Saglam et al., 2010).

To evaluate the depression, anxiety, and stress levels of the participants, the Depression, Anxiety, and Stress Scale (DASS-21) was used (Francis et al., 2019, Yılmaz et al., 2017). It consists of 21 questions (7 questions in each subscale) with a four-point Likert scoring that ranges from 0 (never) to 3 (always) (Francis et al., 2019). The total score is calculated by summing the items in each subscale and multiplying by two. The final scores are interpreted according to the following categories: Normal (depression 0-9, anxiety 0-7, and stress 0-14), mild (depression 10-13, anxiety 8-9, and stress 15-18), moderate (depression 14-20, anxiety 10-14, and stress 19-25), severe (depression 21-27, anxiety 15-19, and stress 26-33), and extremely severe (depression≥28, anxiety≥20, and stress≥34) (Francis et al., 2019).

Sample size

Based on a previous study investigating depression, anxiety, and stress using the DASS-21, as well as associated factors early in the COVID-19 outbreak, the minimum required sample size was calculated as 105 participants for the effect size of .309, the probability level as .05, and the statistical power level of 80% using G*Power Software (ver. 3.1.9.2, Düsseldorf, Germany) (Islam et al., 2020).

Statistical analysis

The Statistical Package for the Social Sciences 22.0 program was used for statistical analyses. The variables were investigated using visual (histograms, probability plots) and analytical methods to check normality. We used descriptive statistics and reported counts and proportions for categorical data and measures of distribution for continuous data. An Independent T-test was performed to compare the means of the periods for continuous variables and a Chi-Square test to examine the difference between periods for categorical variables. One-way ANCOVA was used for within-period comparisons. Univariate analysis was conducted to identify significant predictors of the presence of low PA during the pandemic. Before the bivariate analysis, continuous variables were converted to binomial variables using the midpoint of the ROC (Receiver Operating Characteristic) curve generated discrimination threshold. Using the logistic models, odds ratios and their respective 95% confidence intervals

H.Ü. Sağlık Bilimleri Fakültesi Dergisi
Cilt:10, Sayı:2, 2023
doi:10.21020/husbfd.1088705

(CIs) were calculated. To evaluate the changes in the DASS-21 score, a 3*2 [group*period; (Group 1, Group 2, Group 3*pre-period, post-pandemic period)] repeated measures ANCOVA was performed with the group as a between-groups factor and period as a within-subjects factor, and with demographical and personal lifestyle-related measures set as the covariates. Effect sizes were determined as partial eta squared (η^2_p). A p-value of .05 was accepted as statistically significant.

Results

One hundred and five participants with an average age of 35.79±8.08 years were included in the study. The descriptive characteristics of the participants are presented in Table 1. There was a higher percentage of females (p=<.001). There was a significant difference between the two periods in terms of average hours of sleep (p=<.001), smoking (p=.018), depression (p=.014), anxiety (p=.037), stress (p=.047), total DASS-21 score (p=.012), PA levels (p=.001; p=.008; p=.035), and total IPAQ score (p=<.001). The percentage of the single participants and sleep satisfaction were similar (p>.05).

H.Ü. Sağlık Bilimleri Fakültesi Dergisi
Cilt:10, Sayı:2, 2023
doi:10.21020/husbfd.1088705

Table 1: Descriptive characteristics of the participants

Variable	Mean±SD	Frequencies (n%)	p
Age (years)	35.79±8.08	-	-
Male / Female	-	33 (31.4%) / 72 (68.6%)	<.001
Married / Single	-	50 (47.6%) / 55 (52.3)	.632
Number of family numbers	3.28±1.01	-	-
	Pre-pandemic period Mean±SD	During pandemic period Mean±SD	
Average hours of sleep	7.28±1.45	8.67±2.20	<.001
Sleep satisfaction (yes)	60 (57.14%)	52 (49.52%)	.269
Smoking (yes)	40 (38.09%)	57 (54.28%)	.018
Depression	4.51±4.04	6.15±5.49	.014
Anxiety	2.98±2.79	3.81±2.96	.037
Stress	5.73±3.84	6.98±5.14	.047
Total DASS-21 Score	13.24±8.67	16.96±12.31	.012
Walking Intensity PA	932.30±1081.77	517.15±673.99	.001
Moderate Intensity PA	466.62±633.62	271.34±398.57	.008
Vigorous Intensity PA	779.04±1163.57	468.19±957.02	.035
Total IPAQ Score	2177.98±2140.07	1254.10±1519.28	<.001

PA: Physical activity; SD: Standard deviation; n: Number of participants; %: Percentage; DASS-21: Depression, Anxiety, and Stress Scale.

3*2 ANCOVA revealed a significant group*period interaction effect regarding depression [($p<.001$; $\eta^2_p=.175$)], anxiety [($p=.033$; $\eta^2_p=.064$)], and stress [($p=<.001$; $\eta^2_p=.132$)] in terms of pre- and post-pandemic periods. The depression, anxiety, and stress levels of the participants showed significant differences between the two periods. The results demonstrated a clear association between low PA and deterioration of emotional status in terms of both periods (Table 2).

H.Ü. Sağlık Bilimleri Fakültesi Dergisi
Cilt:10, Sayı:2, 2023
doi:10.21020/husbfd.1088705

Table 2: Comparison of DASS-21 scores between three groups

		Pre-pandemic period (n=105)		
DASS-21	High PA (n=26)	Moderate PA (n=61)	Low PA (n=18)	p^1
Depression	2.12±0.26	3.55±1.33	7.03±2.12	<.001
Anxiety	1.15±0.13	2.56±1.19	3.47±2.54	.043
Stress	4.42±2.15	5.85±3.25	7.12±3.59	.021
		Post-pandemic period (n=105)		
Depression	4.21±2.13	6.22±2.48	11.03±4.47	<.001
Anxiety	2.24±1.98	4.02±1.24	5.35±3.87	.014
Stress	6.78±2.11	8.64±3.24	12.43±4.21	<.001
		3 x 2 ANCOVA		
	Period		Group*Period	
Depression	<.001 (.133)		<.001 (.175)	
Anxiety	.001 (.109)		.033 (.064)	
Stress	<.001 (.118)		<.001 (.132)	

DASS-21: Depression, Anxiety and Stress Scale; PA: Physical activity levels based on their total The International Physical Activity Questionnaire (IPAQ) scores, p^1: One-way ANCOVA results for within-period comparisons; Figures in parentheses are effect sizes partial eta squared (η^2_p)

Lastly, in univariate analysis (Table 3), the female sex was found to be associated with a low PA (adjusted odds ratio [OR] 2.51, 95% CI=2.32-2.86). Higher average hours of sleep (≥9.2 hours) were related to low PA [2.29 (2.08-2.53)]. Active smokers were more prone to low PA than non-smokers [1.26 (1.10-1.41)]. In terms of psychological status, higher levels of depression (≥7.3), anxiety (≥4.9), and stress (≥9.2) were associated with increased odds of a low PA [1.35 (1.17-1.52); 1.21 (1.01-1.40); 1.27 (1.13-1.46)]. There was no evidence of significant odds in terms of age, being a single person, number of family members, and sleep satisfaction (p>.05).

H.Ü. Sağlık Bilimleri Fakültesi Dergisi
Cilt:10, Sayı:2, 2023
doi:10.21020/husbfd.1088705

Table 3: Bivariate analysis of associated factors for low PA during the pandemic

Variable	OR (95% CI)	p
Age (≥48.7)	0.94 (0.84-1.04)	.231
Female sex	2.51 (2.32-2.86)	<.001
Being a single person	1.12 (0.83-1.56)	.632
Number of family numbers (≥3.1)	0.91 (0.81-0.98)	.42
Average hours of sleep (≥9.2)	2.29 (2.08-2.53)	.002
Sleep satisfaction (no)	1.18 (0.98-1.31)	.269
Smoking (yes)	1.26 (1.10-1.41)	.018
Depression (≥7.3)	1.35 (1.17-1.52)	.037
Anxiety (≥4.9)	1.21 (1.01-1.40)	.049
Stress (≥9.2)	1.27 (1.13-1.46)	.041

PA: Physical activity; h: hours; ref: reference; CI: Confidence intervals 95%, OR: Odds ratio

Discussion and Conclusion

Being female, increased hours of sleep, smoking, and higher levels of depression, anxiety, and stress correlated with increased odds of a presence of low PA. Comparing pre-pandemic and during-pandemic periods revealed a clear association between low PA and deterioration of emotional mood, as the PA level increased, emotional status improved.

Due to self-isolation and quarantine measures, fewer opportunities to stay physically active, and fear of infection, the COVID-19 pandemic has led to lower levels of habitual PA. Prolonged physical inactivity and sedentary behaviour are linked to poor mental and physical health, and a higher risk of disease-specific and all-cause mortality (Booth et al., 2017). In a cross-sectional study, Ammar et al. studied the relationship between low PA and the pandemic (Ammar.et al., 2020). The researchers concluded that home confinement could have a significant impact on global lifestyle activities, such as participation in sports and PA (Ammar.et al., 2020). This is a serious concern as dramatic reductions in PA can lead to cardiovascular, physical, and mental health issues (Booth et al., 2017; Ammar.et al., 2020). The results of our study emphasizes the lower PA and its adverse effects during the pandemic. As physical activity is shown as a health indicator, healthcare professionals are advised to be proactive in encouraging personalized PA after the pandemic period.

According to our findings, being female was associated with physical inactivity. Pre-pandemic studies have reported a larger number of exercise barriers for women compared to men, all of which were linked to a lower rate of participation in PA (Portela-Pino et al., 2019; Juarbe et al., 2002). Women often reported time constraints, lack of pleasure, and self-consciousness as

H.Ü. Sağlık Bilimleri Fakültesi Dergisi
Cilt:10, Sayı:2, 2023
doi:10.21020/husbfd.1088705

obstacles to being physically active (Juarbe et al., 2002). Individual and environmental parameters may be influenced by public health limitations and have different impacts on men and women (Portela-Pino et al., 2019; Juarbe et al., 2002). Furthermore, as a result of preventive public health policies (i.e., closure of childcare centers and schools), childcare responsibilities changed within the families. There is evidence that mothers with young children had lower PA than women without children (Mackay et al., 2011). Similar to our findings, Nienhuis and Lesser stated that compared to men, women were more physically inactive, had more obstacles and fewer facilitators to PA, and suffered substantially more generalized anxiety during the pandemic (Nienhuis and Lesser, 2020). The authors also reported lower levels of mental health, reduced social, psychological, and emotional well-being, and substantially higher generalized anxiety in women with lower levels of PA due to the pandemic, whereas women who were more physically active had higher mental health scores (Nienhuis and Lesser, 2020).

Inconsistent with previous research, our findings showed that being a single person was not related to low PA during the pandemic (Hamermesh, 2020; Heidinger and Richter, 2020; Lippke et al., 2021). It has been highlighted that loneliness is correlated with lower levels of PA, and according to a systematic review, PA can help to reduce feelings of loneliness (Lee and Ko, 2018; Pels and Kleinert, 2016). A range of studies have investigated the effect of the COVID-19 pandemic on loneliness and reported that individuals who were alone in lockdown were less happy (Hamermesh, 2020; Heidinger and Richter, 2020; Lippke et al., 2021). Other data, on the other hand, suggests that reported loneliness has little to do with lockdown measures or other parameters, such as being unmarried, in line with the current report (Luchetti et al., 2020). We support the notion that it is critical to take into account an individual's current situation when evaluating loneliness (Hawkley and Cacioppo, 2010).

According to our findings, 9.2 or more hours of sleep was closely linked to lower PA. In line with this result, Palm et al. reported a strong link between sleep hours and lower PA levels and explained that low PA negatively affects body composition, and the consequent increase in body fat is a prominent determinant for the development of sleep disorders (Palm et al., 2015). PA has been shown to enhance sleep quality and metabolic health (Narici et al., 2020). In a study conducted by Banno et al., the exercise group had 3 points improvement on the Pittsburgh Sleep Quality Index (a measure of sleep quality) and 3.22 points on the Insomnia Severity Index (Banno et al., 2018). According to Hori et al., a small increase in daily PA is effective in increasing sleep quality and decreasing sleep latency (Hori et al., 2016). In line with

H.Ü. Sağlık Bilimleri Fakültesi Dergisi
Cilt:10, Sayı:2, 2023
doi:10.21020/husbfd.1088705

the literature, results demonstrated a clear association between more hours of sleep and lower PA.

Heydari et al. examined the relationship between smoking and low PA in a cross-sectional study (Heydari et al., 2015). Similar to the present study, they found that smoking was linked to physical inactivity, and smokers exercised less than non-smokers (Heydari et al., 2015). When compared to non-smokers, smokers spend considerably less time on physical and leisure activities and sports (Klesges et al., 1990). According to a cross-sectional survey conducted in Germany, smokers with a high level of nicotine dependency had a low rate of PA engagement (Schumann et al., 2001). Concordantly, we suggest that during the pandemic, adult smokers should prioritize daily exercise as a way to lower the risk of tobacco-related diseases.

Finally, our study indicated a clear link between low PA and poor emotional state during the pandemic. Studies have shown a clear association between outbreaks of infectious diseases and psychological and emotional distress and signs of mental disorders, such as depression, anxiety, and stress (Hao et al., 2020; Tan et al., 2020; Wang et al., 2020). A higher number of people are affected by these symptoms than people who are infected (Li et al., 2020; Rajkumar, 2020). Anxiety and depression may be exacerbated by a lack of in-depth knowledge about COVID-19, long periods of lockdown/home confinement, poor overall wellbeing, and limited access to healthcare (Hao et al., 2020; Tan et al., 2020; Wang et al., 2020; Li et al., 2020; Rajkumar, 2020). Furthermore, social isolation, tele-working and tele-studying, and little/no physical interaction with other people can all be major psychological stressors and lead to unhealthy behaviours such as physical inactivity and poor diet (Rajkumar, 2020; Troyer et al., 2020).

Based on their total IPAQ scores in the pre- and post-pandemic periods, the participants were divided into three groups, as previously mentioned. The depression, anxiety, and stress levels of the participants showed significant differences between the two periods. Our findings suggest that higher levels of PA can be associated with tackling psychological distress during the pandemic. According to a study by Silva et al., anxiety, stress, and depression levels were lower in individuals who engaged in PA during the coronavirus pandemic (Silva.et al., 2020). In both genders, those who did not participate in PA had higher risks of presenting anxiety symptoms, above-normal depression levels, and stress symptoms (118%, 152%, and 75.1%, respectively). In this context, our findings are consistent with previous studies (Hao et al., 2020; Tan et al., 2020; Wang et al., 2020; Li et al., 2020; Rajkumar, 2020; Troyer et al., 2020; Silva.et al., 2020). "The 2015 Behavioral Risk Factor Surveillance System" was analyzed by Fluetsch

H.Ü. Sağlık Bilimleri Fakültesi Dergisi
Cilt:10, Sayı:2, 2023
doi:10.21020/husbfd.1088705

et al., who reported an inverse association between PA and mental wellbeing in individuals with insufficient PA (Fluetsch et al., 2019). Sedentary behaviour was linked to an elevated risk of anxiety in a study by Teychenne et al. (2015). According to the results of a meta-analysis, depression symptoms could be significantly improved by means of PA interventions (Conn, 2010). Furthermore, PA can reduce self-reported days of anxiety, depression, and stress (Fluetsch et al., 2019). In a meta-analysis with prospective studies (≥ 1 year of follow-up), Schuch et al. reported that compared to lower levels of PA, higher levels of self-reported PA were correlated with a lower risk of anxiety symptoms (Schuch et al., 2019).

We defined the age of the study sample as being apparently healthy participants in the age range of 18-65 years according to the criteria determined by the World Health Organization; however, the average age of our participants was 35.79±8.08 years. Including more participants of various ages and categorizing the age in intervals of decades can improve the generalization of the results. It is important to highlight that as the study sample was asymptomatic individuals, the results of the study cannot be used for pathological conditions. Further studies are recommended to include subjects with musculoskeletal and neuropsychiatric disorders.

This study demonstrated a clear association between reduced PA and impaired emotional state and concluded that being female sex, increased hours of sleep, smoking, and higher levels of depression, anxiety and stress are determinants of the presence of low PA. It seems necessary to address these factors, increase awareness of health practitioners and individuals, and promote regular PA during the pandemic.

As the study has a cross-sectional design, only non-causal associations can be inferred from the findings. Although the model lacks validation in a longitudinal cohort study to determine its predictivity, the current results provide a deep insight into the risk factors of pandemic-related low PA. We would need to follow-up on our sample over time to establish evidence for the identified predictors of low PA.

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Conflicts of interest

The authors have no conflicts of interest to declare.

H.Ü. Sağlık Bilimleri Fakültesi Dergisi
Cilt:10, Sayı:2, 2023
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