Research paper

# The role of physical activity on mental health and quality of life during COVID-19 outbreak: A cross-sectional study

Filiz Ozdemir [a], Neslihan Cansel [b], Fatma Kizilay [a,*], Emek Guldogan [c], Ilknur Ucuz [d], Bercem Sinanoglu [a], Cemil Colak [c], Hatice Birgul Cumurcu [b]

[a] Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, Inonu University, 44280 Malatya, Turkey
[b] Department of Psychiatry, Faculty of Medicine, Inonu University, 44280 Malatya, Turkey
[c] Department of Biostatistics, Faculty of Medicine, Inonu University, 44280 Malatya, Turkey
[d] Department of Child and Adolescent Psychiatry, Faculty of Medicine, Inonu University, 44280 Malatya, Turkey

## ARTICLE INFO

## ABSTRACT

*Introduction:* The COVID-19 pandemic has placed restrictions on people's physical activities. The aim of this study was to evaluate the physical activity levels of individuals and assess the effects of physical activity on quality of life, depression and anxiety levels during the COVID-19 outbreak.

*Methods:* This cross-sectional study were included 2301 participants aged 20–75 years. The data were collected through the Google Forms web survey platform by the virtual snowball sampling method. In the multivariate analysis, the independent predictors were analyzed using possible factors identified in previous analyses by multinomial logistic regression analysis. Hosmer–Lemeshow and Omnibus tests were used to evaluate the logistic regression model and coefficients.

*Results:* The mean weekly energy consumption of the participants was $875\pm1588$ MET-min, and only 6.9% were physically active enough to maintain their health. There was a weak positive relationship between physical activity levels and quality of life, while there was a weak negative relationship between physical activity levels, depression and anxiety ($p<0.05$). In the multinomial logistic regression model established for comparison of physically active and inactive participants, general health status and physical health status variables were statistically significant ($p<0.05$). However, relationships between psychological status, social relationships and environment scores, Beck Depression and Beck Anxiety Inventory scores were not statistically significant ($p>0.05$).

*Conclusions:* Results showed that physical activity programs should be included in guidelines as an integrative approach to pandemic management. During COVID-19 outbreak, community-based rehabilitation programs are needed, and these programs should be carried out in cooperation with community stakeholders.

## 1. Introduction

Coronaviruses are a large family of viruses that have phenotypic and genotypic variations [1]. The Coronavirus Disease-19 (COVID-19) is a beta-coronavirus that can spread through human to human transmission, similar to severe acute respiratory syndrome (SARS). COVID-19 cases first began to be reported in Wuhan in China's Hubei province, in late 2019 [2]. The World Health Organization (WHO) declared COVID-19 a pandemic on 11 March 2020. COVID-19 has now spread globally with nearly 50 million cases in over 200 countries, resulting in over 1 million deaths [3]. Currently, there is no effective vaccine for prevention of COVID-19 [2].

Since the most critical factor in the spread of the disease is contact, it has been stated that the most important preventive measures are social isolation and quarantine [4]. Restrictions have been applied in different ways all over the world, including remote-flexible working hours, lockdown for the elderly and individuals with chronic diseases who constitute the risk group, and advising other individuals not to go out unless necessary, in order to reduce social mobility to prevent the spread of the epidemic [5]. Feeling anxious about some situations in quarantine and social isolation conditions is not a pathological mental response but a natural response [6]. However, a limited number of

studies on the subject reported that the presence of uncertainties about the disease, decreased communication between people and temporary restriction of rights and freedoms may lead to increased rates of depression and anxiety [7, 8]. It was reported in the literature that the effects of the ongoing COVID-19 outbreak on mental health have exacerbated and changed even in a short time [9, 10].

Under social isolation conditions, individuals' physical activity is also restricted, and sedentary behaviors such as sitting, lying down, playing games, watching television and increasing the use of mobile communication devices result in lower physical activity and energy consumption and consequently increase the risk for chronic health conditions. This situation also negatively affects quality of life [11]. In two studies conducted before the pandemic in Turkey, the prevalence of adequate physical activity was reported as 16.4% and 14.8%, respectively [12,13]. The current literature provides consistent data suggesting that physical activity improves general health, quality of life and provides mental well-being [14]. It is known that the physical activity levels of individuals are negatively affected due to restrictions during the pandemic process [15]. Moreover, a study conducted in China reported that individuals who were physically active before the pandemic have significantly changed in their mental health status during the pandemic process [16]. Physical activity has neuroprotective effects and causes a decrease in psychopathological symptoms. Neurobiological mechanisms such as increased brain blood flow in the cortical and subcortical regions, synthesis and use of neurotransmitters, neurotrophic factors and neurogenesis are possible mechanisms that may explain the positive effects of physical activity on mental health [17]. Increasing physical activity in treatment of mental diseases is recommended as a new treatment option [18].

The effects of physical activity on mental health during the pandemic process have also been investigated in different societies [15]. To the best of our knowledge, this is the first study evaluating the effects of physical activity on mental health and quality of life in Turkey. We believe that our study will shed light on community-based rehabilitation programs planned for improving the health of communities during this process, the future course of which is not known.

The objective of this study was to evaluate the physical activity levels of individuals and assess the effects of physical activity on quality of life, depression and anxiety levels during COVID-19 outbreak.

## 2. Materials and methods

### 2.1. Design

In Turkey, the first official case diagnosed with COVID-19 was reported on March 11. As of October 10, there have been 345,678 cases of COVID-19, including over 9224 deaths reported [19]. After this date, measures have been taken across the country to gradually prevent and reduce the spread of the virus in the society. The measures consisted of three main parts; resource-orientation, direction about transmission and healthy person measures which have been adopted and continue to be the advice. This study was planned as a cross-sectional study and started eight weeks after the first case of COVID-19 was officially reported in Turkey.

### 2.2. Ethical approval

Ethical approval for the study was obtained from the Inonu University Health Sciences Non-Interventional Clinical Research Ethics Committee (2020/664). Moreover, since the study protocol involved the COVID-19 outbreak, approval of the Turkish Ministry of Health was obtained.

### 2.3. Sampling

The participants were identified by using the virtual snowball sampling method. In the power analysis performed before starting the study, assuming 15.6% of the prevalence of adequate physical activity in Turkey with a population of 52,687,360 [12,13], the minimum sample size was determined as 2184 with a margin of error of 0.02 and a confidence interval of 99% [20]. The sample size (2301) included in this study was larger than the calculated minimum sample size (2184).

### 2.4. Evaluation and survey

The data were collected through the Google Forms web survey platform by the virtual snowball sampling method (URL: https://docs.google.com/forms/d/15dvMsvEKLrHXc-34bL7uf92vYZphvdN-nyAr7n-FhLk/edit?usp=drive_web; 11.05–16.05 2020). The online survey link was shared through social media tools (Twitter, Instagram, Facebook, WhatsApp, and e-mail), and participants were invited. Individuals who participated in the online survey were anonymous. Informed consent was obtained from each individual who was included. An informed consent form was designed in the Google Forms web survey platform in the study. The participants were required to approve this form before starting the study. No time limit was given for deciding to take part. The designed online survey consisted of three dimensions and a total of 95 questions. The first-dimension questioned the sociodemographic characteristics of the participants (age, gender, marital status, educational status, region, etc.) (15 questions); the second dimension questioned the participants' data regarding the COVID-19 outbreak (5 questions), and the third dimension included questions evaluating the physical activity, depression, anxiety and quality of life levels of the participants (75 questions). During the design of this questionnaire, a pilot study was carried out, and the comprehensibility and appropriateness of the questions and answers were checked by a linguist, three physiotherapists, a biostatistician, two adult psychiatrists and a child psychiatrist. This study consisted of 2659 individuals, between 20 and 75 years of age, who stayed at their homes due to quarantine, isolation and social isolation in the scope of combating the COVID-19 outbreak. Those with psychiatric and neurological diseases were excluded from the study. The study lasted for five consecutive days and was completed with 2301 people after those with missing data were excluded. The results were analyzed and reported in accordance with the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines [21].

#### 2.4.1. Evaluation of physical activity levels

The physical activity levels of the individuals who agreed to participate in the study were evaluated by using the short form of the International Physical Activity Questionnaire (IPAQ) [22]. The Turkish validity and reliability tests of this survey were conducted by Ozturk et al. [23]. The survey consists of 7 questions that provide information about the time spent on walking, moderately intense and intense activities. The total score calculation involves the sum of the duration (minutes) and frequency (days) of walking, moderately intense activity and intense activity. The sitting score (sedentary behavior level) was calculated separately. In the evaluation of all activities, it was accepted that each activity should be performed for at least 10 min at a time. A score as MET-minute/week was obtained by multiplying the minute, day and MET value (multiples of resting oxygen consumption). In calculating the walking score, 3.3 MET was accepted for walking, 4 MET was accepted for moderate-intense activity, and 8 MET was accepted for intense activity. According to the survey, the physical activity levels were classified as physically inactive (<600 MET-min / week), low physical activity level (600–3000 MET-min / week) and sufficient physical activity level (> 3000 MET-min / week) [22,23].

## 2.4.2. Evaluation of depression levels

The Beck Depression Inventory (BDI) was used to evaluate the depression level of the cases [24]. BDI is a test consisting of 21 questions aimed at measuring the presence and severity of depression in patients and typical subjects. Each question's answer is scored between 0 and 3, and the total score ranges between 0 and 63 points. Scores between 0 and 9 points are considered as "minimal depression", 10–18 points are considered as "mild depression", 19–29 points are as "moderate depression", and scores of 30 and above are considered as "severe depression". The validity and reliability study of the scale in Turkish was conducted by Hisli [25].

## 2.4.3. Evaluation of anxiety levels

The Beck Anxiety Inventory (BAI) was used to evaluate the participants' anxiety levels [26]. Beck et al. developed the inventory, and the Turkish validity and reliability study of the inventory was conducted by Ulusoy [27]. BAI is a 21-item self-report scale that measures the severity of anxiety. Four items evaluate anxious mood, three items evaluate specific fears, 14 items evaluate generalized anxiety disorder and panic symptoms with autonomic hyperactivity and motor tension. Each item is given a score between 0 and 3, and higher scores indicate higher anxiety levels. According to this, scores between 0 and 17 points indicate low, 18–24 indicate moderate, and 25 points and above indicate severe anxiety levels [26,27].

## 2.4.4. Evaluation of quality of life levels

The World Health Organization Quality of Life Scale (WHOQOL-BREF TR) was used to evaluate the quality of life of the participants [28]. This scale consists of 4 areas and 26 questions. These four areas include physical (7 items), spiritual (6 items), social (3 items) and environmental (8 items) areas. The physical area includes questions about the ability to carry out daily tasks, dependence on drugs and treatment, mobility, pain, sleep and rest, and the ability to work. The spiritual area includes questions about positive and negative emotions, self-esteem, appearance, personal beliefs, and focusing attention. The social area includes questions about relationships with other people, social support and sexual life. The environmental area includes questions about the home environment, physical security and safety, financial resources, health services, accessibility, opportunities for spending leisure time and questions about physical environment and transportation. Area scores can be calculated between 4 and 20 and between 0 and 100 separately. The measured quality of life increases as the area scores increase. The total score of the scale is not calculated. In our study, scores between 0 and 100 were used. The Turkish validity and reliability study of the scale was conducted by Eser et al. [29].

## 2.5. Statistical analysis

The suitability of the variables to normal distribution was examined using visual (histogram and probability plots) and analytical (Shapiro–Wilk Test) methods. The descriptive statistics are expressed as median, minimum, maximum, interquartile range, or mean and standard deviation for the non-normally distributed variables. Frequency ($n$) and percentage (%) values were calculated for the qualitative variables. The categorical variables were evaluated using Pearson's Chi-Squared test. Comparisons of the physical activity levels and the depression, anxiety and quality of life levels were made by using Kruskal–Wallis H analysis. Conover test was used for binary comparisons for variables that were universally significant after the Kruskal–Wallis H test results. In the multivariate analysis, the independent predictors were analyzed using the possible factors identified in previous analyses by multinomial logistic regression analysis. Hosmer–Lemeshow and Omnibus tests were used to evaluate the logistic regression model and coefficients. In all results, a value of $p < 0.05$ was considered statistically significant. Statistical analyses were performed by using the IBM Statistical Package for the Social Sciences (SPSS) 26.0 package program.

**Table 1**
Participant characteristics.

| Demographic characteristics | $n$ | % |
|---|---|---|
| **Age (years)** | | |
| 20–39 | 1404 | 61.0 |
| 40–59 | 790 | 34.3 |
| 60–75 | 107 | 4.7 |
| **Gender** | | |
| Male | 895 | 38.9 |
| Female | 1406 | 61.1 |
| **Regions** | | |
| Eastern Anatolia | 1100 | 47.8 |
| Central Anatolia | 153 | 6.7 |
| Southeast Anatolia | 195 | 8.5 |
| Aegean | 81 | 3.5 |
| Black Sea | 126 | 5.5 |
| Mediterranean | 320 | 13.9 |
| Marmara | 300 | 13.0 |
| Abroad | 7 | 0.3 |
| Unanswered | 19 | 0.8 |
| **Marital status** | | |
| Married | 1371 | 59.6 |
| Widowed | 142 | 6.2 |
| Separated/divorced | 152 | 6.6 |
| Never married | 636 | 27.6 |
| **Education** | | |
| Up to high school graduate | 99 | 4.3 |
| High School graduate | 305 | 13.3 |
| University graduate | 1897 | 82.4 |
| **Employment** | | |
| Employed | 1668 | 72.5 |
| Retired | 89 | 3.9 |
| Unemployed | 424 | 18.4 |
| Other | 120 | 5.1 |
| **Chronic conditions** | | |
| Yes | 408 | 17.7 |
| No | 1864 | 81.0 |
| Unanswered | 29 | 1.3 |

## 3. Results

The survey had 2659 responses but once, individuals who had missing data for multiple dimensions were excluded, 2301 individuals were finally included in the study. There were also missing data in the demographic variables. The mean age of the participants was 36.2 ± 10.9 years. Among the 2301 participants, 1406 (61.1%) were female, and 895 (38.9%) were male. The mean age was 35.0 ± 10.5 years for the female participants and 38.2 ± 11.3 years for the male participants. Regarding the regions of residence of the participants, 1100 (47.8%) of the participants were from the Eastern Anatolia, 153 (6.7%) were from the Central Anatolia, 195 (8.5) were from the Southeast Anatolia, 81 (3.5%) were from the Aegean, 126 (5.5%) were from the Black Sea, 320 (13.9%) were from the Mediterranean, and 300 (13.0%) were from the Marmara Regions. Besides, 7 (0.3%) of the participants were from abroad. Of the participants, 1371 (59.6%) were married, and 1897 (82.4%) were university graduates (Table 1).

Only 214 (9.3%) of the participants stated that they worked regular working hours during the COVID-19 outbreak, while 617 (26.8%) participants had been working in risky occupational groups. 1934 (84.1%) participants stated that they had been following the current information about COVID-19, and 2136 (92.8%) participants stated that they complied with the warnings and recommendations of the Ministry of Health.

We found that 501 (21.8%) of the participants had moderate and severe depression levels, and 569 (24.7%) participants had moderate and severe anxiety levels. The mean scores of the WHOQOL-BREF TR subfields were 60.58 ± 20.20 for general health status, 55.62 ± 13.03 for physical health status, 66.04 ± 14.80 for psychological status, 62.80 ± 21.77 for social relations, and 69.14 ± 16.66 for environment.

**Table 2**
Physical activity levels obtained according to IPAQ.

| Physical activity levels | IPAQ scoring | Range | Q25–75 |
|---|---|---|---|
| Total physical activity (MET-min/week) | 875.10±1468.83 | 300.00 | 0.00–1080.00 |
| Vigorous physical activity (MET- min/week) | 329.34±959.58 | 0.00 | 0.00–0.00 |
| Moderate physical activity (MET- min/week) | 160.17±454.63 | 0.00 | 0.00–0.00 |
| Walking (MET-min/week) | 385.59±567.19 | 135.00 | 0.00–540.00 |
| Sitting (MET-min/week) | 313.51±211.47 | 300.00 | 120.00–480.00 |

**Table 3**
Comparison of Beck depression, Beck anxiety and WHOQOL-BREF scores according to physical activity levels.

| | | Inactive (<600 MET- min/week) | Minimal active (600–3000 MET- min/week) | Active (>3000 MET- min/week) | $P^*$ |
|---|---|---|---|---|---|
| WHOQOL-BREF TR | General health | 58.87±20.87 [62.50[a,b] (0.00–100.00)] | 62.66±18.02 [62.50[b] (0.00–100.00)] | 66.85±21.16 [62.50 (0.00–100.00)] | <0.001 |
| | Physical health | 54.36±13.40 [57.10 [a,b] (0.00–100.00)] | 57.17±12.14 [57.10[b] (14.30–92.90)] | 60.24±11.64 [64.30 (14.30–85.70)] | <0.001 |
| | Psychological | 64.67±15.33 [66.70 [a,b] (0.00–100.00)] | 68.13±13.71 [70.80 (16.70–100.00)] | 69.17±13.04 [70.80 (29.20–95.80)] | <0.001 |
| | Social relations | 61.56±22.01 [66.70 [a,b] (0.00–100.00)] | 64.72±21.02 [66.70 (0.00–100.00)] | 65.50±22.17 [66.70 (0.00–100.00)] | <0.001 |
| | Environmental | 68.25±16.91 [68.80 [a,b] (0.00–100.00)] | 70.08±16.12 [71.90[b] (12.50–100.00)] | 72.98±15.99 [75.00 (9.40–100.00)] | <0.001 |
| Beck Depression Inventory | | 11.84±9.24 [10.00 [a,b] (0.00–62.00)] | 10.06±7.98 [9.00 (1.00–52.00)] | 10.36±9.05 [8.00 (1.00–53.00)] | <0.001 |
| Beck Anxiety Inventory | | 11.23±10.91 [8.00 [a,b] (0.00–63.00)] | 9.67±9.87 [7.00 (0.00–63.00)] | 9.24±10.58 [5.00 (0.00–52.00)] | <0.001 |

Data are presented as Mean ± Standard Deviation [Median (Min-Max)]. *: Kruskal Wallis H test; a: It is different from minimally active participants, b: It is different from active participants.

The mean weekly energy consumption calculated according to IPAQ was 875 ± 1588 MET-min. It was seen that walking constituted an essential part of the IPAQ total physical activity score (Table 2). When the cases were classified according to the total physical activity scores, 62.5% were not physically active, 30.6% had low physical activity, and only 6.9% were physically active enough to maintain their health.

We found that there was a significant relationship between the physical activity levels of the participants and their quality of life subfields, depression and anxiety mean scores ($p <0.05$). There was a statistically difference between the inactive participants and minimally active participants and between the inactive participants and active participants in terms of all subfields of WHOQOL-BREF TR and the mean scores of the Beck Depression Inventory and Beck Anxiety Inventory. Besides, there were significant differences between the minimally active participants and active participants in terms of their mean scores in the general health status, physical health and environmental subfields of WHOQOL-BREF TR ($p <0.05$) (Table 3).

There was a weak positive relationship between the Total Physical Activity Score and subfield scores of WHOQOL-BREF TR and a weak negative relationship between the Total Physical Activity Score and the Beck Depression and Beck Anxiety Inventory scores (Table 4).

Multinomial logistic regression analysis was used to estimate physical activity types according to the quality of life subfield scores of WHOQOL-BREF TR, Beck Depression Inventory scores and Beck Anxiety Inventory scores. It was determined that the model established according to the Likelihood Ratio Test ($p <0.001$) and Deviance statistics ($p> 0.99$) was suitable for the data set examined (Table 5).

In the model established for the comparison of the physically active and inactive participants, the general health status and physical health status variables were statistically significant ($p <0.05$). However, the relationships between the psychological status, social relationships and

**Table 4**
Comparison of the relationship between physical activity levels of the participants and Beck depression, Beck anxiety and WHOQOL-BREF TR scores.

| Variables | Spearman's rank correlation coefficient |
|---|---|
| General health | 0.113* |
| Physical health | 0.133* |
| Psychological | 0.112* |
| Social relations | 0.083* |
| Environmental | 0.087* |
| Beck Depression Inventory | −0.088* |
| Beck Anxiety Inventory | −0.084* |

* : The correlation coefficient is statistically significant ($p <0.001$).

environment scores and the Beck Depression and Beck Anxiety Inventory scores were not statistically significant ($p> 0.05$). When the physically minimally active and inactive participants were compared, there were statistically significant differences in terms of the physical health, psychological and environmental subfields of WHOQOL-BREF TR ($p <0.05$). There were no significant differences between the physical activity categories in terms of the social relations subfield, or the Beck Depression and Beck Anxiety Inventory scores ($p> 0.05$).

## 4. Discussion

In this study, which we conducted eight weeks after the first case was announced in Turkey, the depression and anxiety levels of the individuals were found to be significantly high, and their physical activity levels were low. We also determined that quality of life was adversely affected in this period. An important result of our study was that a high

**Table 5**
Logistic regression results from the level of physical activity to pose a risk for depression, anxiety and quality of life.

|  | Variables | B | Std. Error | P | OR | 95% Confidence Interval for OR | |
|---|---|---|---|---|---|---|---|
|  |  |  |  |  |  | Lower bound | Upper bound |
| Active | Intercept | −4.882 | 0.672 | **<0.001** |  |  |  |
| vs. | General health | 0.015 | 0.005 | **0.006** | 1.015 | 1.004 | 1.026 |
| Inactive | Physical health | 0.034 | 0.009 | **<0.001** | 1.035 | 1.017 | 1.053 |
|  | Psychological | 0.003 | 0.009 | 0.74 | 1.003 | 0.986 | 1.02 |
|  | Social relations | −0.007 | 0.005 | 0.196 | 0.993 | 0.983 | 1.004 |
|  | Environmental | −0.001 | 0.008 | 0.937 | 0.999 | 0.985 | 1.014 |
|  | Beck depression inventory | 0.015 | 0.014 | 0.299 | 1.015 | 0.987 | 1.044 |
|  | Beck anxiety inventory | −0.011 | 0.011 | 0.31 | 0.989 | 0.967 | 1.011 |
| Minimally active | Intercept | −1.455 | 0.345 | <0.001 |  |  |  |
| vs. | General health | 0.004 | 0.003 | 0.132 | 1.004 | 0.999 | 1.01 |
| Inactive | Physical health | 0.011 | 0.005 | 0.017 | 1.011 | 1.002 | 1.021 |
|  | Psychological | 0.01 | 0.005 | 0.026 | 1.01 | 1.001 | 1.02 |
|  | Social relations | −0.002 | 0.003 | 0.594 | 0.998 | 0.993 | 1.004 |
|  | Environmental | −0.009 | 0.004 | 0.032 | 0.991 | 0.984 | 0.999 |
|  | Beck depression inventory | −0.012 | 0.008 | 0.137 | 0.988 | 0.973 | 1.004 |
|  | Beck Anxiety Inventory | −0.003 | 0.006 | 0.622 | 0.997 | 0.986 | 1.009 |

Reference category: inactive.

physical activity status in the outbreak negatively affected the depression and anxiety levels and positively affected the quality of life levels. Physical activity appears to be an integrative approach to pandemic management.

According to the WHO data, 23% of men and 32% of women aged 18+ years were insufficiently physically active globally in 2016. Over the past 15 years, the levels of insufficient activity have not improved (28.5% in 2001; 27.5% in 2016) [30]. In two studies conducted on different age groups in Turkey, the prevalence of insufficient physical activity was reported to be 16.4% and 14.8%, respectively [12,13]. In our study, the rate of sufficient physical activity was found to be only 6.9%. It was seen that this rate was very low in comparison to both national and international studies. We think that this difference arose from the measures taken for social isolation in the outbreak. At the time the study was conducted, the Government of Turkey's advice was to stay at home It was reported in the literature that the pandemic affected physical activity, especially in those with high physical activity [15,31]. In the descriptive study by Tison et al., The daily step count of the users on the individual level was evaluated with a free phone application. During the study period, a total of 19,144,639 daily step count measurements were provided by 455,404 individual users from 187 different countries. According to the results of their study, those with a high number of daily steps before the pandemic had significantly decreased numbers during the pandemic process [32]. In our study, the pre-pandemic physical activity data of the participants were not available. However, based on previous studies, we think that the pandemic process negatively affects physical activity.

In our study, the moderate and severe depression rate was 21.8%, and the moderate and severe anxiety rate was 24.7%. We also found that the prevalence of depression and anxiety was significantly higher in the general population in comparison to the studies conducted before the pandemic [33-35]. Nevertheless, our results were compatible with studies conducted during the outbreak. Given the linear relationship between physical activity and health status, it is clear that exercising is essential for optimal health. Regular physical activity should be encouraged by increasing social awareness to protect, maintain and improve the health of individuals both in the ongoing outbreak and in the normal process. [35,36]. The comparably higher prevalence in this process may be due to the continuing increase of the number of cases, the uncertainty related to the disease and lack of treatment, fear of getting sick and the decrease in communication among people.

Epidemiological studies show that physical activity reduces the risk of depression and anxiety, relieves symptoms and facilitates recovery [37,38]. Numerous animal models and human studies have shown

that physical exercise supports psychological health, psychological well-being, cognitive performance and functional recovery and provides a series of structural changes in the brain [17]. In their cross-sectional study, Brunes et al. reported that depression and anxiety symptoms were less common in those who performed regular physical activity [39]. In the cross-sectional and descriptive study conducted by Song et al., it was reported that adults with depression spent less time for mild and moderate physical activity compared to the group without depression [40]. It was reported that there was a massive increase in the mental health problems of individuals during the outbreak compared to the pre-pandemic process [9,10]. The impact of the pandemic, especially in terms of the long-term effects, is currently unpredictable. However, studies conducted during this period have reported that physical inactivity increases the symptoms of depression and anxiety [15]. In our study, similarly to the literature, there was a negative correlation between the physical activity levels and the depression and anxiety levels. It was found that an increase in physical activity, even at low intensity, had positive effects on mental health, and mostly inactive individuals had more symptoms of depression and anxiety. The literature suggested that physical activity positively affects mental health by neurobiological mechanisms such as exercise-induced neurotransmitter synthesis and plasticity [41]. According to the results of this study and the experiences gained during the global outbreak, it is clear that exercise plays a crucial role in protecting the mental health of individuals.

Physical activity is important for long-term health and affected by the lifestyles of individuals [42]. Regular physical activity and exercise are associated with well-being, physical health, life satisfaction and improvement of conceptual functions [43]. In this context, quality of life involves the physiological integrity of individuals as well as psychological and social comfort [44]. In our study, the quality of life scores were lower in comparison to population-based cross-sectional studies conducted by similar methodologies [45,46]. The lower scores of psychological well-being were an expected result in the pandemic outbreak. However, one of our study's important results was that other parameters of quality of life were also affected negatively by psychological problems. Besides, the quality of life scores of the participants with higher physical activity levels were found to be significantly higher. When the relationships between the WHOQOL-BREF TR subfields and physical activity levels were examined, there was a weak positive correlation between all subfields and the physical activity levels. In the literature, regular physical activity has been shown to significantly improve quality of life in healthy individuals and patients with chronic disease [47,48]. These results have emphasized the importance of including physical activity programs in community-based rehabilitation programs to protect

and maintain individuals' quality of life during the ongoing outbreak. In parallel with this view, the results of the multinomial logistic regression analysis in our study revealed that regular physical activity was a protective factor in preventing development of depression and anxiety and improving quality of life.

## 5. Limitations

Although this study will shed light on studies to be conducted on the topic during this pandemic of yet unknown duration, the physical activity levels, depression, anxiety and quality of life conditions of the participants were not known before the pandemic process. This study had some limitations. First of all, since the Google Forms web survey platform was used in this study to recruit participants, it is likely not to be representative of the general population. As the study was a cross-sectional study, and the data were collected using a snowball sampling method, older people were under represented. Another limitation was that the evaluations within the scope of the study were self-reported by the participants. Since the main purpose of our study was to evaluate the effects of physical activity on mental health and quality of life, BMI or food intake information was not questioned.

## 6. Conclusion

This study suggested that regular physical activity, as an inexpensive, effective and integrative way, provided an essential contribution in protecting the mental health of societies during the ongoing outbreak. Given the linear relationship between physical activity and health status, it is clear that exercising is essential for optimal health. Regular physical activity should be encouraged by increasing social awareness to protect, maintain and improve the health of individuals both in the ongoing outbreak and in the normal process. It should be kept in mind that physical activity has played a crucial role in dealing with the effects of the COVID-19 outbreak during this process, the future course of which cannot be predicted. We recommend that physical activity programs should be included in guidelines regarding pandemic management. In this process, community-based rehabilitation programs are needed, and these programs should be carried out in cooperation with community stakeholders.

## Authors contributions

Filiz Ozdemir: Conception, design, data collection, writing, critical review; Neslihan Cansel: Conception, design, writing, critical review; Fatma Kizilay: Data collection, literature review, writing, critical review; Emek Guldogan: Data processing, analysis, and interpretation, writing; Ilknur Ucuz: Data collection, literature review, writing; Bercem Sinanoglu: Data collection, literature review, writing Cemil Colak: Analysis and interpretation, editing. Hatice Birgul Cumurcu: Writing, critical review, editing. All authors contributed to the article's revision.

## Declaration of Competing Interest

The authors declare that they have no conflicts of interest regarding the conduct of this study. None of the authors are editorial board members. All authors signed the Declaration of Competing Interest statement.

## Data Availability

All or some of the data related to this manuscript may be shared on request.

## Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.eujim.2020.101248.

## References

[1] D. Parnell, P. Widdop, A. Bond, R. Wilson, COVID-19, networks and sport, Manag. Sport Leisure (2020) 1–7 https://doi.org/10.1080/23750472.2020.1750100.

[2] C. Wang, P.W. Horby, F.G. Hayden, G.F. Gao, A novel coronavirus outbreak of global health concern, Lancet 395 (10223) (2020) 470–473 https://doi.org/10.1016/S0140-6736(20)30185-9.

[3] World Health Organization (WHO)Coronavirus Disease (COVID-2019) Situation Reports, 2020 https://www.who.int/publications/m/item/weekly-epidemiological-update-27-october-2020 (accessed October 30, 2020).

[4] J. Hellewell, S. Abbott, A. Gimma, N.I. Bosse, C.I. Jarvis, T.W. Russell, J.D. Munday, A.J. Kucharski, W.J. Edmunds, Feasibility of controlling COVID-19 outbreaks by isolation of cases and contacts, Lancet Glob. Health 8 (4) (2020) 488–496 https://doi.org/10.1016/S2214-109X(20)30074-7.

[5] World Health Organization (WHO)Mental Health and Psychosocial Considerations during the COVID-19 Outbreak, 2020 https://apps.who.int/iris/bitstream/handle/10665/331490/WHO-2019-nCoV-MentalHealth-2020.1-eng.pdf (accesses July 9, 2020).

[6] D. Huremović, Psychiatry of Pandemics: A Mental Health Response to Infection Outbreak, Springer, New York, 2019.

[7] W. Li, Y. Yang, Z.H. Liu, Y.J. Zhao, Q. Zhang, L. Zhang, T. Cheung, Y.T. Xiang, Progression of mental health services during the COVID-19 outbreak in China, Int. J. Biol. Sci. 16 (10) (2020) 1732 https://doi.org/10.7150/ijbs.45120.

[8] Y. Zhang, Z.F. Ma, Psychological responses and lifestyle changes among pregnant women with respect to the early stages of COVID-19 pandemic, Int. J. Soc. Psychiatry (2020) 0020764020952116 https://doi.org/10.1177/0020764020952116 .

[9] Y. Zhang, Z.F. Ma, Impact of the COVID-19 pandemic on mental health and quality of life among local residents in Liaoning Province, China: a cross-sectional study, Int. J. Environ. Res. Public Health 17 (7) (2020) 2381 https://doi.org/10.3390/ijerph17072381.

[10] Z.F. Ma, Y. Zhang, X. Luo, X. Li, Y. Li, S. Liu, Y. Zhang, Increased stressful impact among general population in mainland China amid the COVID-19 pandemic: a nationwide cross-sectional study conducted after Wuhan city's travel ban was lifted, Int. J. Soc. Psychiatry 66 (8) (2020) 770–779 https://doi.org/10.1177/0020764020935489.

[11] L. Zhang, Y. Liu, Potential interventions for novel coronavirus in China: a systematic review, J. Med. Virol. 92 (5) (2020) 479–490 https://doi.org/10.1002/jmv.25707.

[12] H. Aktas, C.T. Sasmaz, A. Kilincer, E. Mert, S. Gulbol, D. Kulekcioglu, S. Kilar, R. Yuce, Y. Ibik, E. Uguz, A. Demirtas, Study on the factors related to physical activity levels and sleep quality in adults, Mersin Uni. J. Health Sci. 8 (2) (2015) 60–70.

[13] V. Isin, V. Ozcan, Investigation of the physical activity levels who applied to a family health center in rural area, Ortadogu Med. J. 10 (3) (2018) 322–330.

[14] J.A. Zoladz, A. Pilc, The effect of physical activity on the brain derived neurotrophic factor: from animal to human studies, J. Physiol. Pharmacol. 61 (5) (2010) 533–541.

[15] J. Meyer, C. McDowell, J. Lansing, C. Brower, L. Smith, M. Tully, M. Herring, Changes in physical activity and sedentary behaviour due to the COVID-19 outbreak and associations with mental health in 3052 US adults (2020).

[16] S.X. Zhang, Y. Wang, A. Rauch, F. Wei, Unprecedented disruption of lives and work: health, distress and life satisfaction of working adults in China one month into the COVID-19 outbreak, Psychiatry Res. (2020) 112958 https://doi.org/10.1016/j.psychres.2020.112958.

[17] E. Gokce, E. Gunes, E. Nalcaci, Effect of exercise on major depressive disorder and schizophrenia: a BDNF focused approach, Noro. Psikiyatr. Ars. 56 (4) (2019) 302 https://doi.org/10.29399/npa.23369.

[18] G. Mammen, G. Faulkner, Physical activity and the prevention of depression: a systematic review of prospective studies, Am. J. Prev. Med. 45 (5) (2013) 649–657 https://doi.org/10.1016/j.amepre.2013.08.001.

[19] Republic of Turkey Ministry of HealthA Current Situation in Turkey, 2020 Available at: https://covid19.saglik.gov.tr/ (Accessed 17 October 2020).

[20] A.K. Arslan, S. Yasar, C. Colak, S. Yologlu, WSSPAS: an interactive web application for sample size and power analysis with R using shiny, Turkiye Klinikleri J. Biostat. 10 (3) (2018) 224–246.

[21] E. Von Elm, D.G. Altman, M. Egger, S.J. Pocock, P.C. Gøtzsche, J.P. Vandenbroucke, The strengthening the reporting of observational studies in epidemiology (STROBE) statement: guidelines for reporting observational studies, Ann. Internal Med. 147 (8) (2007) 573–577 https://doi.org/10.7326/0003-4819-147-8-200710160-00010.

[22] C.L. Craig, A.L. Marshall, M. Sjostrom, A.E. Bauman, M.L. Booth, B.E. Ainsworth, M. Pratt, U. Ekelund, A. Yngve, J.F. Sallis, P. Oja, International physical activity questionnaire: 12-country reliability and validity, Med. Sci. Sports Exerc. 35 (8) (2003) 1381–1395 https://doi.org/10.1249/01.mss.0000078924.61453.fb.

[23] M. Saglam, H. Arikan, S. Savci, D. Inal-Ince, M. Bosnak-Guclu, E. Karabulut, L. Tokgozoglu, International physical activity questionnaire: reliability and validity of the Turkish version, Percept. Mot. Skills 111 (1) (2010) 278–284 https://doi.org/10.2466/06.08.pms.111.4.278-284.

[24] A.T. Beck, C.H. Wart, M. Mendelson, J. Mock, J. Erbaugh, An inventory for measuring depression, Arch. Gen. Psychiatry 4 (1961) 561–571.

[25] N. Hisli, A reliability and validity study of Beck depression inventory in a university student sample, J. Psychol. 7 (1989) 3–13.

[26] A.T. Beck, N. Epstein, G. Brown, R.A. Steer, An inventory for measuring clinical anxiety: psychometric properties, J. Consult. Clin. Psychol. 56 (6) (1988) 893.

[27] M. Ulusoy, N. Şahin, H. Erkmen, Turkish version of the Beck anxiety inventory: psychometric properties, J. Cogn. Psychother. 12 (1998) 28–35.

[28] The World Health Organization Quality of Life Assessment (WHOQOL): development and general psychometric properties, Soc. Sci. Med. 46 (1998) 1569–1585.

[29] E. Eser, H. Fidaner, C. Fidaner, S.Y. Eser, H. Elbi, E. Goker, WHOQOL-100 and WHOQOL-BREEF's psychometric features, 3P Mag. (1999) 23–40.

[30] World Health Organization (WHO)Global Health Observatory (GHO) Data, 2020 https://www.who.int/gho/ncd/risk_factors/physical_activity_text/en/ (accessed July 1, 2020).

[31] G. Maugeri, P. Castrogiovanni, G. Battaglia, R. Pippi, V. D'Agata, A. Palma, et al., The impact of physical activity on psychological health during Covid-19 pandemic in Italy, Heliyon 6 (6) (2020) 04315 https://doi.org/10.1016/j.heliyon.2020.e04315.

[32] G.H. Tison, R. Avram, P. Kuhar, S. Abreau, G.M. Marcus, M.J. Pletcher, J.E. Olgin, Worldwide effect of COVID-19 on physical activity: a descriptive study, Ann. Internal Med. (2020) https://doi.org/10.7326/M20-2665.

[33] Theo Vos, Amanuel Alemu Abajobir, Kalkidan Hassen Abate, Cristiana Abbafati, Kaja M Abbas, Foad Abd-Allah, et al., GBD 2016 disease and injury incidence and prevalence collaborators, global, regional, and national incidence, prevalence, and years lived with disability for 328 diseases and injuries for 195 countries, 1990–2016: a systematic analysis for the global burden of disease study 2016, Lancet 390 (10100) (2017) 1211–1259 https://doi.org/10.1016/S0140-6736(17)32154-2.

[34] A.J. Ferrari, A.J. Somerville, A.J. Baxter, R. Norman, S.B. Patten, T. Vos, H.A. Whiteford, Global variation in the prevalence and incidence of major depressive disorder: a systematic review of the epidemiological literature, Psychol. Med. 43 (3) (2013) 471 https://doi.org/10.1017/S0033291712001511.

[35] C. Wang, R. Pan, X. Wan, Y. Tan, L. Xu, C.S. Ho, R.G. Ho, Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China, Int. J. Environ. Res. Public Health 17 (5) (2020) 1729 https://doi.org/10.3390/ijerph17051729.

[36] D. Roy, S. Tripathy, S.K. Kar, N. Sharma, S.K. Verma, V. Kaushal, Study of knowledge, attitude, anxiety & perceived mental healthcare need in Indian population during COVID-19 pandemic, Asian J. Psychiatr. 51 (2020) 102083 https://doi.org/10.1016/j.ajp.2020.102083.

[37] A. Ströhle, Physical activity, exercise, depression and anxiety disorders, J. Neural Transm. (Vienna) 116 (6) (2009) 777 https://doi.org/10.1007/s00702-008-0092-x.

[38] M. Hallgren, N. Owen, B. Stubbs, D. Vancampfort, A. Lundin, D. Dunstan, R. Bellocco, Y.T. Lagerros, Cross-sectional and prospective relationships of passive and mentally active sedentary behaviours and physical activity with depression, Br. J. Psychiatry (2019) 1–7 https://doi.org/10.1192/bjp.2019.60.

[39] A. Brunes, L.B. Augestad, S.L. Gudmundsdottir, Personality, physical activity, and symptoms of anxiety and depression: the HUNT study, Soc. Psychiatry Psychiatr. Epidemiol. 48 (5) (2013) 745–756 https://doi.org/10.1007/s00127-012-0594-6.

[40] M.R. Song, Y.S. Lee, J.D. Baek, M. Miller, Physical activity status in adults with depression in the National Health and nutrition examination survey, 2005–2006, Public Health Nurs. 29 (3) (2012) 208–217 https://doi.org/10.1111/j.1525-1446.2011.00986.x.

[41] C. Phillips, Brain-derived neurotrophic factor, depression, and physical activity: making the neuroplastic connection, Neural Plast. 2017 (2017) https://doi.org/10.1155/2017/7260130.

[42] J.R. Thomas, J.K. Nelson, S.J. Silverman, Research Methods in Physical Activity, Human Kinetics, Champaign, IL, 2015.

[43] G. Mammen, G. Faulkner, Physical activity and the prevention of depression: a systematic review of prospective studies, Am. J. Prev. Med. 45 (2013) 649–657 https://doi.org/10.1016/j.amepre.2013.08.001.

[44] F.S. Lodhi, A. Montazeri, S. Nedjat, M. Mahmoodi, U. Farooq, M. Yaseri, A. Kasaeian, K. Holakouie-Naieni, Assessing the quality of life among Pakistani general population and their associated factors by using the World Health Organization's quality of life instrument (WHOQOL-BREF): a population based cross-sectional study, Health Qual. Life Outcomes 17 (1) (2019) 9 https://doi.org/10.1186/s12955-018-1065-x.

[45] B. Patrício, L.M. Jesus, M. Cruice, A. Hall, Quality of life predictors and normative data, Soc. Indicat. Res. 119 (3) (2014) 1557–1570 https://doi.org/10.1007/s11205-013-0559-5.

[46] L.N. Cruz, C.A. Polanczyk, S.A. Camey, J.F. Hoffmann, M.P. Fleck, Quality of life in Brazil: normative values for the WHOQOL-BREF in a southern general population sample, Qual. Life Res. 20 (7) (2011) 1123–1129 https://doi.org/10.1007/s11136-011-9845-3.

[47] A. Rebelo-Marques, A. De Sousa Lages, R. Andrade, C.F. Ribeiro, A. Mota-Pinto, F. Carrilho, J. Espregueira-Mendes, Aging hallmarks: the benefits of physical exercise, Front. Endocrinol. (Lausanne) 9 (2018) 258 https://doi.org/10.3389/fendo.2018.00258.

[48] G. Bogdanovic, L. Stojanovich, A. Djokovic, N. Stanisavljevic, Physical activity program is helpful for improving quality of life in patients with systemic lupus erythematosus, Tohoku J. Exp. Med. 237 (3) (2015) 193–199 https://doi.org/10.1620/tjem.237.193.