

Kinesiophobia, Dyspnea, Pain, Fatigue, Depression, Anxiety, Stress, and Balance in Adolescent Volleyball Players Who Have Had COVID-19

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ABSTRACT

Objective: It is still unclear to what extent kinesiophobia, dyspnea, pain, fatigue, mood, and balance are affected in adolescent volleyball players who have had COVID-19. Therefore, present study aimed to comparatively investigate kinesiophobia, dyspnea, pain, fatigue, depression, anxiety, stress, and balance between adolescent volleyball players with and without post-COVID-19.

Methods: Adolescent volleyball players between ages of 10-19 (n=40) were included in the study between May 2022 and August 2022 and divided into those who have had COVID-19 (n=18) and those who have never had COVID-19 (n=22). Measurements of kinesiophobia (Tampa Scale of Kinesiophobia), dyspnea perception in daily living activities (Modified Medical Research Council Dyspnea Scale), severity of pain and fatigue (Numerical Rating Scale), depression, anxiety, and stress levels (Short Form of Depression Anxiety Stress Scale), static balance (balance test on one leg), and dynamic balance (standing functional reach test) were performed in all volleyball players at once.

Results: There was no statistically significant difference between groups in demographic characteristics, kinesiophobia, dyspnea, pain, fatigue, depression, stress, and balance values (p>0.05). However, anxiety scores of adolescent volleyball players who have not had COVID-19 were statistically significantly higher than those of adolescent volleyball players who have experienced COVID-19 (p<0.05). The incidences of anxiety (n=5, 27.8% versus n=11, 50%) were similar between groups (p>0.05).

Conclusions: During the prolonged COVID-19 pandemic period, kinesiophobia, dyspnea, pain and fatigue perceptions, depression, stress, and balance levels were found to be similar in adolescent volleyball players regardless of their post-COVID-19 status. However, anxiety is more common in adolescent volleyball players without post-COVID-19. Therefore, underlying causes of anxiety observed in adolescent volleyball players without post-COVID-19 should be investigated.

Keywords: Adolescent Volleyball Players, COVID-19, Balance, Depression, Kinesiophobia



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INTRODUCTION

Coronavirus disease 2019 (COVID-19) has been experienced as a deadly respiratory pandemic in the past years and has adversely changed both the style of sports competition and

physical condition of athletes. Face-to-face participation in sports organizations has been cancelled and/or postponed during the pandemic [1]. While the anxiety level of elite athletes increased during social isolation and quarantine periods, it

decreased during the return to a controlled social life. During the restrictions period, while the workout times of young athletes decreased, the time spent outside, and duration of sleep increased. By 86% of these young athletes were able to continue their training program by maintaining social distance during this period. Older athletes had higher rates of depression while younger female athletes had higher levels of anxiety. By 10% of young athletes and 20% of young people changed their sports-related goals during the pandemic process [1].

Due to the rapid transmission feature of COVID-19, mandatory restrictions and strict quarantine rules have been applied in all parts of the society for a long time all over the world. For this reason, the incidences of kinesiophobia defined as the fear of moving, anxiety, depression, and stress, have increased in both individuals with post-COVID-19 and without post-COVID-19 [2-5]. Although children have been less affected by the COVID-19 pandemic than adults, depressive symptoms and anxiety have also been observed in children and adolescents during this period [6,7]. Besides anxiety and depression [5], dyspnea and fatigue are also among the symptoms that can be seen in individuals afflicted with COVID-19 [3,8]. Unfortunately, individuals with post-COVID-19 may continue to experience some symptoms such as dyspnea, pain, and fatigue even months after the infection [3,9]. As previously shown, low back and neck pain have been also observed in mild-COVID-19 patients in home quarantine during the isolation period and post-COVID-19 period [10]. It has been reported that physical performance including balance ability decreases in elderly individuals who have had COVID-19 [8,11]. However, studies evaluating static or dynamic balance in adolescents with post-COVID-19 have not been found in the

literature.

As far as we know, it is not yet known to what extent kinesiophobia, dyspnea, pain, fatigue, depression, anxiety, stress, and balance are affected in adolescent volleyball players who have had COVID-19 compared to their peers who have never had COVID-19. For this reason, in this study, it was aimed to reveal the effects of COVID-19 on these outcome values in adolescent volleyball players and to test the hypotheses by comparing kinesiophobia, dyspnea, pain, fatigue, depression, anxiety, stress and balance between adolescent volleyball players without post-COVID-19 and with post-COVID-19.

MATERIALS AND METHODS

Study Design

Ethics committee approval of this cross-sectional study was obtained from Izmir Democracy University Non-Interventional Clinical Research Ethics Committee on 2022-04-06 with the decision number 2022/04-10. Necessary permissions for the study were received from the Ministry of Health and the Ministry of Youth and Sports. Signed consent forms were taken from all volleyball players and their parents who were informed about the study. In this cross-sectional study, demographic and descriptive knowledge about the volleyball players were recorded. The measurement parameters are kinesiophobia, dyspnea, pain, fatigue, depression, anxiety, stress, and balance levels that were completed in each volleyball player in approximately 30 minutes in one day.

Study Population

Adolescent volleyball players were included in the study between May 2022 and August 2022. They were athletes who actively participated in the tournaments held in Isparta province under the Ministry of Youth and Sports. Inclusion criteria for the players who have had COVID-19 were i) being between the ages of 10-19 (adolescent/adolescence), ii) volunteering to participate in the study, iii) being able to understand and answer the questionnaires and scales applied within the scope of the study, iv) diagnosis of post-COVID-19 (having a positive result of polymerase chain reaction test or having a chest X-ray or lung tomography result consistent with COVID-19 infection despite a negative result of polymerase chain reaction test) and v) having discharged from hospital due to COVID-19 and/or recovered in quarantine at home. Exclusion criteria for the players who have had COVID-19 were i) having any physical or mental disability/disease and/or cognitive impairment that

Main Points;

- During the prolonged COVID-19 pandemic, higher anxiety scores were evident in adolescent volleyball players without post-COVID-19.
- When compared to the scores of kinesiophobia, dyspnea in activities of daily living, pain, fatigue, depression, stress, static balance and dynamic balance scores, there were no differences between volleyball players with and without post-COVID-19.
- Kinesiophobia, dyspnea, pain, fatigue, depression, stress, static balance and dynamic balance disorders existed at similar rates in adolescent volleyball players regardless of having post-COVID-19.
- It is important to evaluate adolescent volleyball players with multidisciplinary approaches when it comes to situations that affect public health in every way, such as COVID-19 pandemic.

could prevent the evaluations, ii) having any acute infection and/or health problems, iii) being newly diagnosed with COVID-19 and therefore in quarantine at home or receiving treatment in hospital and/or iv) having suspected COVID-19.

Inclusion criteria for the players who have not had COVID-19 were i) being between the ages of 10-19 (adolescent/adolescence), ii) volunteering to participate in the study and iii) being able to understand and answer the questionnaires and scales applied within the scope of the study. Exclusion criteria for the players who have not had COVID-19 were i) having any physical/mental and/or cognitive impairments that could prevent the evaluations, ii) having any acute or chronic infection and/or health problems, iii) having had COVID-19 and/or iv) having suspected COVID-19.

Measurements

Kinesiophobia

The Tampa Scale of Kinesiophobia was used to evaluate kinesiophobia status of adolescent volleyball players [12]. Turkish version of this scale is valid and reliable which consists of 17 items in total. Each item is scored in a four-point Likert type as “strongly disagree (1 point), disagree (2 points), agree (3 points) and totally agree (4 points) [13]. The scoring of the 4th, 8th, 12th, and 16th items is calculated by reversing. The total score is calculated by summing up the corresponding score for the answers from all items. The lowest total score that can be obtained from the scale is 17 and the highest total score is 68. A high score from the scale indicates an increase in kinesiophobia status of the individual. A cut-off score above 37 points is defined as a high degree of kinesiophobia [12]. The volleyball players answered this scale themselves.

Dyspnea

Dyspnea is a complex subjective sensation that is an important feature of cardiac and/or pulmonary system diseases [14]. The severity of dyspnea and dyspnea occurring during activities of daily living in adolescent volleyball players were questioned using the Modified Medical Research Council Dyspnea Scale [14]. This dyspnea scale consists of five levels based on various physical activities causing dyspnea. These levels are scored from 0 to 4. The first level indicates the absence of dyspnea (0 point), and the last level indicates severe shortness of breath felt even during dressing and undressing activities (4 points). As the score obtained from the scale increases, the perception of dyspnea during activities of daily living also increases [14].

Pain and Fatigue

The severity of pain and fatigue at rest and during activities of daily living was evaluated using the Numerical Rating Scale which is a verbal, one-dimensional, easy-to-use, and simple scale [15,16]. This scale expresses the severity of pain and fatigue with integers from 0 (no pain/fatigue) to 10 (the worst possible pain/fatigue). This scale, which provides a single-item measurement, has horizontal and vertical forms [15,16]. Volleyball players participating in the study made markings on the vertical form.

Depression, Anxiety, and Stress

The Short Form of Depression Anxiety Stress Scale was used to evaluate the mood of adolescent volleyball players [17]. This form consists of 21 items. There are seven items for each of the sub-assessments of depression, anxiety, and stress [17]. Each item is suitable for 4-point Likert-type scoring and is scored between 0 and 3. Responses to each item are “not suitable for me (0 point), slightly suitable for me (1 point), usually suitable for me (2 points), and completely suitable for me (3 points)” [17]. If a total of 5 points or more is obtained from the depression sub-assessment, a total of 4 points or more from the anxiety sub-assessment, and/or a total of 8 points or more from the stress sub-assessment, it is stated that the individual has the related problem. Turkish version of this form is valid and reliable [18].

Static and Dynamic Balance

The balance test on one-leg is a simple field test which is used to measure the static aspects of balance [19]. This test is commonly used to assess static balance ability in children. It has been reported that children older than 10 years of age can maintain the balance test on one-leg between 53 and 104 seconds [20]. This test was performed separately for the right and left lower extremities of adolescent volleyball players on one-leg on a hard floor. The test was performed with both eyes open and closed. Volleyball players stood with their hands on their waists before the test. When they were ready, they started to stand on one leg (another knee in 90° flexion), keeping their balance on one leg, looking ahead and not touching the other legs. As soon as the volleyball players lifted their feet from the ground, the time began. The maximum time to stand on one leg was recorded in seconds with a stopwatch separately for the right and left sides and for the tests with eyes open and closed. The test was stopped when the volleyball player broke the fixed position or lowered the raised foot. Volleyball players had two attempts for each test. The measurement values obtained by staying in the best and correct position were recorded [19].

The standing functional reach test was used to assess functional/dynamic balance performance of the volleyball players. The use of this test is appropriate in the evaluation of balance in children population. A normal value range is reported as 23-36.5 cm in children aged between 6-12 in the Turkish population [21]. Adolescent volleyball players were asked to stand side by side without touching the wall while the standing functional reach test was being applied. Then, they were asked to extend their arms at the side of the wall in 90° flexion, elbow extension and parallel to the wall. The distance value between the starting point and the farthest point reached was measured and recorded in centimeters. This measurement was repeated three times, performed separately from the right and left sides. The three values obtained for each side were averaged [22].

Statistical Analyses

The sample size was calculated using the program GPower (G*Power 3.0.10 system, Franz Faul, Universität Kiel, Germany). To detect the difference in kinesiophobia scores (9.1) between two independent groups for a statistically significant level by reaching an α value of 0.05, an effect size of 1.5, and a power of 95%, at least 18 players for post-COVID-19 group and at least 10 players for non-post-COVID-19 group were calculated [23]. At the end of the study, statistical analyzes were performed using Windows-based Statistical Program for Social Sciences version 15.0. Descriptive analyzes were presented using frequency (n), percent (%), median, interquartile range (IQR), mean and standard deviation ($x \pm SD$) values. Independent Sample t-test was used to compare the variables with normal distribution, Mann-Whitney U test was used to compare variables that did not fit the normal distribution, and the Chi-square test was used to compare the categorical variables. While the differences between the groups of the normally distributed variables were given as the difference between the means (mean difference)

and the lower and upper limits of the 95% confidence interval (95%CI), the differences between the groups of the non-normally distributed variables were given as the U value. The probability of error in statistical analysis was accepted as $p < 0.05$.

RESULTS

The study included 43 adolescent volleyball players who actively participated in tournaments, 19 of whom had COVID-19 and 24 had not. One of the volleyball players who have had COVID-19 and two of the volleyball players who have not had COVID-19 were excluded from the study because they were suspected of being COVID-19 positive. The study was completed with 18 post-COVID-19 and 22 non-post-COVID-19 volleyball players. All volleyball players with post-COVID-19 have completed their COVID-19 treatment in quarantine at home and these athletes were volleyball players who have had mild COVID-19. When the descriptive and physical characteristics of the volleyball players were compared between the groups, no statistically significant differences were found (Table 1, $p > 0.05$).

No statistically significant difference was found between the groups when the kinesiophobia, dyspnea, pain and fatigue felt at rest and during activities, depression, stress, static and dynamic balance scores of the volleyball players were compared (Table 2-3, $p > 0.05$). The anxiety scores of volleyball players without post-COVID-19 were statistically significantly higher than those who had experienced COVID-19 (Table 2, $p < 0.05$). No statistically significant differences were found in the rates of high degree of kinesiophobia, dyspnea, pain, and fatigue at rest and during activities, depression, anxiety, and stress (Table 1, Figure 1, $p > 0.05$). One (5.6%) of the volleyball players with post-COVID-19 and 2 (9.1%) who have not had COVID-19 had dyspnea while walking fast on a flat road or climbing a slight slope ($p > 0.05$).

Table 1. Distribution of descriptive and physical characteristics of volleyball players

	Volleyball players with post-COVID-19	Volleyball players without post-COVID-19	p value
	$x \pm SD$ / Median (IQR)	$x \pm SD$ / Median (IQR)	
Age (year)	14.72 \pm 2.72	14.27 \pm 3.06	0.630
Height (cm)	166.67 \pm 8.96	160.73 \pm 9.76	0.054
Weight (kg)	56.67 \pm 11.45	51.09 \pm 8.85	0.090
Body mass index (kg/m ²)	20.2 \pm 2.75	19.64 \pm 2.01	0.458
Year of volleyball playing	1.5 (3.25)	2 (2.25)	0.867
	n; %	n; %	
Gender (female/male)	11; 61.1% / 7; 38.9%	18; 81.8% / 4; 18.2%	0.173
Chronic illness	2; 11.2%	2; 9.1%	0.499

High degree of kinesiophobia	8; 44.4%	6; 27.3%	0.257
Pain at rest	3; 16.7%	7; 31.8%	0.464
Pain during activities	6; 33.3%	10; 45.5%	0.436
Fatigue at rest	6; 33.3%	9; 40.9%	0.622
Fatigue during activities	8; 44.4%	9; 40.9%	0.822
Depression	5; 27.8%	7; 31.8%	0.781
Anxiety	5; 27.8%	11; 50%	0.154
Stress	4; 22.2%	6; 27.3%	0.714

n: frequency, %: percent, cm: centimeters, kg: kilograms, x: mean, SD: standard deviation, IQR: interquartile range, Mann-Whitney U test *p<0.05, Chi-square test ** p<0.05, Independent Sample t-test ***p<0.05.

Table 2. Comparison of kinesiophobia, dyspnea, pain, fatigue, depression, anxiety, and stress scores in volleyball players

	Volleyball players with post-COVID-19	Volleyball players without post-COVID-19		
	Median (IQR)	Median (IQR)	U value	p value
Kinesiophobia score (17-68)	33.5 (12.75)	35 (8)	189	0.806
Dyspnea score (0-4)	0 (0)	0 (0)	189	0.677
Pain score at rest (0-10)	0 (0)	0 (2)	167	0.267
Pain score during activities (0-10)	0 (2)	0 (2.25)	174.5	0.470
Fatigue score at rest (0-10)	0 (2.5)	0 (4)	183.5	0.650
Fatigue score during activities (0-10)	0 (2.5)	0 (1.25)	173.5	0.458
Depression score (0-21)	2.5 (5)	3 (4.25)	173.5	0.496
Anxiety score (0-21)	2.5 (3)	3.5 (4.5)	126	0.047*
Stress score (0-21)	3.5 (5.75)	4.5 (5.25)	155	0.240
DASS total score (0-63)	6.5 (14.25)	11 (12.25)	135.5	0.089

DASS: Short Form of Depression Anxiety Stress Scale, IQR: interquartile range, Mann-Whitney U test *p<0.05.

Table 3. Comparison of static and dynamic balance scores in volleyball players

	Volleyball players with post-COVID-19	Volleyball players without post-COVID-19	Mean difference (95%CI) / U value	p value
	x±SD / Median (IQR)	x±SD / Median (IQR)		
Evaluation of static balance				
Balance test on left one-leg with eyes open (sec)	62 (126.25)	48.5 (104.5)	166.5	0.392
Balance test on right one-leg with eyes open (sec)	60 (57.75)	78.5 (140.5)	163.5	0.348
Balance test on left one-leg with eyes closed (sec)	35 (18.75)	30 (26.5)	169	0.428
Balance test on right one-leg with eyes closed (sec)	33.5 (25)	36 (20)	192.5	0.881
Evaluation of dynamic balance				
Functional reach test (left, cm)	47.39±8.21	45.55±6.76	1.85 [(-2.94)-(6.63)]	0.440
Functional reach test (right, cm)	49 (13.83)	43.33 (12.63)	150	0.192

sec: second, cm: centimeters, x: mean, SD: standard deviation, IQR: interquartile range, 95CI%: 95% confidence interval, Mann-Whitney U test *p<0.05, Independent Sample t-test **p<0.05.

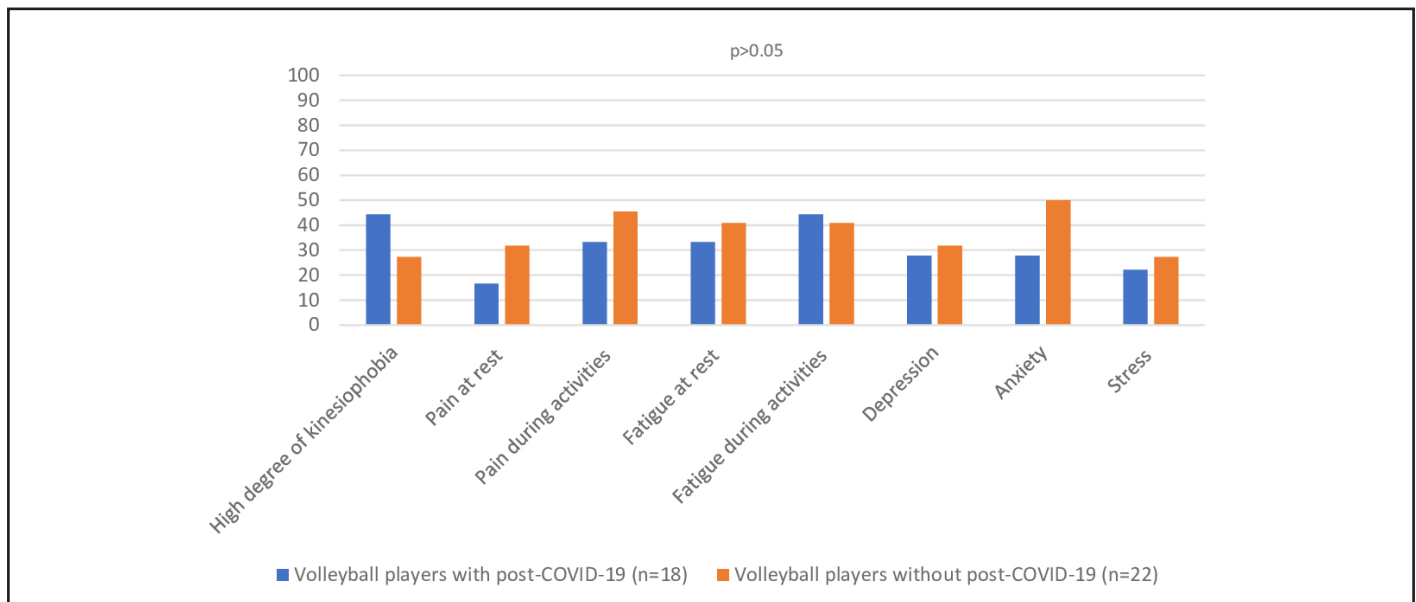


Figure 1. Comparison of high degree of kinesiophobia, pain, fatigue, depression, anxiety, and stress rates in volleyball players.

DISCUSSION

The most notable important findings of current study, which was firstly carried out on adolescent volleyball players with or without post-COVID-19 during the prolonged COVID-19 pandemic, to our knowledge, are as follows: i) The adolescent volleyball players without post-COVID-19 had higher anxiety scores, ii) Kinesiophobia, dyspnea in activities of daily living, pain, fatigue, depression, stress, static balance and dynamic balance scores were indicated to be similar in volleyball players with and without post-COVID-19, iii) High degree of kinesiophobia, feeling of pain at rest, feeling of pain during activities, feeling of fatigue at rest, feeling of fatigue during activities, depression, anxiety, and stress existed in some volleyball players with post-COVID-19, iv) High degree of kinesiophobia, feeling of pain at rest, feeling of pain during activities, feeling of fatigue at rest, feeling of fatigue during activities, depression, anxiety, and stress existed in some volleyball players without post-COVID-19.

In the COVID-19 pandemic, the incidences of physical inactivity and kinesiophobia, defined as the fear of movement, have increased in individuals due to mandatory restrictions and quarantine rules [2-4]. It has been found that the kinesiophobia scores were similarly higher in elderly individuals with and without COVID-19 [2]. Consistent with the results of this study, although high levels of kinesiophobia were reported in some of the adolescent volleyball players with and without post-COVID-19 in our study, kinesiophobia scores were similar

between our groups. The kinesiophobia scores were found to be higher in adult individuals with post-COVID-19 compared to healthy adults who were evaluated in the second year of the pandemic [3,4]. Contrary to the results of these studies, in our study, no difference was found in terms of kinesiophobia scores in adolescent volleyball players with and without post-COVID-19. This difference observed in the kinesiophobia results of these studies may be due to the fact that the times when the measurements were taken in the studies coincided with the processes in which the pandemic passed with different intensities. Our study has been carried out more recently, the restrictions have been relaxed and unmasked socialization has been started during the evaluation period of the volleyball players. In addition, at that time, adolescents were rapidly adapting to face-to-face education. For this reason, the kinesiophobia score may have been found to be lower in the volleyball players in our study compared to the studies. Although the devastating effects of the COVID-19 pandemic on human health have decreased today, it should be considered that effects of the pandemic continue. Multidisciplinary approaches should be planned to improve these public health problems that may remain after the virus has passed in individuals with post-COVID-19.

Dyspnea is among the symptoms that can be seen in individuals with COVID-19 [3,8]. Elderly individuals with post-COVID-19, who were discharged after receiving acute care treatment for COVID-19 in the hospital and followed up in the outpatient service, had mild to moderate severity of dyspnea [8]. Another

study demonstrated that dyspnea score was found to be higher in individuals with post-COVID-19 compared to healthy individuals [3]. Although the difference in dyspnea scores between our groups has not been shown in our study, 5.6% of volleyball players with post-COVID-19 and 9.1% of volleyball players without post-COVID-19 had mild severity of dyspnea in activities of daily living. The fact that dyspnea was less common in adolescent volleyball players with post-COVID-19 compared to older adults who have experienced COVID-19 can be attributed to the higher incidence of comorbidities observed in elderly individuals. As seen, COVID-19 affects children less than adults and may show an asymptomatic course in children [24].

Fatigue (98%) and pain (87%) can be observed as long-term symptoms of COVID-19 [9]. Mild to moderate fatigue existed in elderly adults with post-COVID-19 [8]. It was also reported that pain and fatigue scores of individuals with post-COVID-19 were higher than the scores of healthy individuals [3]. In another study conducted in individuals with mild-COVID-19 showed that while neck pain was observed in these individuals in the pre-COVID-19 period (20%), during the isolation period of COVID-19 (35.6%) and in the post-COVID-19 period (13.3%), low back pain observed in these individuals in the pre-COVID-19 period (22.2%), during the isolation period of COVID-19 (42.2%) and in the post-COVID-19 period (13.3%) [10]. Consistent with these studies, adolescent volleyball players with and without post-COVID-19 had pain and fatigue both at rest and during activities in current study. Due to the severe impact of the SARS-CoV-2 virus at the onset of the COVID-19 pandemic, individuals with COVID-19 had higher rates of pain and fatigue, but these rates and scores decreased in individuals with post-COVID-19 as shown in current study. In fact, as seen in our study, the pain perceptions of individuals with post-COVID-19 were similar to healthy controls. However, considering relatively high rates of pain and fatigue observed in our healthy controls it can be said that the perception of pain and fatigue may have increased due to problems such as kinesophobia, physical inactivity and fear of COVID-19.

Depressive symptoms and anxiety have been reported in children and adolescents during the pandemic period [6,7]. Our study proved that while volleyball players in both groups had similar rates of depression, stress, and anxiety (27.8% versus 50%), anxiety scores of the players without post-COVID-19 (median score (IQR): 3.5 (4.5)) were higher than others (median score

(IQR): 2.5 (3)). Contrary to this result of our study, it has been reported that the depression scores of the young adult athletes who have had COVID-19 were higher than those who have not had COVID-19 while anxiety scores were similar between groups [25]. Moreover, Yıldız and Algün Doğu (2022) showed that the anxiety scores of female young adult athletes were higher than males [25]. The difference between these results may be due to the inclusion of young adult athletes with at least 5 years of licensed athlete history. As a matter of fact, it has been also reported that older athletes had higher depression scores in the COVID-19 pandemic [1]. Öksüz Çapanoğlu found the rate of anxiety to be higher in individuals who have had COVID-19 compared to individuals who have not had COVID-19, contrary to the results we found in our study [3]. On the other hand, no difference was observed in terms of anxiety and depression scores between these individuals [3]. It was also shown in the study published by Barğı in 2022 that the anxiety score may be higher in adults who have had COVID-19 compared to adults who have not had COVID-19 [4]. Adult individuals with and without post-COVID-19 were included in this newly published study, and the measurements were taken from these individuals in November 2021 and December 2021 [4]. As a result, it was found that anxiety (55.2% vs. 20%) and stress (34.5% vs. 5%) were observed more frequently in individuals with post-COVID-19, and anxiety scores were higher in individuals with post-COVID-19 compared to others [4]. Similarly, a study published by Tanrıverdi et al (2022) showed that 33.3% of adult individuals who have had mild or moderate COVID-19 had anxiety and 29.2% had depression [5]. As seen, the studies have demonstrated that individuals with post-COVID-19 had mood disorders including anxiety, stress, and/or depression [3-5]. In the literature, the incidences of depression, anxiety and stress in adults who have had COVID-19 are like the rates observed in our adolescent volleyball players with post-COVID-19. However, in our study, it is an advantage to have a healthy control group without post-COVID-19, whose the anxiety score was found to be higher. This may have been caused by the inclusion of adolescent volleyball players, who can be affected by the physical health status, emotions, and thoughts of other individuals (parents etc.) around them with COVID-19 [26]. In the study of Eroğlu and Yakşi, it was also stated that the anxiety score increased to the highest level in children who had both parents infected with COVID-19 [26]. On the other hand, the thought that having COVID-19 may adversely affect sports performance in athletes may have caused more anxiety in adolescent athletes who have not had COVID-19. As a

matter of fact, being psychologically weak both poses a risk for the physical and mental health of the athlete and reduces the quality of professional sports performance [25]. For this reason, considering the negative long-term effects of the COVID-19 pandemic on the mood of both children and adults with or without post-COVID-19, it is recommended to include these individuals in psychological counseling programs.

The results of present study regarding static and dynamic balance scores were similar in adolescent volleyball players with and without post-COVID-19 which is the firstly exposed in our study, to our knowledge. Similar to our results, balance scores of the individuals with post-COVID-19 were not different from controls [3]. On the other hand, it has been shown that physical performance, including balance, decreased in elderly individuals who have had COVID-19 [8,11]. It is an expected situation since balance disorders can be often seen in elderly people due to chronic comorbid diseases or as a part of the aging process [27]. However, it is reported that these problems can develop in the early stages of life in young people due to sedentary lifestyle. A study conducted in adult males demonstrated that the balance scores of physically active individuals are better than those of sedentary individuals [28]. In our study, due to the young age of the adolescent volleyball players engaged in active sports, balance problems may not have been detected. For this reason, the presence of balance problems in older individuals who have had COVID-19 should be investigated with appropriate evaluation methods.

The most important limitation of our study is that the star balance test, which allows the balance measurement to be used as a more differential test in athletes, was not used. We recommend that this test should be used in the evaluation of balance in athletes by ensuring standardization in physical conditions in future studies. Another limitation of our study is the short-term one-time measurements of adolescent volleyball players with or without post-COVID-19. Because the study was planned as a cross-sectional study. Cross-sectional studies cannot reveal a cause-effect relationship. Therefore, a longitudinal study can confirm the cause-effect relationship. Considering that COVID-19 affects adults more, we recommend that long-term follow-up studies should be conducted to detect problems that may arise in these children in the future.

Adolescent volleyball players without post-COVID-19 had a higher anxiety score than those with post-COVID-19. It is

pleasing that kinesiophobia, perception of dyspnea in daily living activities, pain, fatigue, depression, stress, static balance, and dynamic balance problems are not seen in children who have had mild COVID-19 during the prolonged COVID-19 pandemic period. This makes us think that the devastating and lasting effects of the pandemic on human health in the early stages diminished in the second year of the pandemic. Considering the high rates of kinesiophobia, pain sensation at rest, pain during activities, fatigue at rest, fatigue during activities, depression, anxiety, and stress in adolescent volleyball players with and without COVID-19, regardless of having post-COVID-19, we recommend that children should be evaluated with multidisciplinary approaches and referred to psychological and physical activity counseling when necessary.

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Ethical Approval: Ethics committee approval was received for this study from the Izmir Democracy University Non-interventional Clinical Research Ethics Committee (Approval Number: 2022/04-10, Date: 2022-04-06) and was conducted in accordance with the principles of the Declaration of Helsinki.

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