Submitted: 16 September, 2021 Accepted: 15 October, 2021 Online Published: 28 October, 2021 DOI:10.31083/jomh.2021.143

JOMH Journal of Men's Health

Original Research

Is COVID-19 infection decreasing the sports performance of the volleyball players? A pilot study

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Abstract

Background: Coronavirus (COVID-19) infection has made restrictions on every sports level, from the audience to athletes worldwide. Volleyball players' life were affected by COVID-19 infection, the layout of training, and competitions. This study aims to show the effect of COVID-19 infection on the performance of volleyball players.

Methods: Nineteen volleyball players aged 15–20 in the same volleyball club and infected with COVID-19 in the first league of their country were included in the study. Weight, height, fat percentage, muscle mass, countermovement jump, Squat jump, Spike jump tests, and agility *T*-tests records were compared before (1 and 2 measures) and after the COVID-19 infection (3 and 4 measures). The team physician asked and recorded the players' feelings about changes in their sports performance after the COVID-19 infection.

Results: The mean number of PCR (+) days was 13.4 $\pm$ 2.6. All the median differences of the vertical jump tests had a statistically significant increase at every measure except for the Countermovement jump and squat jump' last two measures, squat jump' first two measures, and spike jump' between twice and third measures. The median differences between the first and last agility *T*-tests were not statistically significant (p = 0.277). The feeling of volleyball players about the sports performance level was decreased by 57.9%, increase 10.5%, no change 31.6%.

Conclusions: Volleyball players' vertical jump performance was getting better despite the COVID-19 infection in our study. Inactivity might be more harmful than COVID-19 infection on sports performance.

Keywords

Sports performance; Volleyball; COVID-19

1. Introduction

Coronavirus (COVID-19) was first identified in China in December 2019 and was found to cause respiratory diseases and acute respiratory syndrome [1]. The virus, which had a significantly higher contamination risk, had spread to many countries within three months. It was declared a pandemic by the World Health Organization (WHO) on March 11, 2020. According to the data of the WHO, more than 216 million people have been infected, and nearly 4.5 million people have died from these viral diseases until now [2]. Restrictions have been made in all areas of society, including sports branches in the COVID-19 pandemic. Public awareness, encouragement of personal hygiene, and cancellation or delay of crowded public meetings have been proposed by WHO to control the spread of the virus [2]. Sports

competitions were also considered risky in spreading the virus due to crowded audience and organization teams, and many national-international sports activities were canceled worldwide [1]. The number of cases decreased due to the precautions, and sports competitions and leagues have resumed within the rules determined by countries and federations [1]. The competitions continue to be played without audiences, with strict COVID-19 precautions and PCR tests often used for screening. However, despite the precautions, athletes from all branches of our country and the world are infected daily. Athletes infected with COVID-19 continue training and competitions at the end of their treatment and quarantine [3]. Athletes with COVID-19 are given medications recommended by the Turkish Ministry of Health, and a 10-day quarantine is applied [3]. Athletes whose symptoms progress and who are indicated for hospitalization during this period are followed up in the hospital. The indications for return to sports are determined according to the severity of the infection, and the athletes return to training and competition individually and as a team concerning these indications [3, 4]. Many reasons affect athlete performance, and infection and lack of training are among these reasons [5].

Volleyball is a sport that requires a high level of aerobic and anaerobic performance. Volleyball players have intense training programs including both aerobic and anaerobic performance improvement [6, 7]. Training programs, loading limitations, and recovery periods are developed very carefully. Also, there are a lot of studies that investigate the training methods to improve performance in the literature [6, 8]. Different training monitoring and testing methods are used to evaluate the performance of the players in volleyball [9, 10]. One of these evaluation methods is jump height measurement. Jump height has been associated with performance previously in volleyball [8, 11]. Vertical jump height is a performance criterion in volleyball [12, 13]. It has been determined that the performance of the athletes with higher vertical jump height is also higher [12, 13]. The agility *T*-test is a test that shows anaerobic capacity, which can be measured simply with a stopwatch. It is used to evaluate the anaerobic performance needed in volleyball. These two tests are among the performance tests that volleyball teams frequently use in their routine [14].

No study demonstrates the effect of COVID-19 infection on athlete performance in the literature. This study aims to show the effect of COVID-19 infection on the performance of young men elite volleyball players.

2. Materials and methods

2.1 Subjects

This retrospective study was conducted to evaluate the effect of COVID-19 infection on the performance of volleyball players. The study includes volleyball players aged 15–20 who are in the same volleyball club and infected with COVID-19 in the first league of our country. The local ethics committee approved the study (Study Number: 2021-22, date: 14.01.2021). Volleyball Club permitted the use of player's data. Volleyball players' age, weight, height, fat percentage, muscle mass, Countermovement jump, Squat jump, Spike jump, and agility *T*-tests are conducted intermittently and recorded. COVID-19 PCR tests of 21 athletes on 16 October–3 November 2020 were positive and quarantined. All of the players were had no or mild symptoms, and none of them needed hospitalization. As of 10 days later, PCR tests were started and repeated until being negative. All of the players who turned out to be negative started to training and participated in competitions because they meet the criteria for returning to sports. However, 2 of these athletes moved to the national team and left the club. Therefore, the data of these players had been extracted. Volleyball players' age, weight, height, fat percentage, and muscle mass were recorded on 18 September, 1 October, 11 December 2020, and 5 January 2021. Countermovement jump, Squat jump, and Spike jump data of the players were recorded on 3 September, 1 October, 25 November 2020, and 7 January 2021. Agility *T*-tests were recorded on 2 September 2020 and 7 January 2021. During the last test recording, the team physician asked and recorded the players' feelings about changes in their sports performance after the COVID-19 infection.

2.2 Assessments and Outcomes

Weight, height, fat percentage, muscle mass, vertical jump tests, and agility *T*-tests records were compared before and after the COVID-19 infection.

Weight, height, fat percentage, and muscle mass were measured using a body composition analyzer (Tanita RD 545, Tanita Corporation, Tokyo, Japan).

Vertical jump heights were measured during training by using the Vertec vertical jump device (Questtek Corp, Northridge, CA, USA). Thirty minutes warm-up was done by all players after warm-up measures were started. The warm-up protocol is the same in every recording day at the request of the coach and team physician.

Countermovement jump: Volleyball players start at a standing position. They performed a downward movement, extending their legs fully and jumping to the highest level to reach.

Squat jump: Unlikely Countermovement jump squat jump starts from a semi-squat position, and there is no preparative movement for the jump [15].

Spike jump has a preparative movement for the jump. Players approach the net, jump, and hit the ball. The highest level was measured as Spike jump as previously defined [16].

Jumps were repeated three times each. The highest reached height was recorded for each of the vertical jumps.

Agility *T*-test was performed as previously defined [17]. The test was done three times, and a better result was used. One minute rest was used between three tests.

2.3 Statistical analysis

This study's data was analyzed by using IBM SPSS Statistic version 25 (IBM Corp., Chicago, IL, USA). The data was shown as a number, percent, mean $\pm$ standard deviation,

TABLE 1. Characteristics of the volleyball players.

	N	Mean ± Std. Deviation	Minimum–Maximum
Age (year)	19	17.3 ± 1.4	15–20
Weight1 (kg)	17	82.7 ± 12.2	59–112
Weight2 (kg)	19	85.4 ± 12.6	62–111
Weight3 (kg)	19	85.5 ± 12.5	63–112
Weight4 (kg)	18	87.6 ± 12.0	65–113
Height1 (cm)	17	194.8 ± 8.1	180–207
Height2 (cm)	19	195.6 ± 8.1	180–207
Height3 (cm)	19	195.6 ± 8.1	180–207
Height4 (cm)	18	196.1 ± 8.0	180–207
Fat percentage 1 (%)	17	14.3 ± 5.1	6.5–23.2
Fat percentage 2 (%)	19	14.1 ± 4.9	6.4–21.9
Fat percentage 3 (%)	19	13.5 ± 4.5	6.5–21.1
Fat percentage 4 (%)	18	14.8 ± 4.5	6.6–21.4
Muscle Mass1 (kg)	6	72.6 ± 6.2	67–84
Muscle Mass2 (kg)	8	75.5 ± 6.4	68–85
Muscle Mass3 (kg)	10	74.3 ± 7.5	61–85
Muscle Mass4 (kg)	14	70.8 ± 9.0	57–88

N: The number of the participations; 1: 18 September 2020; 2: 1 October 2020; 3: 11 December 2020; 4: 5 January 2021.

minimum, and maximum. Wilcoxon test was used for the comparisons of related samples. $p < 0.05$ was considered statistically significant.

3. Results

Nineteen volleyball players were included in the study. Characteristics of the volleyball players were shown in Table 1. The mean number of PCR (+) days was 13.4 ± 2.6 (min. 12 and max. 23). Weight, height, fat percentage, and muscle mass did not change statistically between the first and last records ($p = 0.098$, $p = 0.317$, $p = 0.938$, $p = 0.248$, respectively). Countermovement jump, squat jump, spike jump, and agility *T*-tests of the volleyball players' records were shown in Table 2. The median differences values of each measured vertical jump test were shown in Table 3. The changing of the vertical jump values was shown in Fig. 1. The median differences between the first and last agility *T*-tests were not statistically significant ($p = 0.277$). The feeling of volleyball players about the sports performance level was decreased by 57.9%, increase 10.5%, no change 31.6%.

4. Discussion

This study investigated the COVID-19 infection effect on sports performance of volleyball players. Vertical jump and agility *T*-test performance was not affected by the COVID-19 infection in our study; vertical jump performance has higher values. Interestingly, most of the volleyball players have believed that their sports performance decreased after the COVID-19 infection.

With the definition that performance is related to jumping in volleyball, jump-related training is placed in the training of athletes. From this point of view, jump-related measurements are used to evaluate athlete performance [18]. Vertical jump performance is a vital test method for volleyball players and is routinely used to follow the volleyball players' sports performance [11, 14, 19, 20]. Different types of jump tests were used to evaluate their performance [19–21]. The types of jump tests were associated with the volleyball players' serving, spiking, and blocking capacity [14]. Countermovement jump test is used to evaluate serving, spike jump test for attacking, and squat jump test for blocking. Therefore, three different types of vertical jump tests are used to evaluate the volleyball players' performance by the club routinely. The warm-up protocol was effected the vertical jump height [11]. Our team always uses the same warm-up protocol to avoid affecting the results in test recording days already. Also, jump height can be affected by changes in the players' body weight, height, fat percentage, and muscle mass, but these variables had no statistically meaningful difference. Almost all vertical jump tests had a statistically significant increase at every measure (except for the CMJ and squat jump' last two measures, squat jump' first two measures, and spike jump' between twice and third measures). Training might be the most critical factor in vertical jump performance compared to COVID-19 infection damage, inactivity, or psychological stress in volleyball players.

Ramlan *et al.* [22] evaluated the effect of plyometric training on performance and showed 3.17 cm improvements in men's squat jump performance, 3.34 cm in countermovement. Velickovic *et al.* [23] investigated a 12-week training period effect with several jump tests on men and demonstrated improvements in the squat jump 5.93 cm countermovement 4.98 cm and drop jumps 4.83 cm. Our study was not planned on performance improvement. However, it is aimed to increase performance with the training of our elite athletes throughout the season. For this reason, the tests are followed. CMP jump 5.6 cm, squat 6.2 cm, and spike 5.8 cm improved between the first and last measurements of our athletes between the specified dates in our study.

TABLE 2. Countermovement jump, squat jump, spike jump, and agility *T*-tests of the volleyball players.

	Mean ± Std. Deviation	Min–Max
CMJ 1 (cm)	302.0 ± 12.5	275–318
CMJ 2 (cm)	303.4 ± 11.8	279–319
CMJ 3 (cm)	309.6 ± 13.2	280–325
CMJ 4 (cm)	307.6 ± 13.4	285–325
Squat jump 1 (cm)	301.1 ± 12.7	272–318
Squat jump 2 (cm)	302.6 ± 12.5	275–322
Squat jump 3 (cm)	308.3 ± 12.9	279–325
Squat jump 4 (cm)	307.3 ± 11.5	282–323
Spike jump 1 (cm)	324.8 ± 14.8	295–349
Spike jump 2 (cm)	326.6 ± 15.8	294–354
Spike jump 3 (cm)	328.8 ± 13.0	302–351
Spike jump 4 (cm)	330.6 ± 12.0	306–353
Agility *T*-test before (second)	10.2 ± 0.6	9.5–11.7
Agility *T*-test after (second)	10.1 ± 0.4	9.5–11.1

CMJ, Countermovement jump; 1: 3 September 2020; 2: 1 October 2020; 3: 25 November 2020; 4: 7 January 2021.

TABLE 3. The comparisons of the median differences' values of each measured vertical jump tests.

	p values					
Tests	1–2	1–3	1–4	2–3	2–4	3–4
CMJ	0.009	<0.001	0.011	0.001	0.007	0.721
Squat jump	0.168	0.001	0.001	0.004	0.007	0.679
Spike jump	<0.001	0.002	0.001	0.457	0.025	0.009

CMJ, Countermovement jump; 1: 3 September 2020; 2: 1 October 2020; 3: 25 November 2020; 4: 7 January 2021.

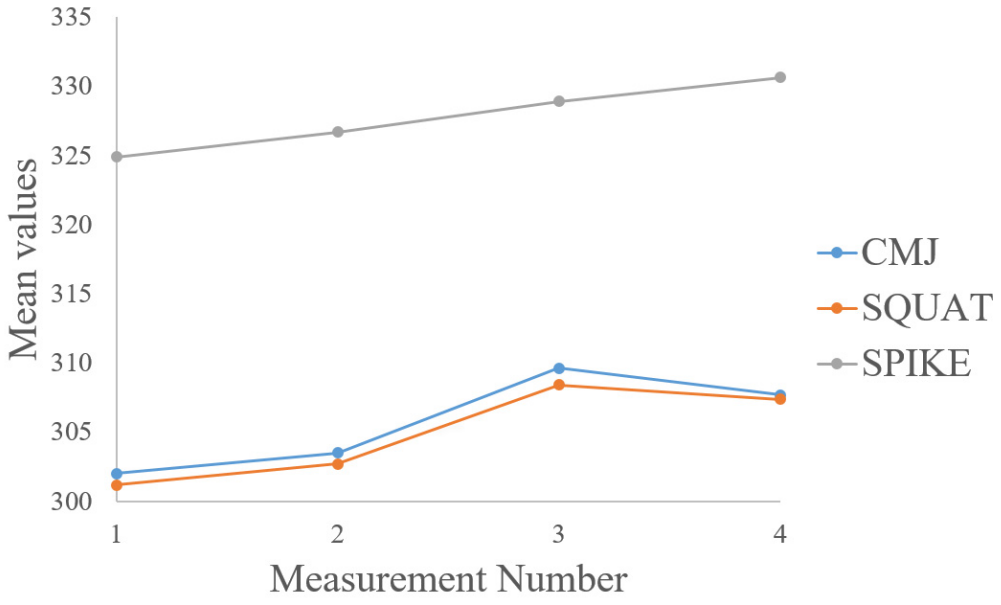

FIG. 1. The changing of the vertical jump values.

Agility *T*-test is another test method used to evaluate an athlete's performance. The agility *T*-tests are similar in the first and last measures in our study. In a study examining the effect of caffeine on the agility *T*-test value of male volleyball athletes, the value before caffeinated energy drink was 10.8 ± 0.4 and after 10.3 ± 0.4 [24]. In our study, the first agility *T*-test was 10.2 ± 0.6, and the last test was 10.1 ± 0.4. The vertical jump values increased with every new measure, but this was not seen in the agility *T*-test in our study. Initially, the test result was good, so there may not be a statistically significant change between the post-tests. The warm-up protocol affected the agility *T*-test results [15, 18], but the coach's same warm-up protocol also avoided this.

Sports performance is the most critical issue which affects everyone in sports, from athletes to club managers. COVID-19 infection affects people over one year, and the things

known about this infection are still unclear and few. We believed that COVID-19 infection would affect the sports performance of volleyball players. However, tests had not resulted as we thought. Volleyball players were infected, and their PCR tests were positive for at least 12 days. Nevertheless, the procedures due to COVID-19 infection in our country limited the training and sports life of the players between March to September 2020, whereas the illness period was much shorter than this limited period. This time is too long for a sportsman and inactivity might be more detrimental than COVID-19 infection.

This study has some limitations. The sample size is small. Lacking some records is another limitation. Using the same warm-up protocol for recording days and the first league volleyball players' results are the strong sides of the study. Also, volleyball players got sick in close times to each other's, and nearly every player performed tests.

5. Conclusions

This is the first study that evaluated the effect of the COVID-19 infection on athletic performance. Volleyball players' vertical jump performance was getting better despite the COVID-19 infection in our study. Anaerobic capacity did not get worse. Inactivity might be more harmful than COVID-19 infection on sports performance in young men elite volleyball players. It is, unfortunately, unclear how long the COVID-19 infection will affect the whole world. For this reason, more comprehensive studies with larger sample sizes are needed to demonstrate the effect of the COVID-19 infection on athlete performances.

Author contributions

Conception, Design of the study: BK, AO; Writing: AO, BK, BA; Investigation, Data collection: IK, BK, BA, CC. All authors read and approved the final manuscript.

Ethics approval and consent to participate

Health Sciences University Gülhane Scientific Research Ethics committee approved the study (Study Number: 2021-22/Date: 14.01.2021).Volleyball Club permitted the use of player's data.

Acknowledgment

Not applicable.

Funding

This research received no external funding.

Conflict of interest

The authors declare no conflict of interest.

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