

# Maintenance of Physical Fitness Levels in Junior Volleyball Players during COVID-19 with Protective Measures against the Pandemic Condition

Ali Fatahi <sup>a</sup>, Razieh Yousefian Molla <sup>a\*</sup>, Mitra Ameli <sup>b</sup>

<sup>a</sup> Department of Sports Biomechanics, Faculty of Physical Education and Sports Sciences, Islamic Azad University of Central Tehran Branch, Tehran, Iran;

<sup>b</sup> Faculty of Physical Education and Sports Science, Payam-e-Noor University, Tehran, Iran

\*Corresponding Author: Razieh Yousefian Molla, Department of Sports Biomechanics, Faculty of Physical Education and Sports Sciences, Islamic Azad University of Central Tehran Branch, Tehran, Iran. Tel: +98-912 2022730, E-mail: raziehyousefian@yahoo.com

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## Abstract

**Introduction:** The importance of physical fitness training programs is evident, especially for children and adolescents who participate in a regular team sport such as volleyball. Unfortunately, COVID-19 pandemic presented a huge disturbance in ordinary lifestyle all over the world, thereby resulting on negative effects on wellness and physical fitness. Therefore the aim of this study was to identify maintenance of physical fitness levels in junior volleyball players during COVID-19 with protective measures against the pandemic condition. **Methods and Materials:** The study was a quasi-experimental design according to pre- post condition. Ten healthy junior volleyball players ( $10.80 \pm 1.03$  yrs.) were selected to participate in this study. Selected Physical fitness variables included demographic characteristics, power, endurance, agility, flexibility and balance. After the end of first quarantine which lasted 5 months, pre-tests were recorded. Eight weeks after end of the second quarantine, following by eight weeks of physical fitness and volleyball training, post-tests were recorded to investigate maintenance of physical fitness variables levels in junior volleyball players during unorganized situation of COVID-19. **Results:** Results showed that, there is no significant differences between the mean of pre-test and post-test in BMI, Sargent Jump test, Sit up test, Sit and Reach test, and Romberg test, but in the other variables such as Bent knee push up, T-test, side jump, triple spike jump, and medicine ball throw, significant differences were observed. **Conclusion:** According to results, participating in volleyball training program for mini-volleyball players with respect to preventive measures of COVID-19 can be a beneficial method to maintenance health and improve vital physical fitness status aside to enhancement of volleyball skills.

**Keywords:** Covid-19, Physical fitness, Volleyball

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## Introduction

The corona virus disease 19 (COVID-19) was first identified in December 2019 in China and caused respiratory illness (1). The highly transmittable viral infection is caused by the virus known as the severe acute respiratory syndrome corona virus 2 (SARS-COV2) (2). This disease was declared a global pandemic by World Health Organization(WHO) on the 11<sup>th</sup> March of 2020 (3). Due to the proven effectiveness of traditional public health measures interrupting human-to-human transmission of viruses, Iran Government approved two periods of quarantine due to COVID-19 pandemic peaks in order to fight the spread of virus (4).

Volleyball players, like the other athletes, have been advised by health authorities to suspend training and staying at home due to closed gyms, sport ventures, and volleyball Clubs in all cities (5). So, all volleyball players inevitably had this periods of inactivity and sedentary during quarantine periods. It could be noticeable that WHO recommended that children and adolescents aged 5-17 should engage in at least 60 minutes of moderate to vigorous intensity physical activity a day (6). Therefore, between intervals of quarantine times, some players, coaches, and semi-open sports clubs tried to compensate periods of inactivity in their volleyball players due to physical fitness maintenance of them.

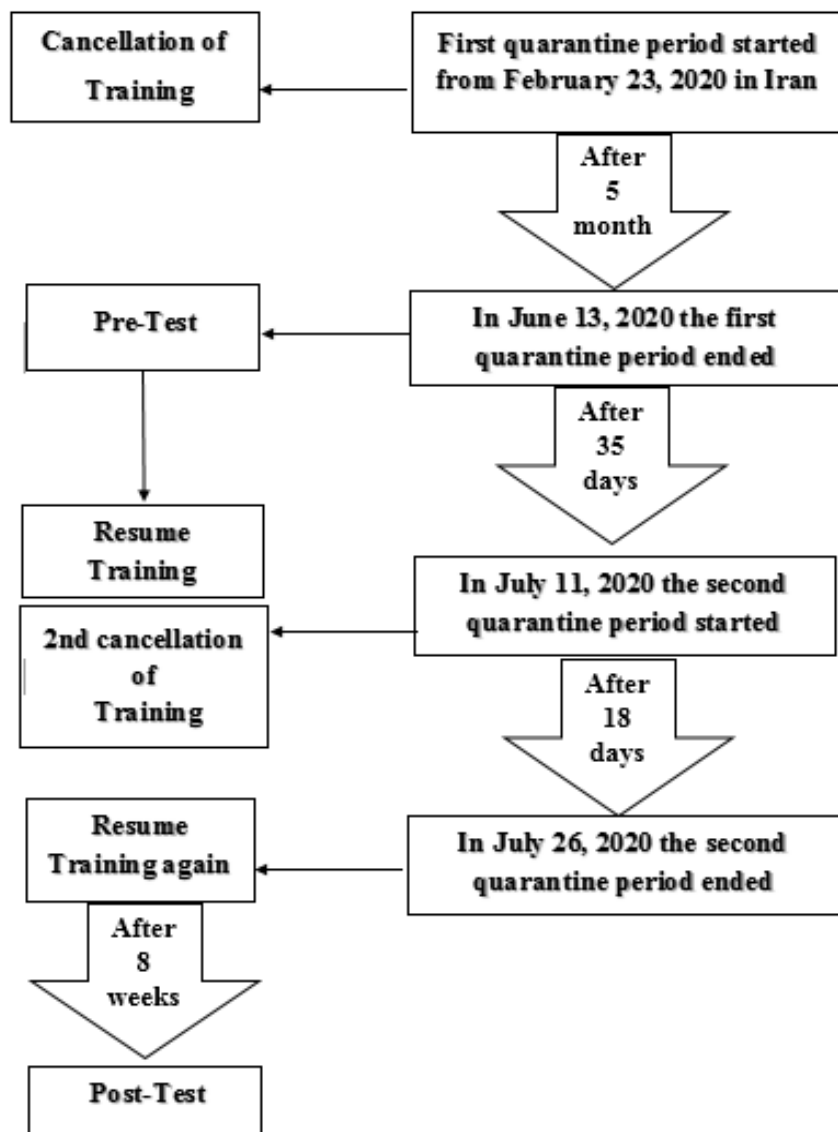


Figure 1. Study Protocol

Although many studies had researched about the physical fitness importance in volleyball players (7-10), the best of our knowledge, there is no research about this challenges of playing volleyball in this pandemic situation. So, in this investigation, a survey was conducted to identify how performing physical fitness exercises as an important factors in all sports especially in volleyball (11) and training volleyball skills by a new plan with regarding protective measures against the COVID-19 pandemic condition can protect the physical fitness levels in junior volleyball players. Therefore the aim of this study was to identify maintenance of physical fitness levels in junior volleyball players during COVID-19 with the protective measures against the pandemic condition.

## Methods and Materials

### Participants

Due to COVID-19 limitations, 10 healthy junior volleyball players (age:  $10.80 \pm 1.03$  (Mean $\pm$ SD) yrs.) as available sample participated in this study. They were excluded from study if they or their family had any symptoms of COVID-19 disease, musculoskeletal or neurological deficit or injury history such as leg discrepancy, anterior cruciate ligament (ACL) rupture, bone fracture, patellar dislocation, and meniscus tear that could influence training and testing. The procedure was clearly described for each subject and their parent. All participants and their parents signed the consent form according to Helsinki Declaration before data collection.

**Box 1.** Volleyball training program with emphasize on more physical fitness exercises

- ✓ Squat with 2 kg medicine ball (4 sets×8 repetition)
- ✓ Roping (3×50 repetition).
- ✓ Lunges with 2 kg medicine ball (4 sets × 8 steps)
- ✓ Push up on knee joint (4 sets× 8 repetition)
- ✓ Ankle jump over 20cm Cons (obstacle) in a row (4 sets × 12)
- ✓ Ordinary volleyball training consisted of training routine basic skills such as overhead and underhand pass, set, drive, spike, service which was performed after end of physical training.

\*Normally, all physical training mentioned above lasted about 30 minutes and 1 hour routine volleyball training afterward in every session.

**Box 2.** Protective measures against COVID-19 transmission during volleyball training

- ✓ All personnels, coaches, trainers, and players required to submit health declaration forms on arrival
- ✓ Body temperature of all players and coaches were measured at the entrance. In case anyone above (37- 38°c), he was banned from entering to the playing field.
- ✓ Fifteen minutes before entrance of players to the court, all the equipment including balls, medicine balls, cons, mats, steps, and ropes were sprayed by sanitizing alcohol
- ✓ All of the players and coaches were instructed to keep 1.5 m physical distance at all times of training
- ✓ All the players were obliged to wash their hands and sanitize them every 15 minutes of training
- ✓ A maximum of 2 players were allowed to use changing room at the same time to decrease the chance of close contact
- ✓ All players, staffs, and coaches had to wear a surgical mask if not included in training and also before and after training.
- ✓ Hand shaking were prohibited during, before and after training
- ✓ All the players and coaches were asked to sneeze and cough in theirs elbow cavity and using towels
- ✓ The number of parents in club environment were limited. They were asked to stay in parking or any other outdoor environment far apart the players.
- ✓ Players were asked to stay at home when they or one of their family member showed at least one of the typical COVID -19 symptoms.

All stages of present research were carried out under the direct supervision of the chief executive officer (CEO) and the educational and research group of this club considering all the ethical regulations approved by the club, the players, and their parents (Ethical Code: 11/E/148/2751, 2020/06/13).

**Study design**

The design of current investigation was according to quasi-experimental and pre-post study type. The process of this study design is shown in Figure 1. In February 23, 2020, the government of Iran announced the first quarantine period for around 5 months and inevitably all the volleyball sports clubs were closed and players stayed at home without any preplanned and special volleyball training. Around June, 13, 2020, the first quarantine condition was ended and players came back to volleyball clubs to start their training sessions. On arrival of every junior player to volleyball club, important physical fitness tests were recorded by a volleyball expertise for pre-test assessment. After this stage, players started their regular volleyball training program with emphasize on more physical fitness exercises under the supervision of coach of national volleyball team (Box 1). All steps of training were performed in an outdoor environment covered with grass, dimensions 40m×20m with a volleyball net in the middle and with regards of all protective measures against

COVID-19 transmission recommended by WHO (Box 2) (2, 3, 12, 13). Around July, 10, 2020, the second quarantine situation was started and lasted until July, 26, 2020. Then, previous training programs (Box 1) with necessary protective measures (Box 2) were resumed again. After 8 weeks ongoing training, the post-test assessment was recorded again by same volleyball expertise to identify the maintenance, retrogression or development of physical fitness in junior volleyball players in this study.

**Data collection**

Before start of the assessments, warm-up protocol was performed for about 15 minutes according to the routine training sessions of volleyball. During the test procedure, every player was asked to stay warm in order to prevent from injury. All data collections were conducted with standard tools including: Electronic Body (Scale WW58A®), Sit & Reach Box (W: 30cm, L: 50 cm, H: 35cm, scaled with the tape on the surface 50cm (±1cm)), Tape meter (Stanly®, 3m), Vertec Jump Tester® (variable height with plastic blade (±10cm), handmade), Stopwatch (Q&Q, HS46®). For considering assessments of variables in this study, following tests were conducted (11): demographic (height, weight and BMI), power (triple spike jump test, Sargent jump test.), muscle endurance (, sit up test), agility (T-test), Flexibility (sit& reach test) and balance (Romberg) test.

**Table 1.** Results of paired t-test of physical fitness variables in junior volleyball players

Physical Fitness Variables	Tests	Stage	Mean	SD	T	Sig
<b>Demographics</b>	Height (cm)	Pre	149.37	14.07	-5.50	0.001*
		Post	152.62	15.35		
	Weight (kg)	Pre	45.25	11.62	-2.37	0.049*
		Post	47.12	11.95		
	BMI (kg/m <sup>2</sup> )	Pre	19.91	2.67	-0.16	0.870
		Post	19.97	2.56		
<b>Power</b>	Sargent jump (cm)	Pre	34.30	5.71	-1.86	0.095
		Post	37.40	6.83		
	Triple spike jump (cm)	Pre	36.90	5.56	-3.06	0.014*
		Post	41.60	7.26		
<b>Endurance</b>	Sit up (Number)	Pre	36.33	9.30	-1.23	0.252
		Post	38.11	8.79		
<b>Agility</b>	T test (s)	Pre	14.27	1.41	3.49	0.017*
		Post	12.83	1.38		
<b>Flexibility</b>	Sit & Reach (cm)	Pre	26.10	9.32	-0.70	0.497
		Post	27.20	5.61		
<b>Balance</b>	Romberg (s)	Pre	10.47	4.54	-0.57	0.593
		Post	12.19	9.20		

\* Significant differences ( $P < 0.05$ )

Assessment of limbs' power (triple spike jump test, Sargent jump test, back head medicine ball throw, chest medicine ball throw): For Jump tests protocol, the player was asked to stand behind the Vertec® instrument and reach up with the dominant hand raised as much as he can. Keeping the feet flat on the ground, the point of the fingertips of hand was recorded. This is called the standing reach height. The athlete then relaxed and leaped vertically as high as possible using both arms and legs to assist in projecting the body upwards. The jumping technique used was countermovement jump and players attempted to touch the Vertec® at the highest point of the jump. The difference in distance between the standing reach height and the jump height was the score.

Assessment of muscle endurance (bent knee push up test (modified push-up test, sit up test): for abdomen muscle endurance in sit up test, the player started by lying on the back, knees bent, heels flat on the floor, with the palm at the opposite of the shoulder. The buttocks remained on the floor with no thrusting of the hips. A partner firmly held the feet down. The player then performed as many correct sit ups as possible in one minute. In the up position, the individual touched elbows to knees and then returned until the shoulder blades touched the floor. Any resting was done in the up position. The total number of correct sit ups in 1 minute was recorded as the score.

Assessment of agility (T test, side jump test): In side jump test, the player was asked to stand beside a step (L:58cm, w:32cm, H:8.5 cm), then jump laterally from one side to the

other side of the step as fast as he can, and finally jumped back to the starting position consecutively. The player tried to complete as many jumps as possible in one minute. The result was recorded as the numbers. For T test, four cones were set like a T word, with the longitudinal distance of 10 yard (9.14 m) to the center cone, and two cones in each side of the center cones at 5 yards (4.57 m) far apart. The player started at the first cone. On the command of the timer, the player sprinted to center cone and touched the base of the cone with their left hand. Then, he turned right and shuffled sideways to the right cone, and also touched its base with their right hand. Then, the player shuffled sideways to the left toward the cone center and touched it with the left hand. The player then shuffled back to the center cone touching with the right hand, and run backwards to the first cone. The stopwatch was stopped as the player pass the first cone. The result was recorded as the seconds.

Assessment of the Flexibility was performed by sit & reach test. The player was asked to perform a short warm-up prior to this test with some gentle stretches. During the test, participants were suggested not to do fast and jerky movements, which may increase the possibility of an injury. The participant's shoes had to be removed. A sit and reach box was placed on the floor. The player sat with the legs extended. Heels of the feet touched the edge of the box. The player slowly reached forward with extended arms, placing one hand on top of the other facing palms down, as far as possible and holding this position for approximately 2 seconds. The player kept the hands parallel.

Fingertips could be overlapped and be in contact with the measuring portion of the sit-and-reach box. The score was the most distant point (cm or inch) reached with the fingertips. Among three trials, the best were recorded.

For Romberg balance test, the player was asked to remove his shoes and stand with the dominant leg (right) in front of the other (left) leg in a line. The arms were held in opposite shoulder. When the player closed his eyes, the stopwatch started by the coach. Score of Romberg test was counted the seconds that the player was able to stand with closed eyes.

### Statistical analysis

Statistical analysis was undertaken using computer program SPSS® (Ver. 21.0). Average Mean and Standard Deviation were used for descriptive analysis. Shapiro-Wilk test was used for examine normality of data. If so, to evaluate the difference between pre-test and post-test, the paired t-test was used to compare the effect of training protocol. All analyses were considered at the significance level of  $P < 0.05$ .

## Results

Results of Shapiro-Wilk test showed that the data distribution was normal in all variables of the study. The results of paired sample t-test are presented in Table 1 ( $P \leq 0.05$ ).

According to results of the Table 1, no significant differences were observed in BMI, Sargent Jump, Sit up, Sit and Reach, and Romberg test variables, but in the other variables including height (+2.17%), weight (+4.13%), triple spike jump (+12.73%), and agility (+10.09%), significant differences were observed between the mean of pre-test and post-test in junior volleyball players.

## Discussion

The aim of this study was to identify maintenance of physical fitness levels in junior volleyball players during COVID-19 with protective measures against the pandemic condition. Our results showed that, there is no significant differences in the mean of BMI, Sargent Jump test, Sit up test, Sit and Reach test and Romberg test after the intervention compared to before, but in the other results including height, weight, triple spike jump test, and T test, significant differences were observed.

Results of current study emphasized that there were a significant differences in some demographic parameters, power, and agility between the mean of pre-test and post-test

in junior volleyball players following eight weeks volleyball training exercises with physical fitness considerations. The relationship between COVID-19 with sports and exercise behavior has already been addressed in the literature, and the importance of physical training during the COVID-19 period has been highlighted (12, 14-16). Although some studies have stated that there was a significant decreases in both moderate and vigorous physical activities during COVID-19 quarantine (6, 17), some other investigations declared no reduction of physical activity in this pandemic situation due to use of online training program or home based exercises (18, 19). The best of our knowledge about volleyball challenges following COVID-19 pandemic, only Tertipi *et al.* (20) had a study about effects of this disease in volleyball players and sports clubs, but their study did not focused on the physical fitness changes of volleyball player. So, it can say that using ordinary volleyball training with considering protective measures and emphasizing on physical fitness exercises may save preparation of volleyball players and their affected communities including volleyball coaches and sports clubs during this pandemic situation.

Significant increase in the demographic characteristics of the players in this study may be due to the change of lifestyle in the players which stayed at home and spent just few times in sports and physical activities (12). According to the results, a significant increase (+2.17%) of standing height was obvious in participants. A review on the age of participants showed the fact that participants of the study were the beginning of the growth spurt of their life cycle (10-14 years for the Boys). Although negative consequences of pandemic COVID-19 have interferences on their regular participation in Volleyball, being in this growth period would be a meaningful explanation for this significant increase in height. Significant increase in players' weight is perhaps due to the change of lifestyle in the players who stayed at home and spent just few times in sports and physical activity (12). Also, most of them announced that because of the fear of COVID 19, their eating habits changed mainly to eating more than usual in order to protect themselves against the virus throughout nutrients (21). The BMI as a demographic parameter in human includes two important factors, weight and height. Some studies stated that volleyball players should be aware every time about losing their weight because of their sport style (21, 22). Although in our study, each one of these parameters (weight and height) showed significant differences between average of pre and post stage, maybe by dividing of these two variables to each other, it would represent a stable change in BMI.

Vertical jumping is probably the most important manifestation of explosive power in volleyball (23, 24). Vertical jump mainly is affected by the player's ability to elevate the position of center of Mass (COM) vertically which depends to the velocity of COM in take-off moment to reach the best record. In our research, jumping tests consisted of two different Sargent and triple jump tests. According to the results, between mean of pre and post, no significant difference was observed in Sargent, but a significant difference in triple jump was found. Perhaps, the main reason could be found in similarity of jumping technique between volleyball spike with triple jump test, while Sargent jump is not similar to routine performance of jumping skills such as Spike and Block.

In our investigation, no significant change in pre and post stage of sit and reach test's result, referring to flexibility, was observed. The reason is probably lack of any specific flexibility work out in our training plan which focuses on increasing range of motion and therefore any significant change is expectable.

Balance, maintaining center of mass in the base of support, is known as prerequisite of appropriate performance of volleyball techniques (25). Results of our study did not show any significant differences on Balance test. A review of the planned training program showed the huge concentration on ordinary volleyball training based on fundamental work out affecting full body. However, we did not have any direct exercise concentrate on balance ability on volleyball players.

A survey of the planned training program showed the huge concentration on these parameters which consequently led to significant improvement. Active lifestyle and being included in different sport and physical activities are of the great concerns for physical experts in the both field of general health as well as specific sport participating. During the COVID-19 period which there is no exact idea when it would come to an end, most of the people would suffer an unusual sedentary lifestyle which may lead to inappropriate physical health status. More investigations are needed to clarify different aspects of training in this period with respect to active lifestyle. One of the most important limitations of this study was the few number of participants in volleyball training due to COVID-19. More investigations concentrating on various aged-groups in different genders or different skills' level are recommended. Altering the training program according to the intensity and volume of variables may also be noticeable for further investigations.

## Conclusion

According to the findings of this study, the authors suggest participating in volleyball training program for mini volleyball players with respect to preventive measures of COVID-19 could be a beneficial method to maintain health, promote skills, and also improve vital physical fitness status aside to enhancement of volleyball skills.

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None

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## Authors' contributions:

All authors made substantial contributions to the conception, design, analysis, and interpretation of data.

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