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Investigation of the Effect of 6-Week Fitness Study on Motorical and Technical Skills in Volleyball Players

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Abstract

Aim: The aim of the study is to examine the effects of 6-week fitness exercises on the motor skills and technical skills in young volleyball players

Methods: Twelve volleyball athletes (average age is 15,7±0,9 year) with a minimum 2-year volleyball license participated in this study voluntarily. Before and after the study, the plank, curl-up, push-up and standing long jump motoric performances of the athletes, as well as volleyball-specific spike, serve and forearm pass technical skills were tested. Players were randomly divided into two groups as experiment and control. In addition to the volleyball training for 6 weeks, the experimental group did 30 minutes of fitness training 3 days a week, while the control group continued the volleyball technical training. ANOVA test for repeated measures in the SPSS program used for anlysis.

Results: There was no difference between the groups in terms of pretest measurements. But after the study, there was a statistically positive difference as a result of push-ups (pretest: 10,1±2,7 rep., posttest: 12,1±2,1 rep.) curl up (pretest: 32,1±4,4 rep., posttest: 40,1±5,6 rep.) and plank tests (pretest: 64,1±5,4 sec., posttest: 109,1±10,3 sec.) of experimental group. Control group showed statistically positive difference on push up scores only (pretest: 8,1±3,2 rep., posttest: 10,8±2,4 rep.). When the post tests of the experimental and control groups are examined, it is observed that the statiscally difference found on plunk scores only in favor of the experimental group (experiment: 109,1±10,3 sec., control: 87,8±16,1sec.)

Conclusion: As a result of this study;6-week strength training had significant effects on volleyball players' performances of push-ups, curl up and planks. On the other hand, 6-week strength training did not have a significant effect on the standing long jump, spike, service and forearm pass performances of volleyball players. While it can be suggested that these trainings can be applied for motor skill development, it may be necessary to do the training for a longer period of time for technical skill development.

Keywords

Volleyball,
Fitness,
Technical skill,
Biomotor ability.

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INTRODUCTION

The sedentary lifestyle, which has emerged due to the physical activity and sports activities that have been distanced rapidly in recent years, puts children in serious physical, mental and social health problems. Web technologies and social media addiction can be seen as the main triggers of sedentary lifestyle in children as well as in people of all age groups (Kırık, 2013; Orhan, 2019). Many parents direct their children to physical activity and sports to save them from this spiral (Aydoğan et al., 2015; Dinç et al., 2011; Knoester & Randolph, 2019). In addition to its contribution to physical health, team sports are especially preferred at the school sports level due to their psychological gains such as preventing negative mental processes and social gains such as helping each other, sportsmanship and communication skills (Saygın & Özşaker, 2012; Türkmen & Varol, 2015; Yıldız and Çetin , 2018; Yıldız, 2019). Volleyball, on the other hand, is one of the sports branches that provide multi-faceted contributions to children with its features and which has the highest participation among team sports.

Volleyball is a sports branch that attracts a lot of attention in the world and the number of participants is quite high. In developed countries and in our country, this interest has made volleyball a part of life by carrying it to schools and clubs. Volleyball has become one of the most popular branches with its psychological, social, physical and pedagogical values, as it is a sport that is easy to play, enjoyable and develops group dynamics. The size and prevalence of volleyball sport is due to the high level of amateur and recreational participation, as well as professional participation (Uluöz, 2019).

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There is no time limit for volleyball matches (TVF, 2017). Matches can last 2--3 hours, requires strength and stamina. The fact that teams must win 25 points in each set and a total of 3 sets makes the game time variable. In an elite volleyball match, the average playing time of men's and women's matches is 90 minutes, while the duration of sets varies between 20-25 minutes. During this time, a volleyball player performs 250–300 moves involving explosive force. When looking at the sum of the movements, jumps comprise 50-60%, high-speed movements, displacements 30%, and falls 15%. Spike and block techniques, which are generally key to winning a match, also include explosive force (Çelenk & Yıldıran, 2000).

Achieving a high-performance level in sports depends on many factors. The most important of these is physical fitness. Physical fitness is the most important criterion in demonstrating physiological capacity. Unless the physical structure is suitable for the applied sport, it is not possible to fully demonstrate the performance (Ayan et al., 2011; Aydos, 1991; Zorba, 2001). In order for athletes in team and individual sports to demonstrate their physical, physiological and motoric capacities, they must have a physical structure suitable for their branch (Açıkada, 1990; Özer, 2006). Volleyball sport also has its own physical requirements. These are physical, anthropometric and somatotype features, and motor skills and technical skills are directly related to these components (İpek and Ziyagil, 2002; Uluöz, 2011).

Volleyball is also one of the branches of sports that show the need for improved physical fitness and anthropometric features (Göral et al, 2009). In the context of physical fitness, the anthropometric characteristics of the volleyball player and his jumping ability are important factors in the team's success in terms of performance (Duyul et al. 2008). Early physical fatigue in athletes with insufficient physical fitness disrupts the nerve-muscle coordination, which has an important effect on achieving the highest level of performance, causing athletes to face injury risks and making it difficult to apply technical capacity at the desired level (Herzog, 1996; Temoçin et al. , 2004; Uluöz, 2016). The importance of strength, flexibility, anaerobic-aerobic power and rapidity in the application of these movements is of great importance (Kartal and Günay, 1995; Csanadi, 1973). For this reason, determining the physical and physiological capacities of the athletes and directing these determinations to the training program is one of the conditions for achieving success in volleyball. At the end of this research; It is predicted that 6-week fitness exercises will have a positive effect on the motoric performance of volleyball players such as plunk, push-ups, sit-ups and standing long jumps, as well as volleyball skills such as service, forearm pass and spike .In this context, the aim of the study is to examine the effect of 6-week fitness training on the motoric properties and technical skills of young volleyball players.

METHOD

Participants

Twelve amateur female volleyball players with the average age of 15,7±0,9 years, who have a volleyball license for at least 2 years and have no health problems, participated in this study voluntarily.

Procedure: Before and after the fitness exercises, the plank, curl-up, push-up and standing long jump performances of the athletes, as well as their volleyball technical skills, serve, forearm pass and spike performances were tested. Volleyball players were randomly divided into two groups (experimental and control). While the experimental and control groups continued their 60-minute volleyball technical training 3 days a week, the experimental group also performed 30-minute fitness exercises added to the volleyball training with 48 hours rest between section as described by Maia et al. (2014).

Table 1. Fitness training program

Sections	1st	2nd	3rd
Warm up (15 min.)	Jogging 5 min. Stretching 15 min.	Jogging 5 min. Stretching 15 min.	Jogging 5 min. Stretching 15 min.
Technical training (60 min.)	Passing drills 20 min. Serving drills 20 min. 6-6 game-based drills 20 min.	Passing drills 20 min. Serving drills 20 min. 6-6 game-based drills 20 min.	Passing drills 20 min. Serving drills 20 min. 6-6 game-based drills 20 min.
Fitness Works (30 min.)	Curl up 3x10 Push up 3x10 Plunk 3x30 sec. 3 m zigzag jump x 3 rep.	Curl up 3x10 Push up 3x10 Plunk 3x30 sec. 3 m zigzag jump x 3 rep.	Curl up 3x10 Push up 3x10 Plunk 3x30 sec. 3 m zigzag jump x 3 rep.
Cooldown (5min.)	Full body stretching	Full body stretching	Full body stretching

Ethical approval: This study was approved by the authoritative human research ethics committee by the number of 2021-YÖNP-0522. Participants signed a voluntary consent form stating that they voluntarily participated in the study

Data Collection Techniques; The data in the study were collected by applying the following tests.

Plank Test: It is one of the basic static tests used to measure the strength of the body. Subjects were asked to lie prone, forearm and elbows bilaterally shoulder-width apart and to stand on their toes, raise the pelvis, create a straight line on the neck, shoulders, back, hips and legs, and maintain this posture (Plank position). With the onset of the period, the time until the subject gets tired and / or breaks his posture was recorded in seconds (Reiman, 2009).

Push-Up Test: In the standard push-up position (hands pointing forward, shoulder level, back straight, heels in pivotal position), a pushup is completed when the chest touches the mat and the elbows come back to the straight position (ACSM, 2013).

Sit-up Test: The abdominal strength of the subjects was measured with the YMCA 1-minute sit-up test. Subjects were laid on the mat on their back, knees bent about 90 degrees, hands tied behind the head. With the mark, the left knee was touched with the right elbow and the starting position was returned to the starting position, and then the right knee was touched with the left elbow. Each touch was counted as one point, and the correct repetitions within 1 minute were recorded as the maximum number of curl ups (Henderson et al. 2007).

Standing Long Jump Test: The horizontal jump distance of athletes was measured in centimeters to determine lower extremity explosive strength. Behind the baseline, the feet were bilaterally arranged, the hands were moved as desired, and the athlete was asked to be fixed in the horizontal jump and fall without losing his balance and falling. The athlete has been given three attempts. The best jump distance test score was accepted (Reiman, 2009) Volleyball Technical Test: Standard tests were also used in the study to determine the performance of volleyball in the selected skills and to ensure the reliability of the observation forms developed by the researchers. For this purpose, forearm and service tests developed by Bartlett et al. 1991 and the spike test developed by Stanley (1967) were used. Information on these tests are presented below.

Forearm Pass Test: The players stand in the volleyball halfway area, 3 meters from the sideline and 1.5 meters from the bottom line. The assistant player on the other side of the net throws the ball to the player who is the test with both hands. The player who is the test throws the ball to the target area using the forearm pass skill over the rope, which is approximately 2.40 meters in height. The aim of the player is to throw the ball to the highest score from the points determined in front of the net by using the forearm pass skill. If the ball is not hit properly, if the ball does not pass over the rope, touches the net, or goes towards the center line, no points are scored. If the ball touches the line between the points, the higher score will prevail. The player who is the test is given ten hits in total, one from the right side and five from the left side (Bartlett et al., 1991).

Service Test: It is located in the player service area and uses 10 service shots to designated and scored areas within the volleyball half court. If the ball touches the antenna after the service or the volleyball goes out of the playing area, the player gets zero points. If the ball touches the areas close to the bottom line, the player gets the highest score (Bartlett et al., 1991).

Spike test: The player is placed face to the wall and spike the ball first on the ground and then touches the wall and performs as many shots as he can in a minute. The shots made by the player in accordance with the technique in one minute are counted (Stanley, 1967).

Statistical analysis

The analysis of the data in the study was evaluated using the ANOVA test for repeated measures in the SPSS v.21 USA program. Findings were considered significant at the $p < 0.05$ level.

RESULTS

Descriptive characteristics of the participants in the study are shown in Table 2. When Table 2 is examined, 12 female volleyball players participated in the study. The height, weight, age and training experiment measurements of the athletes participating in the study are shown in Table 2. by the groups. The average height, weight, age and sports age values of the athletes were determined as 183,3±4,1cm, 62,1±7,4 kg, 15,7±0,9 year, 4,5±0,9 year respectively. There was no significant difference between the observed variables between the two groups.

Table 2. Demographic variables of participants (X±SS)

	Experiment (n=6)	Control (n=6)	Total (n=12)
Body Height (cm)	182,3±5,1	184,7±3,8	183,3±4,1
Body Weight (kg)	60,8±4,4	63,3±11,8	62,1±7,4
Age (year)	16,1±0,4	14,7±0,9	15,7±0,9
Training Experience (year)	4,6±0,8	4,1±1,1	4,5±0,9

Table 3. Peformance measurements of the participants, pre-test and post-test results (X±SS)

	Experiment (n=6)			Control (=6)		
	Pretest	Post test	Change (%)	Pretest	Post test	Change (%)
Curl up (rep.)	32,1±4,4	40,1±5,6*	24,92	32,3±2,5	34,5±5,9	6,81
Push up (rep.)	10,1±2,7	12,1±2,1*	19,80	8,1±3,2	10,8±2,4*	33,33
Plunk (sec.)	64,1±5,4	109,1±10,3*&	70,20	76,8±7,3	87,8±16,1	14,32
Standing long jump (cm.)	185,6±6,5	187,1±3,6	0,81	184,8±7,6	186,3±6,3	0,81
Service (score)	26,1±10,5	37,1±6,8	42,15	35,1±5,3	35,6±5,7	1,42
Spike (score)	40,5±2,4	38,3±7,4	-5,43	42,5±3,2	37,3±8,8	-12,24
Fore arm pass (score)	40,5±10,3	49,1±9,4	21,23	41,1±3,2	45,1±9,1	9,73

* Significant difference between pretest-posttest p<0,05. & Significant difference between groups p<0,05

The pre-test and post-test measurements of the variables observed according to the study groups of the participants are shown in Table 3. Accordingly, when the groups are taken into account, among the observed performance measurements, the curl up, push-up and plunk performance of the experimental group showed a significant improvement compared to the pretest result. In addition, the control group showed a significant improvement in push-up performance compared to the pretest result. In the comparison between the groups, only in plank performance, the experimental group showed a significant change compared to the control group.

ISCUSSION

The aim of this study was conducted to determine the effects of 6-week fitness exercises on plunk, culr up , push up and standing long jump parameters and technical performances such as spike, forearm pass and service skills of young volleyball players. The curl up, push-up and plunk performance of the experimental group showed a significant improvement compared to the pretest result. In addition, the control group showed a significant improvement in push-up performance compared to the pretest result. In the comparison between the groups, only in plank performance, the experimental group showed a significant change compared to the control group. Considering the pretest and postest results in both groups, although there was an improvement in serving and headline passing skills, this change did not make a statistical difference.

Portmann claims that ligaments, tendons and muscle tissues are stronger but not strong enough to withstand external loads at 7-10 years of age. While the highest muscle strength values of some muscle groups were observed between the ages of 10-13, the highest values of other muscle groups were found around 15 years of age. Studies can be initiated to strengthen the wrists between the ages of 9-11 (Mengütay, 2005). Cross-sectional study of Estonian girls aged 10-17 years, the isometric strength of the leg extensor muscle significantly increased between the ages of 11-13. No significant change was observed between the ages of 13-14, significant differences were observed between the ages of 14-16, and the highest strength development in girls was observed between the ages of 14-15 as reported by Loko et al. (2000). When we look at the previous studies investigating the effect of strength training on the performance characteristics of volleyball players; Studies on female athletes who are in the developmental age, especially vertical and horizontal jump performance improving training examples that test the explosive strength feature are encountered. These studies examined the motoric characteristics of plyometric exercise types such as strength, explosive strength, quickness and flexibility of volleyball players (Silva et al., 2019).

Horizontal jumping skill is as important as vertical jumping skill for movements that require horizontal jumping skills such as catching the spike and determining the block location in the volleyball game. Different results have been obtained in previous studies for this skill, which has not been investigated as much as vertical jump in volleyball studies. Demir and Çilli (2018) stated that there was a statistically significant positive change in the long jump and sit-up performances by standing after 12

weeks of pilates exercises applied to female volleyball athletes. Similar findings were reported by Mili'c et al. (2008) and Çimenli et al. (2016). On the other hand, Çağlayan et al. (2018) determined that 10-week eccentric-concentric contraction strength training did not have a statistically positive effect on standing long jump performance in volleyball athletes. In addition, Idrizovic et al. (2018) and Gjinovci (2017) found that plyometric exercises did not statistically affect the standing long jump performance of volleyball athletes. A similar finding is also stated in the study of Sopa (2019). The researcher stated that 8-week plyometric exercises did not create a statistically positive improvement in the standing long jump performance of volleyball athletes. As a result of this study, it was determined that there was no statistically positive improvement in the standing long jump performances of female volleyball players. The lack of improvement in long jump performance in this study may be due to the limitation of the training period to 6 weeks.

The findings in the literature show parallel with the findings in this study, indicating that strength training improves motor properties. However, more studies are needed to examine the effect of fitness training on technical skills. Considering the branch of volleyball, it has been reported that technical-based volleyball exercises have a positive effect on the volleyball skills and short distance speed skills of the players (Gabbet et al. 2006). Strength training such as pliometric rather than skill-based training has a greater effect on the condition parameters of volleyball players (Gjinovci 2017). In addition, if the volleyball training is computer-based or traditionally trained; The increase in volleyball skills of athletes has similar characteristics (Vernadakis et al. 2002). In addition, when the effect of pilates exercises on the volleyball technical skills of female volleyball players was examined, it was determined that the service, forearm pass and spike skills of the athletes showed statistically positive developments as reported (Demir and Çilli 2018). Kitamura et al. (2020) reported that strength and explosive power exercises added to volleyball training had a positive effect on motor performances such as strength and agility of female volleyball players, while statistically positive effects on volleyball technical skills such as defense, spike and block. In studies conducted in different branches, it has been reported that strength training added to skill training creates increases in the skill performance of players. (Bavli 2016, Bavlı and Koç 2018).

CONCLUSION

As a result of this study, the following results were reached: 6-week strength training had significant effects on volleyball players' performances of push-ups, curl up and planks. The 6-week strength training did not have a significant effect on the standing, long jump, forearm, service and spike performances of volleyball players. This study can be applied to different age groups and its effect can be investigated. This study can be used as a training model that improves motoric performance in young volleyball players. In the future study, more positive effects can be achieved when the exercise duration is kept longer and the results are compared.

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