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INFLUENCE OF RESISTANCE TRAINING ON FITNESS AND VOLLEYBALL SERVICE PERFORMANCE OF THE FEMALE PLAYERS OF THE ISLAMIA UNIVERSITY BAHAWALPUR, PAKISTAN

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Abstract

This study is a comparison of the experimental and the control groups of female volleyball players. Purposively selected participants were (n = 34) equally divided into the experimental group and the control group. The experimental group followed an eight-week strength training program and the control group remained at the routine volleyball practice simply as game practice and warm-up exercise. The selected variables were body mass, stature, 30-m dash, flexibility, agility, 600-m run, sit-ups, standing long jump, push-ups, and hand grip strength. The volleyball serving skills were noted at specified Performa with the consultancy of two qualified volleyball coaches. Two video cameras were used to capture the volleyball service's actions. Repeated measures of ANOVA were applied for statistical analysis to compare the experimental and control groups. Results exhibited that the players of the experimental group significantly improved performance by eight weeks of strength training as agility, flexibility, standing and vertical jumps, 30-meter dash, speed, endurance, and set-ups than the control group. Further, the experimental group improved the accuracy of the volleyball service than the control group. It was concluded that the eight weeks of resistance training would increase the physical fitness and volleyball service performance of female volleyball players. Therefore, it is proposed that female volleyball players should be trained by considering strength training programs to improve their volleyball service accuracy and ball speed.

Keywords: Players, Fitness, Kinematics, Training, Flexibility

Introduction

The volleyball service significantly influences match outcomes. It plays a vital role in the game by shaping the team's approach to both offensive and defensive strategies (Tsoukos et al., 2019). Volleyball services contain various styles such as tennis service, underhand, and jump service (Haff et al., 2008; Singh, 2018). The stance position at the tennis serve was apart open chest, floating the ball high in the air with a non-dominant hand, and finally hitting the ball with the dominant hand with full force. The underhand serve is performed as the player bands his body forward, lifts the ball with a non-dominant hand then hits the ball from behind the ball. In the jump service, the player takes a few steps behind the service line, floats the ball forward and higher in the air, jumps after two of three steps finally hits the ball with the dominant hand, and lands inside the court after the jump. Female players preferred to adopt the tennis service style to control the accuracy of volleyball service. On the other hand, float and smash service styles are a bit difficult to learn and perform accurately during matches. Consistently accurate services challenge the receiving team, keep them under pressure, and finally increase scoring chances (Hong et al., 2018). In short, the volleyball service plays a pivotal role in establishing the momentum for continuous point scoring in the game (Parsons & Alexander, 2012). In contrast, inadequate service grants an advantage to the opposing team for easy point scoring (MacKenzie et al., 2012). The volleyball service is affected by various training elements such as physiological, technical, and tactical (Hodges et al., 2005). Training programs incorporate adjusting factors such as sets of repetitions and set configurations (Gabbett & Georgieff, 2008). A primary advantage of training for volleyball players is increased muscular strength to perform successful service (Oliveira et al., 2013). A complete plan of resistance training empowers volleyball players to achieve their full potential on the court (Acar & Eler, 2019). The resistance training program helps volleyball players to increase the strength of lower and upper body muscles which is associated with forceful and speedy services (Kraemer & Ratamess, 2004). Moreover, this training strengthens players in reducing fatigue time and improving stability and balance for maintaining correct body position during serving, passing, setting, and smashing (Faigenbaum et al., 2001). Strength and conditioning professionals ensure that strength training programs maximize the overall performance of volleyball players (Gangey & Kerketta, 2006; Gabbett, 2008). The physical fitness of volleyball players would such as power, endurance, flexibility, and agility to improve technique, skills, and mental toughness in games (Maizan, 2020). On the other hand, the lack of physical fitness of volleyball players resulted in poor performance in games (Yenes & Leowanda, 2019). Hansen et al., (2011) demonstrated the training set structures lead to a greater peak service velocity in volleyball. Resistance training is recommended to enhance the strength of upper body muscles and to maximize the velocity of volleyball service (Haff et al., 2008). Previous research indicates that strength training is an effective strategy for building muscular strength as Oliveira et al., (2013) have found that a 12-week resistance training program assists in muscle development of the upper and lower limbs. The valuable training potentially influences muscular strength, sprinting, speed, and explosive power in diverse jumping performances (Visnes & Bahr, 2013; Pacholek, Zemkova, Arnolds, & Sagat, 2021). A more recent study has reported that a 6-week training program significantly improves jump performance and sprint speed which is associated with the overall performance of volleyball players (Turgut et al., 2016). When reviewing scientific literature, it is widely

documented that engaging in resistance training enhances jumping performance and improves the capacity of athletes to generate high power of service in volleyball (Arazi et al., 2014; Kraemer et al., 2001). Previous studies have assessed the volleyball performance of proficient and non-proficient female players (Malousaris et al., 2008). The scientific literature currently lacking in focus on the physical fitness properties and the effects of resistance training on the performance of female volleyball players during the execution of volleyball services (Cabarkapa et al., 2021). Hence, there is a necessity to investigate the flexibility, balance, and endurance of female volleyball players (Rahmawati et al., 2007). An experimental study is designed to assess the impact of resistance training on the performance of female volleyball players in Pakistan. Analyzing physical fitness and service performance would contribute to team selection and provide insights into the effects of resistance training on the performance of these players.

Methods and Material

Participant

The current study recruited (n = 34) university female volleyball players, aged (20.23 ± 5.23) years. This is an experimental study therefore, all participants were equally divided into two groups experimental group (n = 17), and control group (n = 17). The nonregular, and injured players either before the start of training or during training were excluded from the data procedure. All participants duly signed the consent documents to ensure their voluntary involvement in the research process. Pre- and post-experimental data were gathered at the premises of the sports complex of the Islamia University in Bahawalpur, Pakistan. The eight-week resistance training program was also continued in the same premises.

The Procedure of the Measurements of Physical Fitness Various assessments were obtained before the start of the eight-week resistance training program and were also repeated from the same participants at the end of the training program. The following variables were measured as the standard board jump the muscular strength, the vertical jump for leg power, the 30-meter dash for speed, the zig-zag run for agility, the hand grip for hand strength, set and reach flexibility test, 600 meters run for endurance, set-ups for trunk strength, ten volleyball serves were performed by each participants to assess the accuracy of service and ball speed as guided (Gulati et al., 2021). Handgrip strength was assessed by using a digital dynamometer (Takei, Japan) in the guidelines of (Barut et al., 2008). Before each attempt, the dynamometer was calibrated and adjusted to match the hand range, and a one-minute break was given between the first and second trials. Three trials were given to each participant and the maximum score was considered the final score (Pavlovic et al., 2022). The participants were guided to flex their elbows at a 90-degree angle. The left arm and other body parts were prevented from exerting external force and support from any other object. Leg strength was assessed by measuring a vertical jump, which was executed from a stationary position by using both feet without any stepping. Participants stood laterally adjacent to the wall and reached the highest point on the wall. The highest point of the wall was guided to be marked with a pointer or markers which were carried by the participants during the procedure of vertical jump. Every participant performed three repetitions. The best score was recorded as the final score with a minimum value of 0.01 meters (Sozen, 2012). A five-minute break was provided after each attempt, and each participant underwent an appropriate warm-up, the vertical jump was completed in a two-stage approach as reported (Hale et al., 2019). To assess agility, participants engage in forward, sideways, and backward sprints as part of the Agility T-test.

For this assessment, a flat surface was marked with two parallel lines spaced 10 meters apart (Karahan, 2018). Cones were arranged at the beginning, at the center, end, and at three turning points for the setup. Participants assumed a ready position in front of the starting line. The individual swiftly moved 5 meters forward to the first position, then 5 meters to the left, followed by a 10-meter run to the right. Next, they returned to the center cone, covering 5 meters, and concluded with a 5-meter run back to the starting point. The test was recorded with a precision of up to 0.01 seconds. Participants were instructed to traverse the distance between the starting and ending points with maximum speed. The test was conducted three times, with a three-minute interval between each iteration, and the quickest result was utilized for statistical analysis (Tiaprapong et al., 2022). The sit and reach test was conducted by using an equipment flexometer (Taware et al., 2013). This assessment gauged hip flexion and leg hamstring extension by sitting the participants on the floor with extended their legs, the soles of their feet were placed flat on a wooden box, and both knees were pressed to the floor. The distance on the sit and reach box scale was then measured in inches, three trials were given, and the best score was recorded as the final score (Taware et al., 2013). Speed was assessed through a 30-meter sprint test with a stationary start. They were directed to run from the starting point to the endpoint at their maximum speed, timed with an audio signal, and the measurement accuracy was set at 0.01 seconds (Lidor et al., 2010). The standing broad jump was executed with the individual positioned with feet slightly apart, standing behind the line of the long jump pit. The takeoff and landing involve using the balls of the feet, with swinging arms and bending knees to generate forward momentum. The participant aims to achieve the longest possible jump while landing in an upright position without losing balance. The participant is given three opportunities to accomplish the task.

The Procedure of the Measurements of the Performance of Volleyball Service

The participants were positioned behind the volleyball court which is a 9-meter line and considered as the serving zone (Gabbett, 2008). Overhand service was considered for this study, the player was positioned one foot slightly ahead, held the ball in their non-dominant hand, and drew back their dominant hand. The ball is tossed into the air, and at its highest point, the swings its dominant hand forward, contacting the ball (Singh, 2018). This results in the ball traveling over the net, causing a dip and drop at the opponent's court. Underhand serve is commonly employed by novice players or those who favor a more controlled approach (Palao et al., 2009).

Reliability of the Variable

The intra-rater test was used to test the validity and reliability of the instruments and investigator (Sattler et al., 2015). By employing the intra-investigator method, we guaranteed the precision of both the instruments, identical measuring instruments were utilized in a prior examination. Thirty-five to ten individuals were surveyed and measured twice, with an interval of one day for this purpose (Gantois et al., 2022).

Resistance Training Program

Table 01: ***An eight-week resistance training program for female volleyball players.***

Week	Sets × Repetitions	Training Exercises
Standing shoulder press		
1-2	3×12	Chest fly
		Triceps French press
		Biceps curl
		Knee flexion
		Mini squat
		Ankle plantar flexion
3×4	3×12	Trunk twist
		Reverse flies
		Elbow Kick Back
		Retraction

		Lunge
		Quick kicks
		Leg press
5×6	3×12	Straight arm pulldown
		Chest press
		Wrist flexor
		Triceps kickback
		Lying Hamstring curls
		Trunk curl-up
7×8	3×12	Upright row
		Dynamic Hug
		Front raise
		Squat
		Knee extension
		Calf Raise

(Hale, Kollock, Pace, & Sanders, 2019), This training program is linked to enhanced physical fitness, heightened muscular strength, and improved neuromuscular coordination, factors that contribute to proficiency in volleyball service, smash, digging, and blocking (Fischetti et al., 2018). Additionally, resistance training has a positive effect on reducing body fat while enhancing the strength of both the upper and lower limbs, thus enhancing the performance of female players (Chatterjee & Bandyopadhyay, 2022). This training program involves short periods of rest between the first and second repetitions, aiming to mitigate fatigue, enhance speed, and improve both the offensive and defensive performances of players during competitions (Oikonomopoulou et al., 2022).

Statistical Analysis

Different statistical techniques were employed to examine the physical fitness variables and the volleyball service performance of female players. Descriptive statistics, including mean and standard deviation, were calculated by using the SPSS version 22 (SPSS Inc., Chicago, IL, USA) (Batez et al., 2021). Repeated measures ANOVA was utilized to evaluate group comparisons between the experimental and control groups at both pre-test and post-test measurements. Tukey's post hoc analysis was utilized to identify noteworthy differences in group comparisons during the pretest and posttest phases. The assumption of repeated measures was examined, considering data normality and multicollinearity. The significance values were adjusted as *P*-value < 0.05.

Result

Table 1 showed significant differences between the group's comparison at pre and post-test measurements of sitting height *P* > 0.01.

Figur 01: *Pre-Post Composition of experimental and control groups of female volleyball*

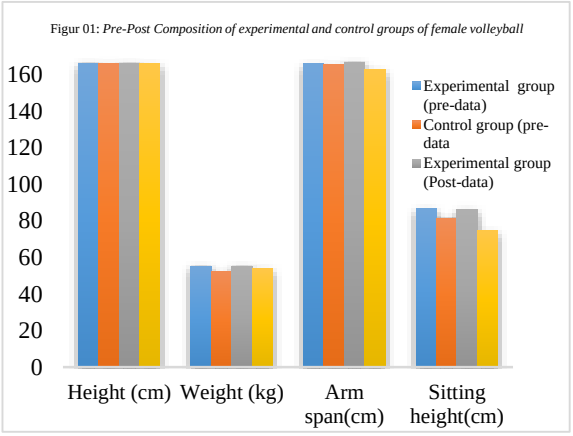


Table 2 shows a significant difference between groups comparison of pre and post of experimental and control groups in the measurement of agility test *P* > .000, standing broad jump, *P* < 0.02, flexibility *P* > 0.01, 600m long race *P* < 0.01, vertical jump *P* < 0.02, set up, *P* < .000, 30m shuttle run race P <. 000, right-hand grip strength was *P* < 0.06.

Figur 02: *Pre-Post Physical Fitness of experimental and control groups of female volleyball players*

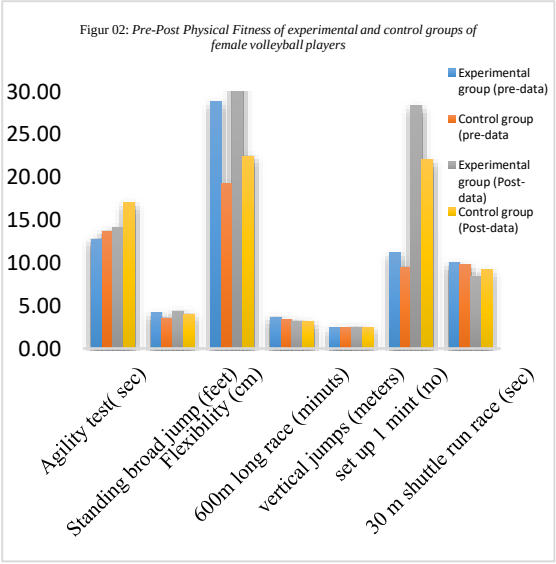
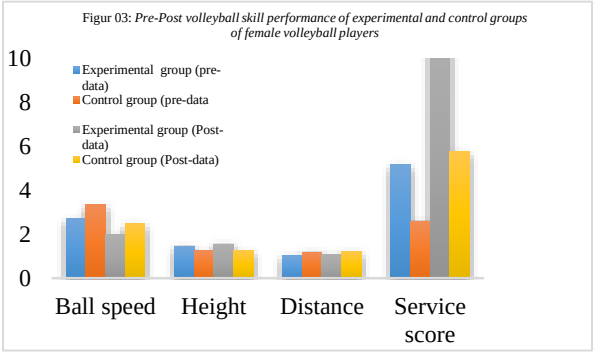


Figure three showed a significant difference between groups of comparison of pre and post-data of experimental and control groups in the measurements of ball speed at service *F* (5.19), *P* < 0.03. Tukey post hoc showed that the experimental group significantly improved their ball speed at service. It also reported the significant difference between groups of comparison of pre and post-data comparison of experimental and control groups in the service score *F* (8.24), P < 0.01. Tukey post hoc showed that the service scores of the experimental group were significantly improved in pre-post data analysis. A notable significant difference was observed in ball speed after serving by the experimental group as well as a significant difference observed in agility, flexibility, vertical jump, 600m race, sit-ups, and standing board jump than the control groups.

Figur 03: *Pre-Post volleyball skill performance of experimental and control groups of female volleyball players*



Discussion

This study aimed to investigate how resistance training impacts the performance of female volleyball players, focusing on physical fitness, and the performance of volleyball service. To achieve this objective, a total of (n = 34) female volleyball players were chosen and divided into experimental and control groups. The control and experimental groups displayed notable significant differences in the 1-minute sit-up test, the investigation of the present supports the previous findings (Singh & Rathore 2013). It may result in fat accumulation around the waist, abdomen, and thighs, accompanied by a decreased probability of engaging in additional sit-ups and sustaining muscular endurance. Significant differences in vertical jump performance were observed between the experimental and control groups. The present study supports the findings of the previous study as it was observed that strength performance during a vertical jump significantly increased following eight weeks of training (Arazi, 2018). The findings of the present study align with earlier research that strength training gives an advantage to volleyball players by increasing hand grip strength and service speed (Trajkovic, 2011; Visnes & Bahr, 2013). The importance of resistance training for developing core strength of the upper and lower body contributes to the ability of volleyball players to generate power in their service (Cormie, McGuigan, & Newton, 2011; Pereira et al., 2015). The present study emphasizes the importance of muscular strength of the upper and lower body which is associated with the stability and service performance of female volleyball players. The findings of this study confirm the findings of Myer, Ford, Brent, & Hewett, (2007) that resistance training increases the stability, agility, muscular strength, and dynamic movements which also increase the serving performance of female volleyball players. However, it's critical to control muscular strength and stability during the rapid and fast movement in volleyball service. Resistance training emphasizes the role of training for optimal performance as reported by Hibbs, Thompson, French, & Wrigley, (2008) that football players enhance their performance by following resistance training programs. Now present study's finding supports the findings of Hoffman, Cooper, Wendell, & Kang, (2004) that resistance exercises are stimulators to enhance the service performance of female volleyball players.

Conclusion

This study aimed to evaluate the skills of two groups of female volleyball players. The objectives of this study were to investigate how resistance training affects the physical characteristics and the performance of female volleyball players. It is concluded that resistance training plays a key role in improving the performance of the volleyball service of female university-level players by enhancing the capacity of specific muscle groups and various physical characteristics. Resistance training assists female volleyball players in building muscular strength, particularly in the lower body and shoulder muscles. During the volleyball service, human movement occurs like a chain, it works from a powerful leg drive, then trunks, and finally transfers to the served ball through the shoulder and hand. Strong ability of vertical and forward jump is associated with the ability to produce quick force. Resistance training exercises improve power output, helping volleyball players deliver more force into their serves. Stability is essential for maintaining balance and control during a volleyball serve. Resistance training develops the abdominals and lower back muscles that enhance the stability of female volleyball which results in the accuracy of volleyball service. This pattern of training engages multiple joints in movements to enhance the coordination and balance of female athletes. Further, it assists female volleyball players in better body control during the phase of a volleyball service, from the starting position to the follow-through. Volleyball matches demand high physical fitness as endurance is crucial for maintaining performance throughout a game. Resistance training also improves overall endurance, confirming that a player can sustain a high level of effort during serving and other aspects of the game. Resistance training can be adapted to simulate the specific movements involved in a volleyball serve. This sport-specific training can help improve the neuromuscular coordination required for effective and accurate service, especially for female players (Noyes, Barber-Westin, Smith, & Campbell, 2011). While resistance training primarily focuses on building strength, incorporating flexibility exercises can contribute to a more fluid and efficient service motion. A proper range of motion in the shoulders, hips, and other joints is essential for executing a smooth serve. It's important to note that a well-rounded training program should include a combination of resistance training, cardiovascular conditioning, skill drills, and adequate rest for optimal results. Additionally, athletes should work closely with coaches or fitness professionals to design a training plan that addresses their specific needs and goals.

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