
Sports Training: Latest Trends In High Level Sports (Volleyball)

Introduction

History

Volleyball has been one of the top team sports for both men and women. It has been around since the 1895 when it first started in United states. It was first named "Mintonette" developed as a sport derived from tennis and handball. Mainly it was a new sports shaped as a less rough version of basketball for older people. Because the rules of the game consist of serves, hitting and volleying, the name "volleyball" was given to it in the year 1896 in its first exhibition match. Volleyball later branched out of the united states towards Philippines, Canada, European countries and finally to Asia in the 1900's. Women started playing volleyball as a sport not until 1920 when they changed they way a woman was perceived in society for being strong and able to play rather than an image of beauty or weakness compared to men. It was the sports that introduced women into the sports world.

Motivation

The aim of this paper is to analyze volleyball as a sport while focusing on specific demands of players, the planification of best training cycle and the assessment of strategies for optimal performance of players. I have chosen this sports because I have had previous experiences with it in school and university for 4 year and I would hope in the future to be a part of a training team for volleyball. I believe this paper will aid in making me understand volley as a sport with a clearer plan of execution. Another reason for my choice is that volleyball is one of the most famous competing female sports when compared to basketball or football.

Analysis and Demands

Volleyball is a sport where many movements that occur are of explosive nature [5]. Most of the muscles involved in the execution of movements include the shoulder and arms in the upper body, and knees and legs in lower body. Considering those needs, some of the physical attributes found essential to player were height and arm length. According to Pandey et al., (2016) Players who were of higher height, body mass and longer leg length showed higher performance compared to shorted players with shorter legs or lower body mass [4]. Other than physical attributes, some physiological attributes were tested that need to be considered essential in volleyball some of which included aerobic capacity, muscle strength, vertical jumps and agility and strength [5]. Volleyball players must have high reaction ability which are accompanied with high speed and power in-order to perform any hits or spikes [5].

Regarding the aerobic capacity of players, it was an average of 40.72 ml/kg min⁻¹ whereas the average anaerobic capacity was of 43.96 ml/kg min⁻¹ [5]. According to the results shown, players use more anaerobic metabolism since most of their moves done need high speed and power to perform rather than relying more on aerobic metabolism. Players in this sport need to

have high aerobic profile where maintaining a high performance during the game is essential [6]. A study conducted compared oxygen consumption between athletes and non-athletes. The athletic groups were football and volleyball. They mainly tested oxygen consumption (VO₂ max) on players and control group. The results for football, volleyball and non-athletes were 4.25 vo₂max/l/min, 3.95 vo₂max/l/min and 3.19 vo₂max/l/min respectively [6]. This means that although volleyball players rely more on anaerobic metabolism, aerobic capacity is essential for better performance as an indicator of physical capacity during games just like any other sport which in this case is football [6].

Review According Lidor and Ziv (2010), since power is essential for spiking, serving and hitting in volleyball, strength is an integral part of performance in this sport. Some tests were conducted on players and non-players of volleyball. One test was on bench press power comparison where volleyball players showed significantly higher values compared to the non-players [7]. Another test was an Isokinetic testing on concentric and eccentric shoulder and elbow strength in female volleyball players and nonactive women. These results also showed significant difference in both groups the authors expected the volleyball players had significantly higher concentric and eccentric peak torque of the shoulder and elbow rotator muscles but not for concentric flexion peak torque in the elbow [8]. This was mainly due to the fact that elbow flexors are used for deceleration after hitting the ball and not before whereas arm extension with torque cause an increase in spiking velocity [8].

Vertical jumps are probably the most crucial skills to have in volleyball games [9]. Having different jumping abilities is what differentiates performance between different players whether they are of higher or lower levels. "A "critical height" above the net exists for optimal spiking and blocking and that the players who are able to reach this threshold have an advantage over those players who fail to reach it" [9].

As for the speed and agility, it is an integral part in every defensive an offensive maneuver performed by the players [REVIE]. One study had shown that volleyball players have higher sprint speed when compared to non-players however, surprisingly the strength and plyometric training alone cannot improve these aspects when compared to non-players in a 12 week training program [10].

Attacker

In the next part of the specific demands I will be focusing on one specific player position which is the attacker position. The attacker is mainly responsible for attempting to hit the ball towards the opponent's court side with the purpose of scoring the volley and gaining a point for their team [12]. Their usual movements include hitting or spiking the ball with explosive power, high jumps and high speed [11]. The hitter usually does not have to do much running thus their total meters travelled and low. An attacker should always be positioned in an 8 to 12 step distance from their spiking location [11]. This gives them ball anticipation, power and speed build-up necessary to perform the jump and spike with maximal power [11].

Functional

I will be using myself as a reference in this part since I was mainly an attacker in my previous team. Many attack players are usually known for their higher stature, long arms and longer legs

to aid in easier jumps. "It is frequently suggested that a volleyball players height has a lot to do with their ability to spike which is non-surprising as the athletes mentioned below are around 2m tall if not more" [5].according to Palao, J. M., Manzanaras, P., & Valadés, D. (2014), the average height of male and female world championship volleyball players between 2000 to 2012 were 199 cm and 185 cm respectively. Their BMI were in the normal range between 20.9 and 23.3 kg/m² [3]. As for my measurements, my height lies in female requirements of 185 cm and my BMI is 23 kg/m². I was mainly chosen for this position due to my height and ability to jump higher compared to my team mates.

Physiological

The most physiological properties needed were those related to speed and strength [14]. Studies had shown that quadriceps-hamstring strength is not different between either positions played between players stating that an attacker uses as much quadriceps and hamstring muscle strength as any other player [14]. On the other hand, attackers in volleyball had higher speed response for the 2 muscle groups when compared to the other players. This shows that attackers are able to perform movements faster than other players which is essential for their position since speed is essential for increasing power [14]

According to Elahe, Narges, Mahdiah and Somayeh (2013) the results of different player positions aerobic and anaerobic capacities showed that attackers/spikers have the highest anaerobic and lowest aerobic capacity of 47 ml/kg min⁻¹ and 39.38 ml/kg min⁻¹ respectively compared to the others since most of the moves done are jumps.

The attacker usually must have specific set of skills to perform the best spikes which include the preparation, approach, take-off, midair contact and finally the landing [14]. Since most of the actions done by an attacker include jumps with spikes, it is only normal to have both upper and lower limbs muscles included [14]

As for the phases, the preparation is the position in which the player must be in before their first step towards the jump and spike. In this phase the player must be in a flexed position with dominant foot towards their spike direction and arms hanging in a relaxed state [14]. Since the player will need high force, maximum speed must be reached in a short period of time to allow for the force build-up leading to the spike, here comes the approach phase [14]. In the approach phase, a 3 or 4 step run is done right before the jump which helps produce a more vertical jump. Right after the third step in the run , the fourth step done is a minimum-floor contact step which increases jump elasticity this goes back to " Newton's third law: Newton's third law completes the volleyball spike as for every action there is an equal and opposite reaction. Thus when running or in this case jumping, athletes apply force to the ground with both a downward (vertical) and (horizontal) component" [15] .Arm position is essential in this part for generating maximum force. After this step is done the player jumps up with high elasticity, speed and momentum/torque created in the last step before the jump making an elastic-explosive jump [14]. At the take off part the players hands must be swinging back which also helps in jump elasticity [14].

After the jump is done the hands are both swung up in complete extension allowing the spike to hit with maximum power, this is produced by using the whole body for power production.in this phase hip rotation plays an essential part[14]. Right handed players must rotate their left hips

called ipsilateral rotation allowing them to project more force. "Move total upper limb through a hip flexion. This creates a mechanical advantage and this improves his performance" [13].

The landing is also another important part of the whole spike since many injuries may occur so it must be done correctly. The perfect way to land is on both feet together in order to absorb the landing [16]. Another important thing to do is to land with both knees bent to prevent "jumper's knee" [16].

Muscle groups in every step in performing the jump and spike include elbow, knee, wrist, ankle, hip and glenohumeral joints as well as complete leg muscles; which will all be used together at some point in the game. Every muscle group used for flexion and extension aid in the moving of that joint [13].

Leg muscles such as calves, quadriceps, hamstrings, glutes and hip flexors are essential for running, but they also play a vital part in quick, explosive jumps. Strong leg muscles give you the power you need to elevate your jumps for effective all jumps, spikes, setting and blocking [6].

Some additional muscles play a role for stabilizing the shoulder and arm movements during spikes, some of which are the scapular and latissimus dorsi muscles of the back. Chest muscles move up and down with the body depending on the arm movement for support in relation to shoulder position.

Psychology

As many know, being in matches can be stressful on all players but specifically ;the one they count on for the scores, the attacker. Being the person in charge of scoring can be sometime overwhelming because they are expected to perform the best in order to win. One of the most essential psychological trait for an attacker is the volume of attention. They must be aware of all their surrounding and movements done by the players and the ball. This attention helps them in estimating the approximate location of the ball, when they need to jump and to which location the ball needs to be hit by them. This excess need of attention can have some negative effect on the players in a way that can cause excessive fatigue and unbalanced emotional state. The player must be on perfect mental state in order to perform at their best with minimal distraction. A common trait between attackers is being mentally tough which means the player must know how to conquer fear, rise above circumstance and know their body and capabilities.in other words, nothing must affect the player in the team. The player's performance remains solid and stable no matter the situation. They should be able to ignore any negative external influences and focus only on controlling themselves by positive thinking while maintaining focus. Anxiety is very common between all players the only difference is how the player allows to affect their performance. Many studies conducted on volleyball players showed the players who have high self-confidence when playing accompanied with anxiety seem to perform better, whereas on the other hand lack of self-confidence accompanied with anxiety leads to poorer performance. "the absence of self-confidence during stressful competition maybe critical factor, owing to its additional motivational properties along with experiencing anxiety symptoms" [10].

References

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1. Lopez, M., Texidor, S., White, E., & Zaremba, P. (2010). Volleyball. Retrieved from <http://www.ohio5.org/woosterwomeninsport/exhibits/show/sports/volleyball>
 2. Dupuis, C., & Tourny-Chollet, C. (2003). Increasing Explosive Power of the Shoulder in Volleyball Players. *Strength and Conditioning Journal*, 25(6), 7-11.
 3. Palao, J. M., Manzanares, P., & Valadés, D. (2014). Anthropometric, physical, and age differences by the player position and the performance level in volleyball. *Journal of human kinetics*, 44, 223–236.
 4. Pandey, & Kumar Correspondence, Ajay & , Pandey & Tilak, Raj & Meena, Inder & Kerketta, Sunita & , Bisht. (2016). Relationship between Selected Anthropometric Measurement and Volleyball Players Performance. *International Journal of Physical Education, Sports and Health*. 217. 217-219.
 5. Elahe, K., Narges, G., Mahdieh, G., & Somayeh, R. (2013). Description of aerobic and anaerobic capacity of male student volleyball players. *Res J Sport Sci* , 1 (2), 54-7.
 6. Rankovic, G., Mutavdzic, V., Toskic, D., Preljevic, A., Kocic, M., Nedin Rankovic, G., & Damjanovic, N. (2010). Aerobic capacity as an indicator in different kinds of sports. *Bosnian journal of basic medical sciences*, 10(1), 44–48. doi:10.17305/bjbms.2010.2734
 7. Morrow, JR Jr, Hosler, WW, and Nelson, JK. A comparison of women intercollegiate basketballplayers, volleyball playersand nonathletes. *J Sports Med Phys Fitness* 20: 435–440, 1980
 8. Alfredson, H, Pietila, T, and Lorentzon, R. Concentric and eccentric shoulder and elbow muscle strength in female volleyball players and non-active females. *Scand J Med Sci Sports* 8: 265–270, 1998.
 9. Gladden, LB and Colacino, D. Characteristics of volleyball players and success in a national tournament. *J Sports Med Phys Fitness* 18: 57–64, 1978.
 10. Fry, AC, Kraemer, WJ, Weseman, CA, Conroy, BP, Gordon, SE, Hoffman, JR, and Maresh, CM. The effects of an off-season strength and conditioning program on starters and non-starters in women’s intercollegiate volleyball. *J Appl Sport Sci Res* 5: 174–181, 1991
 11. “What Are the Biomechanical Principles That Are Crucial to a Volleyball Spike?” *Biomechanics of the Volleyball Spike*, 19 June 2015, biomechanicsvolleyball.wordpress.com/2015/06/19/7/.
 12. Denny Jackson. (2007). strength and power for volleyball. Retrieved from <https://www.strength-and-power-for-volleyball.com/about-me.html>
 13. Muscolino, J. E. (2014). *Kinesiology : the Skeletal System and Muscle Function*. Elsevier Health Sciences.
 14. Tkachev, Jessica. “Mechanical and Anatomical Analysis of Spiking.” *Academia.edu*, 2 May 2014, www.academia.edu/10948723/Mechanical_and_Anatomical_Analysis_of_Spiking.
 15. “What Are the Biomechanical Principles That Are Crucial to a Volleyball Spike?” *Biomechanics of the Volleyball Spike*, 19 June 2015, biomechanicsvolleyball.wordpress.com/2015/06/19/7/.
 16. Bisseling, R. W, et al. “Relationship between Landing Strategy and Patellar Tendinopathy in Volleyball.” *British Journal of Sports Medicine*, vol. 41, no. 7, 2007.