

# Development Of Volleyball-Specific Physical Qualities Through The Use Of Related Movement Games

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**Annotation.** Volleyball games require good motor skills and cardiorespiratory skills. Power, strength and endurance become very influential factors in performance and winning the match. This study aims to compare the power, strength and endurance of volleyball athlete among different levels of competition. Multistage fitness test was used to measure aerobic endurance capacities. We concluded that elite athlete, both senior and junior, have many differences from local athletes based on power, strength and endurance.

**Key words:** Endurance, power, strength, volleyball.

## Introduction

Performance of athlete depends on motoric skills, regular training, motivation and physiological factors. Motoric skills are factors that determine the athlete's performance and achievement in the volleyball game. Serve, pass, spike, block, and dig require good motoric skills so that it can be done perfectly. Spike is a characteristic technic of volleyball requires a complex skill involved many components of the movement, technical, and muscular qualities. A scientific and rational training method was the key for the athletes to improve spike skill (Tang: 2013). A study showed that spike performance of high-level volleyball athlete was influenced by some specific strength and physical characteristics (Forthomme et al.: 2005).

## Results And Discussion

Muscle power was defined as the product of force and velocity. Muscle power was influenced by exercise, age, and gender (Alcazar et al.: 2018). Vertical jump test as a simple indirect measure of leg power, while the power of arm was tested by medicinal ball throw. Jumping is a fundamental movement pattern to volleyball. Volleyball players who have higher vertical jump score have better performance (Ziv & Lidor: 2010) because vertical jumping abilities improved the height of spike jump (Sheppard et al.: 2008). Vertical jump and spike jump height was different between volleyball player in different levels of play (Yusuke et al.: 2018; Villalobos et al.: 2018; Ahmad & Ahmad: 2019; Rincón et al.: 2019; Annía et al.: 2019). The higher vertical jump ability increases volleyball player successfully to contact the ball at the highest point and then hitting the ball to strike it past the net.

Strength (strength) is the maximum effort that can be issued by a muscle to overcome pressure. Volleyball games involved almost all muscles that play the same importance (Sattler et al.: 2015). Strength of arm muscled are very important in volleyball games. Strength of arm is one factor that used to predict the quality of volleyball players (Ahmad & Ahmad: 2018, pp. 44-49; Grgantov et al.: 2013, pp.61-68). The strength of handgrip correlated with the strength of spike, the stronger hand-grip, the stronger ball hits were produced (Koley & Kaur: 2011).

Endurance is all about the level of cardiorespiratory fitness. Aerobic endurance is how efficiently the body can transport oxygen to where it needed during exercise. The maximal oxygen consumption (VO<sub>2</sub>max) has been considered by the World Health Organization as the single best indicator of cardiorespiratory fitness. Volleyball game with a relay point system allows the game to last for quite a long time. Cardiorespiratory capacity is very influential in maintaining performance throughout the game (Ahmad & Sahar: 2019). Players with a better cardiorespiratory capacity will be able to maintain their performance and increased opportunity to win. Athletes who compete in different levels of competition face off against opponents who have equal ability or performance. This research aims to describe the power, strength and endurance of volleyball athlete based on their level of competition.

### Participants

A total of thirty-seven volleyball athletes involved in this research. They were senior elite athlete, junior elite athlete and local athlete. Senior athletes were recruited from Central Java volleyball team. Junior elite was recruited from Central Java Student team, and local athlete was recruited from district volleyball club. All participants were exam their health status before the test and signed the agreement as a volunteer.

### Strength test

The variable of strength included left-hand grip and right, upper arm strength pulls and push, and leg strength. The strength was examined by handgrip dynamometer, pull and push dynamometer and leg dynamometer. Each athlete exam the test for three chances, and the highest score was recorded.

### Power test

The variable of power for volleyball athlete was explosive power of arm and explosive power of the lower leg. The explosive power of arm was examined by medicinal ball throw test. Athlete throws the 5 kg medicinal ball for three chances, and the longest distance was recorded. The explosive of the lower leg was exam by vertical jump test.

### Endurance test

The endurance capacity was measurement by Multistage Fitness Test. Athletes conducted warm-up before the test for about five minutes. The test was conducted by running continuously between two points that are 20 m apart from side to side. Athlete runs allowed the pre-recorded audio from computer software, which plays beeps at set certain intervals. The interval of beeps increased from the level to the next level. The athletes must increase their speed to keep in sync with the beeping rhythm. When the athlete being tested did not make the next interval, the most recent level they completed is their final score. VO2max was predicted by the beep test calculator.

### Characteristics of participants

The anthropometric variable had been measured, presenting in Table 1. The junior elite was the youngest, and senior elite athlete was the oldest. The senior elite as high as the junior elite, but they have higher body mass index value.

Table 1. The characteristics of participants

	Senior elite (n=9)	Junior elite (n=16)	Local athlete (n=12)
Age (year)	24.4	16.6	18.2
Body height (cm)	180.2	180.1	171.4
Body weight (kg)	79.2	70.1	68.4
Body Mass Index	24.4	21.6	22.7

### Power

Medicinal ball throw test appearance the explosive power of upper arm muscle. The upper arm muscle power was the difference between a senior elite athlete and the other one ( $p=0.000$ ), while no difference power between junior elite and local athlete ( $p=337$ ). The explosive power of the lower leg was measured by vertical jump test. In opposite with the upper arm explosive power, the lower leg explosive power was not the difference between senior elite junior elite and local athlete ( $p=0.126$ ). Although the vertical jump value not different between groups but all the values were excellent category.

Table 2. The result of medicine ball throw and vertical jump among the senior elite, junior elite and localvolleyball athlete

	Medicine ball throw (m)	Vertical Jump (cm)
Senior Elite	4.8	74.1
Junior Elite	3.9	70.4
Local Athlete	3.7	67.5

### Conclusion

Volleyball elite athlete needed physical pre-condition are supported by the techniques and strategies of the volleyball game. Power and strength muscle, especially upper and lower extremity, were important to the result of serve, pass, spike and block. The high capacity of aerobic ensures the availability of oxygen and energy to maintain performance during long matches. The difference level of competition forcing the athlete to enhance their ability in preparation for a balanced match. This research concluded that elite and non-elite athlete were different based on muscle strength, muscle arm power and aerobic endurance.

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