DIFFERENCE IN JUMPING ABILITY AND BODY COMPOSITION IN COMPETITIVE VOLLEYBALL SETTERS

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Abstract
The purpose of this study was to determine the difference in physical performance and body composition in competitive volleyball setters. Ninety volleyball players participated in this study. Players were members of Volleyball clubs in three different levels. Players performed assessments of body composition and vertical jump. Significant differences were found in all variables except for BMI which had no significant differences at the 0.05 level. This study has confirmed that jumping ability could discriminate players in different level of play in volleyball.

Key words: *players, compare, fitness, morphological characteristics*

Introduction

Elite male volleyball players have been reported to perform 250 to 300 high-power activities during a 5-game match (Hasegawa et al., 2002). Of these activities, the attack and block situations represent 45% of total actions of the game and are also responsible for 80% of the points obtained within international matches (Voigt & Vetter, 2003). In addition to technical and tactical skills, muscular power is one of the most important factors that give a clear advantage for successful participation during volleyball competitions (Marques, Van den Tillaar, Vescovi, & Gonzalez- Badillo, 2008). It is believed that to improve their volleyball performance, players must arrange specific volleyball conditioning with some additional resistance and sprint and agility training (Scates & Linn, 2003). During the preseason, coaches usually implement a conditioning and training routine in attempt to maximally prepare their athletes for the upcoming competitive season.

Accordingly, a number of studies have investigated the effects of different training methods at off-season (Gabbett & Georgieff, 2007), preseason (Sheppard et al., 2008), or during the competitive season in volleyball (Bloomfield, Polman, O'Donoghue, & McNaughton, 2007; Moir, Button, Glaister, & Stone, 2004; Stanganelli, Dourado, Oncken, Mancan, &da Costa, 2008). Thissen-Milder & Mayhew (1991) showed that selected physiological and anthropometric characteristics could discriminate successfully among freshman, junior varsity, and varsity volleyball teams and starting and non-starting players. Moreover, Sattler, Hadžić, Derviševic, & Markovic, (2015) tried to explore the differences in VJ performance among different competition levels and different playing position. Aforementioned authors observed significant differences in VJ height between different levels of play with the SJ as the most pronounced. However, few data are available about volleyball setters and their abilities in volleyball. Moreover, to our knowledge, no previous study has examined the difference of physical characteristics and body composition in volleyball setters concerning the level of players. Having in mind that season is very long and there is little time for preparation, there is a need for training in team sports to provide advantages in terms of time-efficiency, motivation, and training compliance (Gamble, 2007). Therefore, the purpose of this study was to determine the difference in physical performance and body composition in competitive volleyball setters.

Methods

Subjects
Ninety volleyball players participated in this study. Players were members National selections and Volleyball clubs in three different levels. Descriptive characteristics are presented in Table 1. Each player had at least 6 years of training experience, corresponding to 2hour training sessions, and at least 1 competition per week.

Procedures
Each athlete performed a standardized 15minute warm-up consisting of general movements and dynamic and static stretching. After the general warm-up, players performed assessments of vertical jump.

Table1. Descriptive statistics in three different levels

	N	Mean	SD	Min	Max
Semi-pro	29	26.86	3.11	16	34
Professional	37	27.16	2.51	19	35
Top level	24	30.76	2.34	23	37

Players underwent physical tests assessments in an indoor stadium. During the test air temperature ranged from 22°C to 25°C. It began at 10 am and

finished by 1 pm. Standard anthropometry (height, standing reach height, body mass) and lower-body muscular power (vertical jump and spike jump), were the physical tests selected. Players were instructed not to be involved in strenuous exercise for at least 48 hours before the fitness testing session and consume their normal pre-training diet before the testing session.

None of the subjects were injured 6 months before the initial testing as well as during the training program. There was no supplement addition regarding the nutrition of players. In addition, subjects were not taking exogenous anabolic-androgenic steroids and other drugs that might be expected to affect physical performance or hormonal balance during this study. Measurements were taken on Monday morning because the athletes had rested during the weekend. The testing session began with anthropometric measurements.

Players were then instructed to assess the lower-body muscular power (vertical jump, spike jump). Subjects performed 3 trials for muscular power tests, with a recovery of approximately 3 minutes between trials.

Players were encouraged to perform static stretching between trials. Body height and body weight were measured according to the instructions of the International Biological Program–IBP (Weiner & Lourie, 1969).

The body height was measured with a GPM anthropometer (Siber&Hegner, Zurich, Switzerland) to the nearest 0.1 cm. Body weight was obtained by TANITA BC 540 (TANITA Corp., Arlington Heights, IL) to the nearest 0.1kg. Body mass index was calculated by formula: BMI=Body mass (kg) / (Heighy (m))2. Percentage of body fat (Bfat%) was calculated by formula: Adult body fat % = (1.20 x BMI) + (0.23 x Age) - (10.8 x gender) - 5.4 (Deurenberg et al., 1991).

Spike and block jump performances
For the standing reach, while wearing their normal volleyball footwear, players were requested to stand with their feet flat on the ground, extend their arm and hand, and mark the standing reach height while standing 90° to a wall. Players were encouraged to fully extend their dominant arm to displace the highest vane possible to determine their maximum standing reach height. The measurement of the standing reach height allowed for a calculation of the relative jump heights on each of the jumping tasks (absolute jump height (cm) – standing reach height (cm) = relative jump height) (Sheppard et al, 2009). Spike and block jump performances for volleyball players depend heavily on the height at which these skills are performed above the net and are determined by not only the capacity of the athlete to raise vertically his center of gravity, but also his stature and standing reach. In this particular case, specific tests would provide a further understanding of the training-induced adaptation. For the Spike jump, the standing reach was determined as the maximal distance between the fingertip of the attack hand and the ground, while standing 90° to a wall.

The Spike jump was measured from a running lead (2- or 3-step approach) by using a basketball backboard marked with lines 1 cm apart with a 1-minute rest interval between them. For the Block jump, the standing reach was determined as the maximal distance between fingertips of the block hands and the ground, while facing the wall. The Block jump jumps started from a standing position with the hands at shoulder level and arms raised from the start position without extra swing. All tests used the same observer who was situated on a volleyball referee stand placed 2 m from the backboard. Both jumps were recorded as the best of the 3 attempts (Stanganelli, et al, 2008).

Results

Table 2 shows the differences between the groups at the univariate level . The table shows that there are significant differences in all variables except for BMI which had no significant differences at the 0.05 level. The greatest differences were found in tests Block jump and Spike jump where the differences were in the level of significance of 0.01.

Table 2. Difference between groups

	Top level	Professional	Semi-pro	p
Body height	195.86±1.6*†	191.9±6.6†	182.9± 7.0	0.000
Body weight	88.4 ± 8.8†	85.8±6.6†	81.2 ± 10.0	0.006
BMI	21.53±4.3	23.4±1.4	21.8 ± 3.5	0.066
Fat%	11.7 ± 2.3	12.4±1.9†	10.7 ± 2.8	0.023
Block jump	54.4 ±9.5†	52.70±7.9†	46.1 ±5.6	0.000
Spike jump	69.1 ±7.2*†	64.50±6.7†	54.4±6.9	0.000

*significantly different from professional †significantly different from semi-pro

According to post hoc test, there is significant difference between semi-pro and top level volleyball setters in almost all variables accept for BMI and fat%. Difference between professional and top level setters was found for body height, and spike jump. Other variables showed no statistical differences between groups.

Discussion

The aim of this study was to determine the difference in physical performance and body composition in competitive volleyball setters. We have found significant differences between setters of different level. The difference was obvious in almost all variables between semi-pro setters and

top level setters. However, difference between professional and top level setters was found in for body height andspike jump ($p<0.05$). Smith, Roberts & Watson (1992) compared physical, physiological, and performance characteristics of national-level and college-level volleyball players and found significantly higher block and spike jumps, 20-m speed, and VO2max in the national-level players. Palao, Santos &Ureña (2004) have found a significant difference in male volleyball players between team levels for the skills of spiking and blocking. In females, a significant difference in the performance of the spike in level 1 teams was found. In addition, Sattler, et al. (2015), found the most pronounced and statistically significant differences in VJ performance according to the level of play in SJ. Our results were similar with those found in aforementioned authors.

However, interestingly we found differences for spike jump between top level and professional setters. During a game, setters are rarely jumping to attack. In some cases, setters usually jump and just suddenly pass the ball over the net into the undefended part of the opponent's field (Sattler et al., 2015). Marques et al. (2008) found significant strength differences among playing positions in elite male volleyball players, with setters having significantly poorer parallel squat performance than the outside and opposite hitters. This finding goes along with our results suggesting additional strength and plyometric training in order to obtain better jump performance for setters during a game. One more possible reason for better results in spike jump for top-level setters is the fact that they more often use jump service compared to professional and semi-pro setters. Grgantov, Katić&Janković (2006) have stated that the elementary technique of all volleyball elements is important for competition success and have indicated that the mastering of the technique of volleyball elements is a longstanding process that should be paid due attention in all age groups. However, this study has confirmed that body composition and jumping ability could discriminate players in different level of play in male volleyball. The importance of jumping ability at different competition levels could be confirmed with this kind of research.

References

Bloomfield, J., Polman, R., &O'Donoghue, P. (2007).Effective Speed and Agility Conditioning Methodology for Random Intermittent Dynamic Type Sports. *Journal of strength and conditioning research: the research journal of the NSCA, 21*(4), 1093-1100.

Deurenberg, P., Weststrate, J. A., & Seidell, J. C. (1991). Body mass index as a measure of body fatness: age-and sex-specific prediction formulas. *British journal of nutrition, 65*(02), 105-114.

Gabbett, T. &Georgieff, B. (2007). Physiological and anthropometric characteristics of Australian junior national, state, and novice volleyball players. *The Journal of Strength and Conditioning Research 21*(3), 902-8.

Gamble, P. (2007). Challenges and Game-Related Solutions to Metabolic Conditioning for Team Sports.Strength & Conditioning Journal, *29*(4), 60-65.

Grgantov, Z, Katić, R., & Janković, V. (2006). Morphological characteristics, technical and situation efficacyof young female volleyball players. Collegium Antropologicum, *30*(1), 87-96

Hasegawa, H, Dziados, J, Newton, RU, Fry, AC, Kraemer, WJ, and Hakkinen, K. (2002). Periodized training programmes for athletes. In: *Strength Training for Sport*. Kraemer, WJ and Hakkinen, K, eds. London: Blackwell Science. pp. 69–134.

Marques, M. C., Van Den Tillaar, R., Vescovi, J. D., & González-Badillo, J. J. (2008). Changes in strength and power performance in elite senior female professional volleyball players during the in-season: a case study. *The Journal of Strength & Conditioning Research*, *22*(4), 1147-1155.

Moir, G., Button, C., Glaister, M., & Stone, M. H. (2004). Influence of familiarization on the reliability of vertical jump and acceleration sprinting performance in physically active men. *The Journal of Strength & Conditioning Research*, *18*(2), 276-280.

Palao, J.M., Santos, J.A., & Urena, A. (2004). Effects of the setter's position on the block in volleyball. *International Journal of Volleyball Research, 6*(1), 29-32.

Sattler, T., Hadžic, V., Dervišević, E., & Marković, G. (2015). Vertical jump performance of professional male and female volleyball players: effects of playing position and competition level. *The Journal of Strength & Conditioning Research, 29*(6), 1486-1493.

Scates, A and Linn, M. *Complete conditioning for volleyball*. Champaign, IL: Human Kinetics, 2003.

Sheppard, J. M., Cronin, J. B., Gabbett, T. J., McGuigan, M. R., Etxebarria, N., & Newton, R. U. (2008). Relative importance of strength, power, and anthropometric measures to jump performance of elite volleyball players. *The Journal of Strength & Conditioning Research*, *22*(3), 758-765.

Smith, D.J., Roberts, D., & Watson, B. (1992). Physical, physiological, and performance differences between Canadian National Team and Universiade volleyball players. Journal of Sports Sciences, 10 (2), 131-138.

Stanganelli, L. C. R., Dourado, A. C., Oncken, P., Mançan, S., & da Costa, S. C. (2008). Adaptations on jump capacity in Brazilian volleyball players prior to the under-19 World Championship. *The Journal of Strength & Conditioning Research*, *22*(3), 741-749.

Thissen-Milder, M., & Mayhew, J. L. (1991). Selection and classification of high school volleyball players from performance tests. *The Journal of sports medicine and physical fitness*, *31*(3), 380-384.

Voigt, H. F., & Vetter, K. (2003). The value of strength-diagnostic for the structure of jump training in volleyball. *European Journal of Sport Science*, *3*(3), 1-10.

Weiner, J. S., &Lourie, J. A. (1969). Human Biology, A Guide to Field Methods.

RAZLIKE U SKOČNOSTI I TJELESNOJ KOMPOZICIJI KOD DIZAČA U ODBOJCI

Sažetak

Cilj ovog istraživanja bilo je utvrđivanje razlika u eksplozivnosti i tjelesnom sastavu kod dizača u odbojci različitih razina natjecanja. Devedeset odbojkaša je sudjelovalo u ovom istraživanju . Igrači su bili članovi odbojkaških klubova na tri različite razine. Na igračima je izvršena procjena tjelesne kompozicije i vertikalnog skoka. Značajne razlike su dobivene u svim varijablama, osim kod BMI koje nisu bile značajne na razini 0.05. Ovo istraživanje je potvrdilo da skakačke sposobnosti mogu diskriminirati igrače na različitim razinama igre u odbojci.

Ključne riječi: *igrači, usporedba, fitnes, morfološke karakteristike.*

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