



COMPARATIVE STUDY OF SELECTED BIOMECHANICAL VARIABLES OF ADOLESCENT SPIKER AND LIBERO PLAYERS IN VOLLEYBALL

Dr. Vishaw Gaurav¹, Mukhwinder Singh^{2*}, Pankaj Bhanot³, Sandeep⁴, Ved Parkash⁵

¹Department of Education, Punjab, INDIA.

²Department of Physical Education, S.S.M. College, Dinanagar, Punjab, INDIA.

³Department of Sports, Punjab, INDIA.

⁴Department of Physical Education (T), Guru Nanak Dev University, Amritsar, INDIA.

⁵Department of Physical Education, SGGS Khalsa College Mahilpur, Punjab, INDIA.

Abstract: The purpose of this study was to compare the selected biomechanical variables between adolescent spiker and libero players in volleyball. The present study was conducted on a sample of thirty eight (N=38) adolescent volleyball players, which includes (Spikers: $N_1 = 24$) and (Liberos: $N_2 = 14$) of age group 15-18 years were selected from different schools Punjab, India. The purposive sampling technique was used to select the subjects. All the participants were informed about aim and methodology of the study and they volunteered to participate in this study. The age of the subjects were obtained from the records of their respective schools. The height (cm) and weight (kg) of the subject were measured by standard tools and techniques. The Illinois agility test was used to measure the agility and vertical jump test was used to assess the jumping performance. Medicine ball put test was used to measure the upper-body muscular power and hand grip strength was measured by hand dynamometer with adjustable grip. The independent samples t-test was applied to assess the differences of selected variables between spiker and libero players. Results indicated that spiker players had significantly greater values in height ($p < 0.05$), body weight ($p < 0.05$), vertical jump ($p < 0.05$), right hand grip strength as compared to libero players whereas libero players had significantly better agility ($p < 0.05$) than spiker players. There were no differences in upper-body muscular power measured by medicine ball put test between spikers and liberos.

Keywords: Biomechanical variables, spiker, libero, volleyball.

I. INTRODUCTION

Volleyball requires specific biomechanical characteristics of players for elite performance (Fattahi et al., 2014). Volleyball players need high level of strength (jumping ability, explosive power) and agility which play important roles (Vescovi & McGuigan, 2008; Zhang, 2010). Volleyball involves repeated jumping, blocking, spiking, power hitting, and setting which require a high level of strength and power (Lidor & Ziv, 2010; Popadic gacesa et al., 2009). Volleyball requires players to be explosive in the lower limbs muscle power when attacking on offense or blocking on defense (Stojanovic & Kostic, 2002; Sheppard et al., 2007; 2008; 2009). Physical performance requirements for volleyball include high levels of strength in shoulder, elbow and hands, which will be used for spiking, serving and saving ball; strength in knee extension, which will be used of jumping (Zhang, 2010). A volleyball team comprises 12 players with team positions broadly defined as setters, spikers, blockers and liberos. Each of these positions plays a specific role in a volleyball match (Gabbett et al., 2006). Liberos as the backline players participate in receive and digging during the match but spikers plays in front of the net, performing spike and block (Duncan et al., 2006). Libero player is a specialist in reception and defense. The libero cannot serve, set inside of the 3 meter line, or spike (Palao et al., 2014). Therefore, the purpose of this study is to compare the selected biomechanical variables between adolescent spicker and libero players in volleyball.

II. MATERIALS AND METHODS

A sample of thirty eight (N=38) adolescent volleyball players, which includes (Spikers: $N_1 = 24$) and (Liberos: $N_2 = 14$) of age group 15-18 years were selected from different schools Punjab, India. The purposive sampling technique was used to select the subjects. All the participants were informed about aim and methodology of the study and they volunteered to participate in this study. The age of the subjects were obtained from the records of their respective schools. The height (cm) and weight (kg) of the subject were measured by standard tools and techniques. BMI was calculated by the formula of; Body Mass Index = Weight/Height². The Illinois agility test (Getchell, 1985) was used to measure the agility. The Vertical jump test (Fleishman, 1964) was used to assess jumping performance. Medicine ball put test was used to measure the upper-body muscular power. Hand grip strength was measured by hand dynamometer with adjustable grip.

Statistical Analyses: Values are presented as mean values and SD. Independent samples t tests were used to test if population means estimated by two independent samples differed significantly. Data was analyzed using SPSS Version 16.0. The level of significance was set at 0.05.

III. RESULTS

Table-1. Demographic Characteristics of Spiker and Libero Players.

Variables	Spiker Players (N ₁ = 24)		Libero Players (N ₂ = 14)		Mean Difference	SEDM	t-value
	Mean	SD	Mean	SD			
Height (cm)	175.88	4.23	169.21	5.69	6.67	1.62	4.122*
Weight(kg)	70.67	6.15	63.14	3.57	7.53	1.80	4.172*
BMI(kg/m ²)	22.82	1.34	22.10	1.74	0.72	0.50	1.423

*Significant at 0.05 level

Table-1: depicts the demographic characteristics of spiker and libero players. The mean height of spiker players was 175.88 cm and libero players were 169.21 cm. The mean weight of spiker players was 70.67 kg and libero players were 63.14 kg. The mean value of body mass index of spiker players was 22.82 and libero players were 22.10. Results of the study indicated that spiker players had greater height ($p < 0.05$) and body weight ($p < 0.05$) as compared to libero players.

Table-2. Comparison of Agility and Vertical Jump between Spiker and Libero Players.

Variables	Spiker Players (N ₁ = 24)		Libro Players (N ₂ = 14)		Mean Difference	SEDM	t-value
	Mean	SD	Mean	SD			
Agility (sec)	19.80	0.80	16.84	0.79	2.96	0.27	11.064*
Vertical Jump(cm)	47.29	1.63	44.07	1.59	3.22	0.54	5.929*

*Significant at 0.05 level

Table 2 depicts the comparison of agility and vertical jump between spiker and libero players. Results indicated that libero players had significantly greater values in agility ($p < 0.05$) than spiker player. The spiker players had significantly better vertical jump ($p < 0.05$) as compared to libero players.

Table-3. Comparison of Medicine Ball Put and Handgrip Strength between Spiker and Libero Players.

Variables	Spiker Players (N ₁ = 24)		Libro Players (N ₂ = 14)		Mean Difference	SEDM	t-value
	Mean	SD	Mean	SD			
Medicine Ball Put Test (m)	8.27	0.36	8.05	0.45	0.22	0.13	1.702
Right Handgrip Strength(kg)	28.94	0.38	28.45	0.61	0.49	0.16	3.039*
Left Handgrip Strength(kg)	27.85	0.51	27.51	0.65	0.34	0.19	1.790

*Significant at 0.05 level

Table 3 depicts the comparison of medicine ball put and hand grip strength between spiker and libero players. Results indicated that spiker players had significantly greater values right hand grip strength ($p < 0.05$) as compared to libero players. There were no significant difference's found between spikers and liberos in term of medicine ball put test and left hand grip strength.

IV. DISCUSSION

In the present study selected biomechanical variables of spiker and libero players have been evaluated and compared. The demographic characteristics of spikers and libero volleyball players show that spiker players were taller and heavier as compared to the libero players. The differences in height could be the result of different technical and tactical demands placed on players in different positions (Duncan *et al.*, 2006). Results of the present study indicated that spiker players had significantly greater values in vertical jump than the libero players. It is suggested that libero players usually do not perform jumps for blocking and spiking (Sheppard *et al.*, 2009), therefore libero had lower vertical jump performance than spikers. These findings are not in line with previous studies (Marques *et al.*, 2009; Duncan *et al.*, 2006) found no differences in vertical jump performance between spikers and liberos. On the other hand, there were no significant difference found between spiker and libero players in upper-body muscular power measured by medicine ball put test. High levels of upper-body muscular power during spiking and serving is an important factor of volleyball players (Gabbett *et al.*, 2006). The study conducted by Mielgo-Ayuso *et al.* (2015) reported that, the highest upper-body muscular power to be

present in opposite and outside hitters (known as spikers in the present study) compared to other playing positions. On the other hand, spiker players in the present study had better hand grip strength as compared to libero players. A high level of hand strength to be needed in volleyball players for better spiking (Zhang, 2010). Results of the present study indicated that libero players had significantly greater agility than the spiker players. These findings are in line with the study of Mielgo-Ayuso *et al.* (2015), they observed that libero players were the most agile players of the volleyball team.

V. CONCLUSIONS

In conclusion, we found that spiker players were taller and heavier as compared to the libero players. Results of the study revealed that spiker players had better vertical jump, upper-body muscular power and hand grip strength as compared to libero players. On the other hand, libero players had significantly greater agility than the spiker players.

REFERENCES

- [1]. Fattahi1, A., Shamsabadi, A. M.M., Amin Kalani, A., Khalifeh, S.N. & Ghofrani, M.H. (2014) Differences between biomechanical variables of professional volleyball attackers due to game's position. *European Journal of Experimental Biology*.4(2):406-411.
- [2]. Fleishman, E.A.(1964) *The structure and measurement of physical fitness*. Englewood Cliffs, N.J.: Prentice- Hall, Inc.
- [3]. Gabbett, T., Georgieff, B. Anderson, S. Cotton, B. Savovic, D. & Nicholson, L. (2006) Changes in skill and physical fitness following training in talent-identified volleyball players. *J. Strength Cond. Res*, 20(1):29-35.
- [4]. Getchell, B. (1985) *Physical Fitness: A way of life* (3rd ed.). New York: Macmillan Publishing Co.
- [5]. Lidor, R. & Ziv, G.(2010) Physical characteristics and physiological attributes of adolescent volleyball players-a review. *Pediatrics Exercise Science*. 22:114-134.
- [6]. Marques, M.C., van den Tillaar, R., Gabbett, T.J. *et al.*(2009) Physical fitness qualities of professional volleyball players: Determination of positional differences. *J Strength Cond Res*; 23:1106-11.
- [7]. Mielgo-Ayuso, J., Calleja-Gonzalez, J., Clemente-Suarez, V.J. & Zourdos, y M. C.(2015) Influence of anthropometric profile on physical performance in elite female volleyballers in relation to playing position. *Nutr Hosp*31(2):849-857
- [8]. Palao, J.M., Manzanares, P. & Valades, D.(2014) Anthropometric, physical, and age differences by the player position and the performance level in volleyball .*Journal of Human Kinetics* volume 44: 223-236
- [9]. Popadic gacesa, J.Z., Barak, O.F. & Grujic, N.G. (2009)Maximal anaerobic power test in athletes of different sport disciplines. *The Journal of Strength and Conditioning Research*. 23:751-755.
- [10]. Sheppard, J. M., Gabbett, T., Taylor, K. L., Dorman, J., Lebedew, A. J., & Borgeaud, R. (2007). Development of repeated-effort test for elite men's volleyball. *International Journal of Sports Physiology Performance*, 2: 292-304.
- [11]. Sheppard, J. M., Gabbett, T., Taylor, K.L., Dorman, J., Lebedew, A.J. & Borgeaud, R. (2007) Development of a repeated-effort test for elite men's volleyball. *International Journal of Sports Physiology and Performance* 2:292-304.
- [12]. 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. *Journal of Strength and Conditioning Research* 22:758- 65.
- [13]. Sheppard, J.M., Gabbett, T.J. & Stanganelli, L.C. (2009) An analysis of playing positions in elite men's volleyball: considerations for competition demands and physiologic characteristics.. *Journal of Strength and Conditioning Research*.23: 1858-1866.
- [14]. Stojanovic, T., & Kostic, R. (2002) The effects of the plyometric sport training model on the development of the vertical jump of volleyball players. *FACTA UNIVERSITATIS series: Physical Education and Sport*, 1(9):11-25.
- [15]. Vescovi, J. & McGuigan, M. (2008) Relationships between sprinting, agility, and jump ability in female athletes. *Journal of Sports Sciences*, 26(1): 97-107.
- [16]. Zhang, Y. (2010) An investigation on the anthropometry profile and its relationship with physical performance of elite Chinese women volleyball players, MSc thesis, Southern Cross University, Lismore, NSW.