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ANALYSIS ON SELECTED KINEMATIC AND MOTOR VARIABLES OF JUMP SERVE AMONG YOUTH NATIONAL LEVEL MALE VOLLEYBALL PLAYERS

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Abstract

The purpose of the study was to predict the velocity of jump serve of youth national level male volleyball players using selected kinematic and motor variables. The sample size consisted of a total of 10 male subjects selected randomly from the players who have represented Kerala state at the national level competitions. For Jump serve the variables considered were Approach distance, Approach velocity, Distance of jump, Height of CG, Velocity of Serve, Trunk Flexibility, Shoulder Strength, Abdomen Strength, and Leg power. The serve trials of the subjects were captured with camera and analysed with Kinovea Motion analysis software. The data pertaining to the variables of jump serve were tested using Multiple Regression analysis. The level of significance was set at .05 for testing the hypotheses. The analysis of the variables of Jump Serve revealed that velocity of jump serve of youth national level male volleyball players can be significantly predicted with the height of cg, distance of jump and trunk flexibility. The velocity of jump serve has a positive relationship with height of cg and distance of jump and negative relationship with trunk flexibility.

Key Words : Jump Serve, Velocity of Serve

Introduction

In the sport of volleyball, the serve can be considered the first offensive action of each rally (Depra et al., 1998). Without the proper techniques and timing, the serve cannot reach to the opponent ground effectively. So, different factors such as start and stop angle of arm, force and arm length influence the flight distance of the struck ball. There are deeply correlations between these factors and applying them appropriately will result in success of serve. (Maryam Mohammadi and Afagh Malek, 2012)

The primary goal is to score an ace or make the served ball as difficult as possible for the opposing team to pass. Four primary characteristics of a serve determine the level of difficulty presented to the receiving team: ball speed (Strohmeyer, 1996), flight time (Katsikadelli, 1996), predictability of the trajectory (amount of random movement in the flight path) (Depra et al., 1998). The serve, just like attacking and blocking, has a purpose-determined nature and may be decisive in a team's performance (Drikos et al., 2009; Patsiaouras et al., 2009). The benefit of the serve is not just that a point is immediately scored, but rather, the serve has an influence on the later development of the game. Thus, it has been observed that the execution of a good serve (power serve or with a tactical intention), affects the reception performance (Quiroga et al., 2010; Quiroga et al., 2012). The importance of the serve is high in men's international top volleyball. Strong serve is a powerful offensive weapon in scoring points directly and in assisting the block and defense to score points (Palo J.M et al., 2004). In volleyball the serve techniques and speeds differ according to the performance level. (Hayrinen, M et al., 2007). Hence an attempt is made by the researcher to predict the velocity of jump serve with selected kinematic and motor variables of youth national level male volleyball players.

Methodology

The purpose of the study was to predict the velocity of jump serve with selected kinematic and motor variables of jump serve among youth national level male volleyball players. The sample size consisted of a total of 10 male subjects were selected randomly from the players who have represented Kerala state at the national level competitions. The sample of present study includes International and national level male volleyball players from the volleyball teams of St. Thomas College, Pala, SAI Training Center, Calicut, and Members of different University teams which participated in All India Inter University Volleyball Championship. For the present study Approach distance, Approach velocity, Distance of jump, Height of CG, Velocity of Serve, Trunk Flexibility, Shoulder Strength, Abdomen Strength, and Leg power were considered as variables of the study.

For the present study the researcher along with a technical team for videographer visited the training centers of different volleyball teams and recorded jump serves using digital video camera (Canon 70 D, 50 fps). The camera lens was oriented perpendicular to the plane of motion (sagittal) at a distance of 10 m. The camera was mounted on a tripod at a height of 1.50 mts from the ground. An object of known dimension was filmed before the trails of the subjects. A practice session, which lasted approximately half an hour, immediately followed the instruction period to ensure correct and consistent execution of jump serve. The analysis on each serve trail was done using Kinovea Motion Analysis software. The Approach Distance was obtained by measuring the displacement from the starting position of the player to serve to the point of takeoff, the Approach Velocity was calculated by dividing the displacement during approach with the time taken for it. The Distance of Jump of the server was the displacement from the point of takeoff to the nearest point of landing after serve. The Height of the CG was the vertical displacement of center of gravity at the point of ball contact for the serve. The value for Velocity of Serve was calculated by dividing the displacement of the ball from the point of ball contact to the point where it crosses the net with the time taken for it. The parameter time was obtained from the motion analysis software. Trunk Flexibility, Shoulder Strength, Abdomen Strength, and Leg power were measured using bridge test, two hand seated medicine ball throw, sit up test, and standing broad jump test respectively. The data were analysed using SPSS Version 20.0 (SPSS Inc., Chicago, IL). The data pertaining to the variables of jump serve were tested using multiple regression analysis. The significance of the different models was assessed by ANOVA and significance of coefficients of different regression models were assessed by t-test. The level of significance was set at .05 for testing the hypotheses.

Results of the study

Model summery of regression analysis of Jump Serve of Youth Male Volleyball Players

Using the multiple regression analysis 3 models were constructed and corresponding R square values were calculated. The details are given in Table 1.

Table 1. ***Summary of multiple regression models***

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate
1	.796[a]	.634	.588	1.12824
2	.961[b]	.924	.903	.54848
3	.985[c]	.969	.954	.37677

a. Predictors: (Constant), Height of CG
b. Predictors: (Constant) , Height of CG, Trunk Flexibility
c. Predictors: (Constant), Height of CG, Trunk Flexibility, Distance of Jump

Model 1, which includes only 1 variable (height of cg), will predict velocity with an R square of 0.634, i.e 63.4% of variation in velocity can be explained by the variables Height of CG. Model 2, which includes 2 variables (height of cg, trunk flexibility), will also predict velocity with an R square of 0.924, i.e 92.4% of variation in velocity can be explained by the variables height of cg, trunk flexibility. Model 3, which includes 3 variables (height of cg, trunk flexibility, and distance of jump), will also predict velocity with an R square of 0.969, i.e 96.9% of variation in velocity can be explained by the variables height of cg, trunk flexibility and distance of jump.

Table 2. ***Significance of the regression models assessed by ANOVA***

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	17.616	1	17.616	13.839	.006[b]
	Residual	10.183	8	1.273		
	Total	27.800	9			
2	Regression	25.694	2	12.847	42.706	.000[c]
	Residual	2.106	7	.301		
	Total	27.800	9			
3	Regression	26.948	3	8.983	63.278	.000[d]
	Residual	.852	6	.142		
	Total	27.800	9			

a. Dependent Variable: Velocity of Serve

b. Predictors: (Constant), Height of CG

c. Predictors: (Constant), Height of CG, Trunk Flexibility

d. Predictors: (Constant), Height of CG, Trunk Flexibility, Distance of Jump

Table 2 reveals that the regression equation based on the model 1 is significant (F= 13.839, p = .006). Therefore, velocity can be significantly predicted using height of cg. The regression equation based on the model 2 is also significant (F= 42.706, p =.000). Therefore, velocity can be significantly predicted using height of cg, trunk flexibility. The regression equation based on the model 3 is also significant (F= 63.278, p =.000). Therefore, velocity can be significantly predicted using height of cg, trunk flexibility and distance of jump.

Effect of independent variable on velocity of the ball

Table 3. ***Coefficients of regression models and their significance***

Model		Coefficients	T	Sig.
1	(Constant)	5.321	1.341	.217
	Height of CG	8.288	3.720	.006
2	(Constant)	17.892	5.772	.001
	Height of CG	6.681	5.930	.001
	Trunk Flexibility	-12.995	-5.182	.001
3	(Constant)	16.094	7.271	.000
	Height of CG	6.041	7.521	.000
	Trunk Flexibility	-11.808	-6.678	.001
	Distance of Jump	1.077	2.972	.025

a. Dependent Variable : Velocity of Serve

The regression equation based on **Model 1** is velocity= 5.321 + 8.288 x height of cg. Here, the coefficient of approach velocity was found statistically significant using t- test (p= 0.006).

The regression equation based on **Model 2** is velocity= 17.892 + 6.681 x height of cg – 12.995 x trunk flexibility. Here, the coefficient of approach velocity and trunk flexibility was found statistically significant using t- test (p= 0.001 & p= 0.001 respectively).

Hence,

i) velocity has a positive effect with height of cg, when the trunk flexibility is kept constant.

ii) velocity has a negative effect with trunk flexibility, when the height of cg is kept constant.

The regression equation based on **Model 3** is velocity= 16.094 + 6.041 x height of cg – 11.808 x trunk flexibility + 1.007 x distance of jump. Here, the coefficients of all variables were found statistically significant.

Hence,

i) velocity has a positive effect with height of cg, when the trunk flexibility and distance of jump is kept constant.

ii) velocity has a negative effect with trunk flexibility, when the height of cg and distance of jump is kept constant.

iii) velocity has a positive effect with distance of jump, when the height of cg and trunk flexibility is kept constant.

Selection of the best regression model

Model 1, which contains 1 independent variables (F= 13.839, p = .006), model 2, which contains 2 variables (F= 42.706, p =.000) and Model 3 which contains 3 variables (F= 63.278, p =.000) were found significant. When the analysis on the effect of independent variable on velocity of serve was carried out, in model 1, 2, and 3 all the variables were found statistically significant using t- test ($p<0.05$). But in Model 3, which includes 3 variables (height of cg, trunk flexibility and distance of jump), will predict velocity with an R square of 0.969, i.e 96.9% of variation in velocity can be explained by the variables height of cg, trunk flexibility and distance of jump than that of Model 1 (R square of 0.769, i.e 76.9%) and Model 2(R square of 0.924, i.e 92.4%**)**.

Discussion of Findings

The model 3 ie; velocity = 16.094 + 6.041 x height of cg – 11.808 x trunk flexibility + 1.007 x distance of jump was selected as the best model to predict the velocity of jump serve of national level youth male volleyball players. Here velocity has a positive relationship with height of cg and distance of jump and negative relationship with trunk flexibility. Chenfu Huang and Lin-Huan Hu (2003) studied the difference between serve speed of Jump Serve and Float Serve. The results showed that the jump topspin serve had greater values than the jump float serve on ball velocity, velocities at takeoff, jump height, spike height, takeoff to service line distance, and horizontal displacement from takeoff to ball contact. They also reported that the higher the ball contact the greater the success of ball contact. The regression models constructed to predict the velocity of youth male volleyball players reported that the velocity of jump serve can be significantly predicted using the height of the cg (the height which the centre of gravity was raised from the ground level at the time of ball contact), distance of jump (the horizontal displacement of the server from the point of takeoff to the point of landing), and trunk flexibility. These variables along with its coefficients were found to be significant to predict the velocity of jump serve of national level youth male volleyball players. As reported by Chenfu Huang and Lin-Huan Hu (2003) the topspin server jumps higher and forward for increasing the ball velocity. The regression model constructed in the present study showed evidence for the positive relationship between height of cg and distance of jump with the velocity of jump serve of national level youth male volleyball players. The most essential variable, which is closely associated with the velocity of jump serve was the position of the ball and the centre of gravity at the time of ball contact (M. Hayrinen, 2007).

Conclusions

1. Based on the best model to predict the velocity of jump serve of national level youth male volleyball players, the height of cg, distance of jump and trunk flexibility have a large effect in predicting the velocity of jump serve of national level youth male volleyball players.

2. Velocity of jump serve of national level youth male volleyball players has a positive relationship with height of cg and distance of jump and negative relationship with trunk flexibility.

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