

Comparative analytical study of the approach stage to perform the spike skill of the volleyball game and its relationship to accuracy

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Abstract

The skill of spike is accurate as the jump is faster, higher, and more convenient. This result cannot be obtained unless the player adjusts the starting steps and preparing to jump. The kinetic momentum that the player receives as a result of the starting steps (moves) is equal to the kinetic impulse of the player according to the law kinetic momentum. As we see during the game. Part of the player perform the skill of spike with one step than jump and there are some players perform the spike with two or three steps depending on the distance and the height of the ball. The aim of the research is to compare between the first step, second and third steps of the Approach stage in some biomechanical variables in the performance of the skill of spike, Ten players representing the university's volleyball team were selected, The researcher used the coefficient of variation of the physical variables range between (6.2 - 8.8%), The analysis was performed by means of a special device (jump mat) number (2) with dimensions (50 x 110 cm) The device measures the kinetic variables during the performance directly by connecting the device with the computer using a cable. The researcher reached several conclusions: The speed of the player during the last touch of the ground and jump produces a large explosive force and finally the distance of the jump is bigger. And the sports which are performed by beatings are less accurate compared to the ones performed with throwing.

Keywords: Distance, Explosive force, Kinetic momentum, Biomechanics

Introduction

We all know that the volleyball game is one of the most popular games in the world as volleyball has more than 500 million registered players around the world (PLAWINSKI, 2008). The globally high level of performance in the volleyball game has developed remarkably in some countries, which have not been developed in the past few years at this high level, making great achievements, and sent to the specialized staff of the game to study the reasons that push to this level of development the game. The volleyball game depends fundamentally on some basic skills. The spike is at fore front of them. with all its kinds. the biomechanics literature has shown that the hitter will use the approach to achieve a high jump with minimal horizontal motion the 'backswing' or 'preparatory' phase and the 'forward swing' or 'hitting' phase (Oka, 1975) (Prsala, 1982) (Chung, 1990) (Coleman, 1993) (Maxwell, 1981), Where it is considered the spike is the decisive in determining the win and get points scored by the winning team, It is worth mentioning that all the basic volleyball skills must be built and ends by spike. which all skills are set up to build an offensive to get a winning point, and that the successful attack reflected positively on the level of morale among all players in the team and increases their self-confidence. As global statistics indicate that 80%, " of the Points of the match are through the attack skills. The most important of these skills is the strike attack, and the percentage of repeat performance of attack strikes in all skills during play is 87.97%, and it is the highest percentage of performance, with its positive impact rate of 60.61%. It is the highest positive impact on the rest of the skills in the men's world championship (2002). "(FIVB, 2017), Increasing the effectiveness of offensive strikes has given rise to attention to the development of defence plans in its different formations. (Pedro, 2001), It is a skill that requires a combination of timing, balance, muscular strength, speed of motion and without the right mechanics, all of which is a wasted effort (Sondorafi, 1996), The first key to the skill of the spike is the approaching stage because after this stage is directly jump, and approach, is the means by which the attacker earns speed on the ground before jumping. This speed is translated to start jumping high because in relation to that stage is an approaching process that is of importance to give the volleyball player maximum momentum for the height of the vertical jump in the advancement stage (Hughes,

2014). This is a horizontal force that is transferred to a vertical force. Thus, this approaching is a decisive in volleyball success in real aspect. Timing the hit takes practice. The approach should be delayed long enough so that the hitter is able to generate a great deal of speed and power which will generate an explosive jump. This allows the hitter to reach the ball at the peak of the jump and contact the ball at the highest possible point. (Dunphy, 1991) the biomechanics literature has shown that the hitter will use the approach to achieve a high jump with minimal horizontal motion. (Prsala, 1982), The higher rise in the jump depends on the larger horizontal velocity in the approaching run. The previous evidence has further shown that the hitter should maximize horizontal velocity at touch-down and minimize it at take-off (Dusault, 1986). And through the follow-up of the researcher of the game there are players performing the stage of approaching with three steps and there is one step or two steps. The importance of research lies in the following questions: Is the performance of the approach phase affect the biomechanical variables during the performance of the skill of spike? Does one-step jump preparation affect the biomechanical variables skill of spike? or two- or three-step jump preparator? Are there differences in terms of biomechanical variables between preparing to jump in one step, two steps and three steps? Are these variables measured kinematic have a relationship between them and the accuracy of the beating? Thus, the problem of research in the analysis of the biomechanical variables of the skill of spike according to the steps of jumping and comparing the biomechanical variables among them at volleyball players.

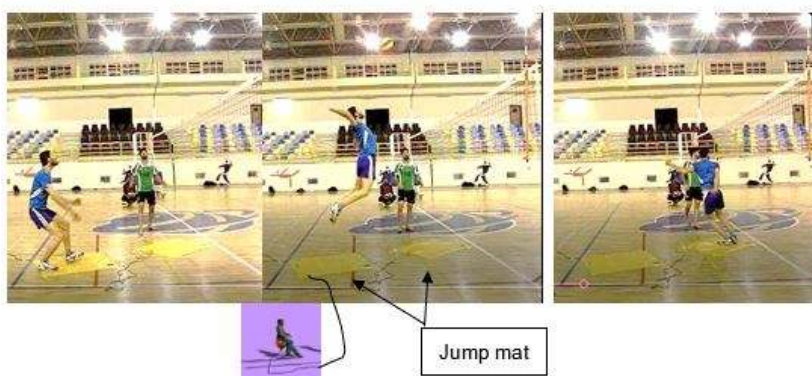
Research methods and materials

Data Analysis

The research community consists of (12) players who represent the team of Koya Volleyball University, for the academic year 2017-2018. (10) players were chosen who can perform the skill of spike in a deliberate manner, the research sample represents (83.33%) of the research community, for the sake of homogeneity, the researcher used the coefficient of variation of the physical variables, ranging between (2.6 - 8.8%), This means homogeneity of the sample. Each player has played for at least four years, and all the players use their right hand. The average age of the sample was 22.70 years, body mass 69.80 kg, body height 185.40 cm and arm length 76.00 cm.

Procedures

The results of the analysis were obtained by means of a special device (Jump mat), type (Axou), number (2) with dimensions (50 x 110 cm) Measures the kinematic variables directly during performance Where by means of a cable connecting the device to the computer the (Axou) programme should be installed on the computer. All attempts were chosen in order for the analysis to be more precise and to ensure the scientific fact of Each player in the approaching stage to perform the skill of spike. The test inside the volleyball court where each



player (6 bid) two attempts for each stage according to the steps of performance. Form(1)
Figure (1) shows the jumping mat during the performance of the spike in the volleyball

Test Used in the Research (Hamdi, 1997)

Purpose of the test: Measure the accuracy of the spikeskill In the inner triangle of the opponent's stadium. The stadium is divided into two halves (half of the pitch opposite) and then divides the inner triangle (the grid side) Into three regions each display area 3.

Performance: After the preparation, the teste performs the skill of the spike towards the inner triangle of the network.

the conditions:

Each teste six attempts, two for each center of the front line of the stadium.

Scores are calculated according to where the ball falls. Form (2)

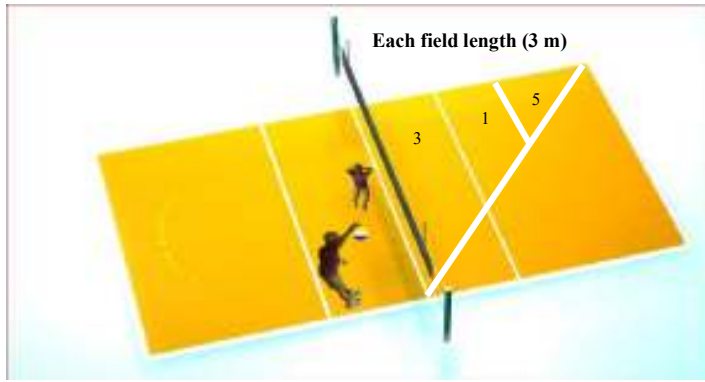


Figure (2) shows the accuracy test of the crushing skill of spike skill in the volleyball

Kinematic variables:

The researcher selects the variables that the device has a direct jump mat to measure it as follows:

- Distance of the vertical jump of the centre of the body mass in centimetre’s during the performance of the skill of spike.
- Speed starting player (m /s) during the performance of the spikeskill.
- Time of performance from the moment of jumping to perform the skill of spike until descent and first touch the ground.
- Peak power: The maximum power variable has been extracted according to the Harman equation:
 $Peak\ power\ (W) = 61.9 \times VJ\ (cm) + 36.0 \times mass\ (kg) + 1822$ (Harman, 1991)

Statistical Means

The researcher used the statistical SPSS version 18 for data processing

Result

Table (1) Shows the mean and standard deviations the value of the variance analysis (F) and the probability of spikeskill in the volleyball

Sequence	Variables	Measuring unit	One Step		Two Steps		Three Steps		ANOVA	Sig (p-Value)
			Stability scoring							
			Maen	S.D	Maen	S.D	Maen	S.D		
1	Movement time	a second	0.577	0.031	0.646	0.055	0.672	0.041	12.175	0.000
2	Cruising speed	M /s	2.873	0.221	3.223	0.303	3.331	0.160	10.292	0.000
3	Jump distance	cm	41.010	4.404	51.550	9.252	55.480	6.968	10.937	0.000
4	Peak power	Watt	6891.31	406.191	7543.7	712.573	7787.01	591.342	6.294	0.006

*. The mean difference is significant at the 0.05 level.

Table (2) shows the significance of the differences between (one step, two steps and three steps) using the (Scheffe) equation for the variables of the movement time, the starting speed, the jumping distance and the Peak power

Sequance	Variables	Data	One Step		Two Steps		Three Steps	
			Average	Sig	Average	Sig	Average	Sig
1	Movement time	One Step						
		Two	-0.0688*	0.007				
		Three	-0.0945*	0.000	-0.0257	0.442		
2	Starting speed	One Step						
		Two	-0.3500*	0.010				
		Three	-0.4580*	0.001	-0.1080	0.598		
3	Jumping distance	One Step						
		Two	-10.5400*	0.001				
		Three	-14.4700*	0.000	-3.9300	0.480		
4	Peak power	One Step						
		Two	-652.4260	0.060				
		Three	-895.6930*	0.008	-243.2670	0.652		



Figure 3 Shows the graph of the search variable

Table (3) shows the correlation matrix between some biomechanical variables and accuracy and the same biomechanical variables between themselves when performing the spike skill in one step.

Sequence	Variables	Movement time	Starting speed	Jumping distance	Peak power	Accuracy
1	Movement time					
	Sig.(2-tailed)					
2	Starting speed	0.975**				
	Sig.(2-tailed)	0.000				
3	Jumping distance	0.999**	.976**			
	Sig.(2-tailed)	0.000	0.000			
4	Peak power	0.747*	0.697*	0.746*		
	Sig.(2-tailed)	0.013	0.025	0.013		
5	Accuracy	0.366	0.340	0.360	0.443	
	Sig.(2-tailed)	0.298	0.337	0.307	0.200	

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Table (4) shows the correlation matrix between some biomechanical variables and accuracy and the same biomechanical variables between themselves when performing the spike skill in two steps

Sequence	Variables	Movement time	Starting speed	Jumping distance	Peak power	Accuracy
1	Movement time					
	Sig.(2-tailed)					
2	Starting speed	0.829**				
	Sig.(2-tailed)	0.003				
3	Jumping distance	0.999**	0.825**			
	Sig.(2-tailed)	0.000	0.003			
4	Peak power	0.940**	.745*	0.933**		
	Sig.(2-tailed)	0.000	0.013	0.000		
5	Accuracy	-0.339	-0.547	-0.339	-0.381	
	Sig.(2-tailed)	0.337	0.102	0.338	0.277	

Table (5) shows the correlation matrix between some biomechanical variables and accuracy and the same biomechanical variables between themselves when performing the spike skill in Three Steps

Sequence	Variables	Movement time	Starting speed	Jumping distance	Peak power	Accuracy
1	Movement time					
	Sig.(2-tailed)					
2	Starting speed	0.944**				
	Sig.(2-tailed)	0.000				
3	Jumping distance	1.000**	0.946**			
	Sig.(2-tailed)	0.000	0.000			
4	Peak power	0.907**	0.829**	0.905**		
	Sig.(2-tailed)	0.000	0.003	0.000		
5	Accuracy	-0.351	-0.325	-0.342	-0.208	
	Sig.(2-tailed)	0.319	0.360	0.334	0.565	

Discussion

When following Table (2 and 3) and through the application of the analysis of law of variance to compare the steps of the approach of the skill of spike in the volleyball. The research variables are Movement of time, starting speed, jumping distance, Peak power, in general there were significant differences between one step and two steps and three steps during the performance of the skill of spike volleyball. and there was no difference between two steps and three steps. It is noticeable when returning to the computational medium to find out the difference in favor of any step of approach. It is noted that when we return to the computational medium to find out the difference in favor of any step of approach, the result is that the three-step variables (Starting speed and Peak power) were larger with a mean value of (3.331) (7787.012) respectively. The researcher attributed the reason for this difference between the steps of the approach of the skill of spike to the performance of this skill as it needs to force and speed at the same time, i.e. explosive power according to the law ($\text{power} = \text{strength} \times \text{speed}$). And the performing the skill in the least time if it is possible so that the vertical Component will overcome the horizontal Component, which led to increased jumping distance. Therefore, during the exercises, it is necessary to make sure that the beating skill of the approaching stage is performed in three steps to produce explosive power. The American College of Sports Medicine confirms that the definition of "An explosive exercise can be defined as the movements of the rate of development of the force being maximal or near to the maximum for a particular type of muscle movement for example (isometric, eccentric, isokinetic)" (ACSM, n.d.) And through this result we reach that the performance of the skill of spike in the volleyball in three steps produces a faster starting speed and it is normal whenever the strength of the muscles of the legs is great, the speed of starting increases. And these can be obtained while performing skill of spike three steps. When there was an increase in Cruising speed of starting during jumping the means there was a greater momentum of the body of the player due to performing it in three steps and we didn't find this result when performance of the skill of spike one step. "In relation to this the preparation phase which includes a running approach that is important to give the volleyball player maximum momentum for the height of the vertical jump in the takeoff phase (Kessel, 2013). The muscles of the legs produce the maximum explosive power and the least time in the approaching stage while performing the skill of spike in three steps. and an explosive word refers to the ability to exercise force as soon as possible in a particular action. Because the force is "muscle tension or a group of muscles can exercise against the resistance in maximum effort and for one time" (Foss, 1998). This means the use of force against gravity when jumping to perform the skill of spike. and can only be obtained by combining the strength and high speed, which we mentioned earlier according to the law of power. Because power is "Measuring the possibility of exercising force at high speed or more accurately means the output of force exerted on the body and the speed of the body in the direction of the force exerted" (Baechle, 1994).

Also, when viewing tables (3,4,5), we see a strong relationship between the biomechanical variables in general. and this is one of the scientific principles. The time thrust is the first key to increase the speed of jumping and the last explosive power of the legs. Controlling the technique of the Steps of approaching is one of the important things and if it is one step. And this in turn increases the distance between the body of the player and the ball during the performance of the skill of spike. and thus the player increases the increase of pulling the hitting arm and increases the acceleration of the hitting arm". Numerous studies have shown that arm swing has a significant influence on jump height " (Lees, 2004) . These studies indicated that the arm increases the angular speed and torque at the lower limb joints, and the height of the center of gravity, and the speed at the start of the counter jump. in addition to that, Hsieh and Heise (2006), found that the hitting arm was one of the most important factors which contributed to volleyball. This process assists the arm to store and release the energy from the muscle and tendon at lower extremities (Hsieh, 2006), This can only be achieved by increasing the explosive power of the legs where ($\text{power} = \text{power} \times \text{velocity}$), since ($\text{force} = \text{mass} \times \text{acceleration}$). Therefore, time has its effect and has an inverse relationship to the change in speed according to the law of acceleration, because Newton's first law states that "An object will remain at rest or continue to move with constant velocity as long as the net force equals zero" (Bazevich, 2010). In relation to this the preparation phase includes a running approach that is important to give the volleyball player maximum momentum for the height of the vertical jump in the takeoff phase (Kessel, 2013). This is due to the concepts of kinetic energy and potential, "The goal is to transfer this kinetic energy into potential energy in preparation for the jump. If it comes to a stop the kinetic energy will be less, therefore, preventing jumping as high. Since potential energy is the product of the mass of the player, gravity, and the height of the jump, the height is what determines how much potential energy can be attained" (Bazevich, 2010). At the same table, we see that there is no correlation between the biomechanics and accuracy variables. The researcher attributes this one correlation to the fact that the kinetic is closely related to the mental processes as during the performance of any skill stimulates a specific muscle group that works on a particular joint to form the right angle for its performance. So, the variables of the angles of the body is determine the direction of the ball especially the wrist joint. as found in a study on analysis of the volleyball "set shot found a pushing pattern, with players put their arms behind the ball to "push" in the direction of the ball trajectory, causing the ball to follow a more vertical arc, which was associated with greater accuracy" (Portus, 2011) (Tant, 1993) This shows that the skills, whose performance is throwing or pushing, are more accurate, compared to the beating skills (touch only). In the closed skills, greater mastery of performance Such as (tennis, table tennis, badminton, etc.), (Antunez, 2012).

Conclusions

- 1-During the performance of the skill of spikethe player must take a good preparatory situation as the approach is not less than two steps.
- 2-The speed of the player during the last touch of the ground and jump produces a large explosive force and the latter a greater jump distance.
- 3-Direct measurement during performance produces more accurate results than indirect measurement.
- 4-There is no difference between jumping two steps and three steps but produces almost the same strength.
- 5-necessity to exercise in accordance with the skill technique of body weight against gravity in the volleyball.
- 6-Biomechanical study variables do not have A relationship with accuracy spikein the volleyball.
- 7-Variables (Movement time, starting speed and Jumping distance) during the performance of the crushing skill have a strong relationship to the explosive power of the legs in the volleyball.

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