THE RELATIONSHIP BETWEEN SOME BIO KINEMATIC VARIABLES AND STRENGTH FUNCTION-TIME OF JUMP SERVE IN VOLLEYBALL

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Abstract

The study aims at identifying the relationship between some bio-kinematic variable and strength function-time of jump serve in volleyball. The research sample was selected and 10 male right-handed volleyball players of Erbil club who had average to excellent level of jump serve participated in the study. The average mean and standard deviation of the players for height, weight and age were found to be 188.1cm ± 6.48 cm,78kg ± 9.29 kg and 24± 4.86(years), respectively. Kinematic and kinetic were measured for collision, absorption, pushing. Both anticipatory and directional effects were seen for many of the variables including angle of right knee, angle of right shoulder, angle of right hip, time, and height of C.G. The kinematic data were recorded by using Sony camera and analyzed by skill Spector V 1.3. This study utilizes quantitative approach in finding the relation between some kinematic variables and strength function-time of jump serve in volleyball. Also, the research uses descriptive statistics such as mean and Standard deviations to determine the responsiveness of the variables to a change in either a situation or strategy. In statistics, correlation r measures the force and direction of a linear relationship between two variables and SPSS version 20 was used for this. The current study revealed that only # variables include relation between kinematic variables for jump serve with minimum force variable on the platform of volleyball players, this includes significant difference r=-0.69, p≤0.02 for angle of right hip at the moment of push with less force on platform, r=-0.65, p≤0.03 for angle of tendency with a vertical line, r= 0.64, between the angle of right of knee in the collision stage with foul touch time on platform, r= -0.64, p≤0.04for. Thus, the remaining variables show insignificant relation thereby rejecting the hypothesis.

Keywords: Volleyball. Jump serve. Kinematic. Strength function-time. Variable.

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Introduction

The access to the upper levels of the important things that require knowledge of the most important mechanical variables that contributes to the perfection skills as well as on movement performance of less effort. To establish the correct methods that help to overcome the mistakes and address weaknesses, And evaluating the training curriculum according to scientific basis based on mechanical analysis organized and scheduled, For the purpose of performance analysis and evaluate it to help the coach to get the player to the upper levels (Susan, 1995).As well as to study and clarify and analyze spiker movements will contribute to arriving at the best technique, The study of the mechanical properties gives us a clear perception of the existence of the differences in kinetic possibilities among players, and volleyball skills requires from the player in multiple kinds, whether offensive or defensive skills, that the performance is high speed and high accurate (Sandor, 1997) And that require the player to achieve harmony by force as a result of the movement of the various parts of the body within a body mass, which generates totality what is called instantaneous force at jumping which means the process of movement transfer from the ground and legs to the arms (Jawad, 1997).

And the researcher may choose the appropriate method of analysis of the movement and effectiveness to be analyzed and that are appropriate to the nature of work, and at the present time modern scientific instruments been used to help describe the movement and carefully analyzing, detecting all the factors that go into that analysis." The best use of devices that give a thorough analysis of the movement in the kinetic analysis is a fast computer.

The close relationship between achieving bio-kinematic conditions and the performance of jump serve skill rely basically on the variables of the corners of the joints of the body, especially that rely on the kinetic path for the center of the weight of body mass and maintain a balance and kinetic transport from the ground to the moment of contact with the ball and strike it, as well as rising to the highest point through movement of the top forward and get a good curvature of the trunk towards the movement.

From here lies the importance of research in the study and analysis of jump serve movement through dividing them into several stages, and the analysis of some bio-kinematic variables caused by the body for each stage of the jump serve movement from the moment of preparing for transmission and taking steps and then push from the earth and upgrading and to the moment of the strike and end of the movement as well as determine the explosive force obtained by the player through upgrading to a the highest point closely with the dynamics third law for each action there is a reaction equals in value and opposite of its direction.

The importance of the platform strength lies on the study of the amount of explosive force obtained from the use of force and time measuring platform to get to know the momentum of the various stages values (collision and absorption and then pushing) and this in turn will give the role of extreme importance for the coach to know his capabilities and abilities and thus control the jump serve movement successfully when the study of variables are positive and good and therefore serve the main movement which is jump serve successfully and achieve points against the opposing team, and at the same time giving the momentum and the confidence to the player to continue to improve this type of transmission. Such as this study may be helpful for volleyball coaches to realize how they could analyze the jump serve and its levels. In addition, this study may help volleyball players to improve the requirements of their jump serve.

Statement of research problem

The skill of jump serve is one of the basic offensive skills that plays a crucial role in the outcome of the game, the researcher noticed and through following up to many of the games that most players of clubs in the Iraqi League and in Kurdistan specifically, after their performance of jump serve, weakness of the ability to continue playing to defend the stadium or to participate in the attack from the second line, which means that most of the players consume a significant amount of force for the purpose of performing this serve, meaning that the performance skills they have are not economical, the researcher believes that the reason for this could be due to lack of players ability to create a consensus bio-kinematic through the correct binding between the force and apparent change required for the skill, such as achieving good curvature for the purpose of obtaining the determination of the force required. The researcher finds it difficult to locate unless examine the relationship between the strength indicators and kinematic variables to perform jump serve skill, like the speed to hit the ball or coincided maximum height with the correct kinetic path of the arm strike.

The researcher felt to study the skill of jump serve in bio-kinematic and bio-mechanic aspects to get to know the amount of explosive force that the player put on the ground, and raise up and implement the serve measured by the platform of force-time, because through this platform the period of contact with the ground as well as the maximum force when pushing can be estimated.

Hypotheses

The research hypotheses (H1) of the study states that there is correlation with a statistical indication p≤0.05 between kinematic variables and strength functions-time during the execution of the jump serve in volleyball. This includes:

1. There is correlation between Kinematic variables for jump serve

stages with minimum force variable on platform of volleyball players.

2. There is correlation between Kinematic variables for jump serve stages with push force time on platform of volleyball players.

3. There is correlation between Kinematic variables for jump serve stages with pushing force on platform of volleyball players.

Objective of the study

1. Identify the values of certain bio-kinematic variables of jump serve skill performance of Volleyball player.

2. Identify the values of some forms of schedule force function, specifically the explosive force of the stages of the movement during the push and upgrade of the volleyball players

3. Find a relationship between some bio-kinematic variables and the strength function-time during the push movement to the jump serve of Volleyball.

Methodology

Research design

This section will give details on the research approach and how the data is collected and analyzed.

Research approach

This study utilizes quantitative approach in finding the relation between some kinematic variables and strength function-time of jump serve in volleyball.

The questionnaire

Three different questionnaires that answer questions on the appropriate and performance of volleyball serve; second questionnaire is about the appropriate bio kinematic variables to be used in the study and the third questionnaire is about the variables for strength function-time.

Selection of the research area and unit

In the following sub-section, the research area and the participants in the survey will be presented.

Study population: The study population included 18 volleyball players from Erbil club and the time period is 2015-2016 season.

Description and selection of the research units: The subjects that take part in this study were selected based on some given criteria. These include players that are right-handed, male players and age of between 18 to 32 years.

Sample size: Planning in any research requires a number of sampling size needed in the research. This sample size will depend on the aims, scope and nature of the research and on the expected result (Lwanha et. al, 1991). However, the sample size of this study was chosen to be 10 right-handed male volleyball players.

Materials and Methods

10 male volleyball players of Erbil club who had average to excellent level of jump serve participated in the study. All of them were healthy and had no history of serious injuries at least 3 months prior to data collection. All the subjects were informed about the purposes, procedure and important of the study. The anthropometric data were measured as shown in table 1. A video camera (Sony camera), the first camera is located at 7.65m left and 1.5m height of the force platform, the second camera is located right side of the platform at a distance of 7.65m and 1.5m height, the third camera was placed at the front of the platform at a distance of 8.34m and 1.5m height to capture the motion of the players. Five successful trials were recorded for each player and the results are as shown in table 1. Kinematic and kinetic data were examined and analyzed using skill Spector V.1.3 the selected kinematic variables were collision variables, absorption variable, pushing variables. The statistical analysis was conducted with SPSS version 20 (Table 1).

Data Collection Instrument

Three different questionnaires that answer questions on the appropriate and performance of volleyball serve; second questionnaire is about the appropriate bio kinematic variables to be used in the study and the third questionnaire is about the variables for strength function-time.

Test for jump serve skill in Volleyball was done by drafting questionnaire with two different tests. 10 experts in the field of volleyball were administered the questionnaire and all the 10 respondents choose the first test. Thus, first test received 100 percent approval, the nature and procedure of the test is presented in the appendix page of this study identify bio-kinematic variables in Volleyball was validated by administering questionnaires to 8 different

Table 1: Anthropometric data of the subjects (volleyball players).

s/n	Height/cm	Mass/Kg	Age/Years
1	197	86	20
2	180	63	19
3	187	80	22
4	190	90	25
5	192	92	25
6	190	70	19
7	180	72	26
8	198	73	21
9	185	80	32
10	182	74	32
$\bar{x}$ SD Coefficient of Variance	188.1	78	24.1
	6.48	9.297	4.863
	3.4	11.91	20.1

Table 2: Mean and standard deviation of kinematic variables.

Stages	n	Variables	$\bar{x}$	Sd
Collision	1	Angle of Right Knee (deg)	174.79	9.88
	2	Angle of Right Shoulder (deg)	77.43	21.25
	3	Angle of Right Hip (deg)	135.19	12.6
	4	The height of C. G (cm)	103.92	11.63
Absorption	7	Angle of Right Knee (deg)	125.34	11.33
	8	Angle of Right Shoulder (deg)	27.09	2.78
	9	Angle of Right Hip (deg)	119.25	11.31
	10	The height of C. G (cm)	95.58	8.54
	11	Angle of Left Hip (deg)	130.74	16.48
Pushing	13	Angle of Tendency (deg)	2.45	.99
	14	Angle of Tendency for hip C.G with Horizon (deg)	89.420	1.86
	15	Right Shoulder with Horizon (deg)	130.48	12.52
	16	Angle of Right Knee (degree)	141.02	10.11
	17	Angle of Right Shoulder (deg)	172.91	8.09
	18	Angle of Right Hip (deg)	194.98	12.69
	19	The height of C. G (cm)	141.98	17.87

experts in the field of volleyball, # variables that relate to bio-kinematics were presented and the responded selected some variables that fit the current study and also categorize these variables into jumping stage (collision, absorption, pushing) stage.

The anthropometric data of the players

As shown in table 2 above, the anthropometric data of the players, the mean score of their ages was found to be 24 years; the mean weight is 78kg and the mean height is 188cm. Thus, the above 10 subjects volunteered to participate in the experiment (Table 2).

Research test

Test the accuracy of jump serve for research's sample, and the purpose is to measure the accurate of the test and the tools used are: Volleyball court, Volleyball balls (10), Volleyball net as well as columns, stick tape to determine squares on playground

Force measurement platform: A measurement platform of earth reaction force has been built (0.8m X 1.2m) which reflects the hanging force on the device provided with a computer, works with (AC – DC) force (220 Volt), the platform transmits the electric indicators to the computer throw number of (Strain gauges), the gauges start to work at the moment the center foot touches the external board, it stops reading data the moment of athlete's launching at the end of throwing. As for platforms ingredients as shown in figure (Figure 1).

This is for the way of knowing the amount of the variables of measuring platform of earth's reaction which are recorded on (Excel), page (Sheet 1). And for the of getting and knowing the shape of the curve chart, just click on (chart 1) at the bottom of the Excel, the curve chart will come out and for any recorded movement on the platform. See figure (Figure 2).

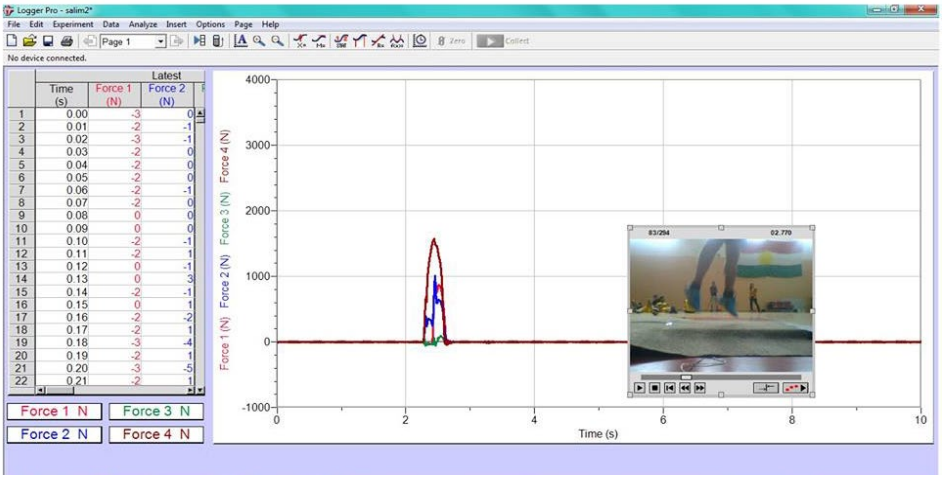

Figure 1: X coordination (Time) and Y coordination (the amount of recorded earth's reaction) as shown in computer.

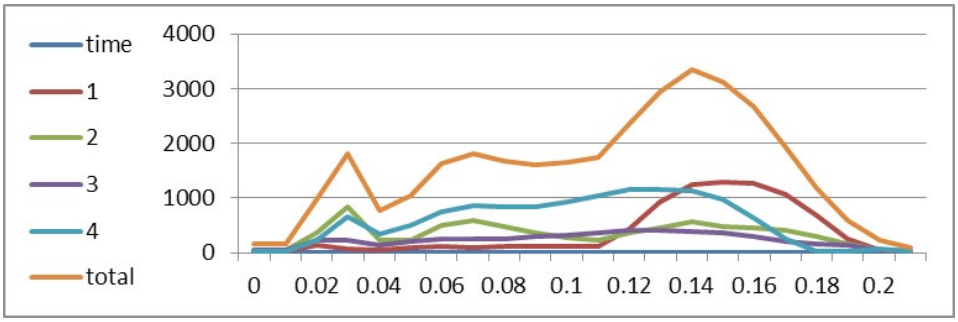

Figure 2: Shows the chart curve of force-time module, and the system of weighing for one member from the sample as shown in (Excel 2007).

Scientific technique observation

To achieve the scientific observation, the researcher has used the following:

Three video recorders have been used, type (Sony) with (480) frames per second, and the results were:

1. First camera: the distance from the force platform on the left 7.65m and 1,5m height.

2. Second camera: from right side of platform the distance was 7.65m and 1.5m height.

3. Third camera: 8.34m to the front of the platform and 1.5m height.

The figure 3 shows the location of distance and height of the video recorder during the main experiment of the research (Figure 3).

The video record has been done for explosive strength on the force platform at the same time to measure the power of reaction at once to all the five attempts for each player the best attempt was chosen.

Pilot study

The first exploratory experiment was done in May 23th 2016 at exactly 10am in Duhok University's stadium, on two players from the university's team.

Main Experiment

The researcher has made the main experiment in an internal basement of college of physical education/DUH, on May 25th 2016 at 12.00 pm.. Three recording cameras have been prepared, as shown in figure (Figure 4).

The stage of jump serves in Volleyball

The video has been recorded with saving the amount of explosive force on the force of center reacting measurement platform in the same time, as shown in figure 5 for Collision, Absorption, and Pushing (Figure 5).

Method of extraction of kinematic variables

The researcher extracted the variables of kinematic depending on program (MAX TRAQ) to find out the levels and values of the following variables:

Figure 3: Location of the video recorders and height during the main experiment of the research**.**

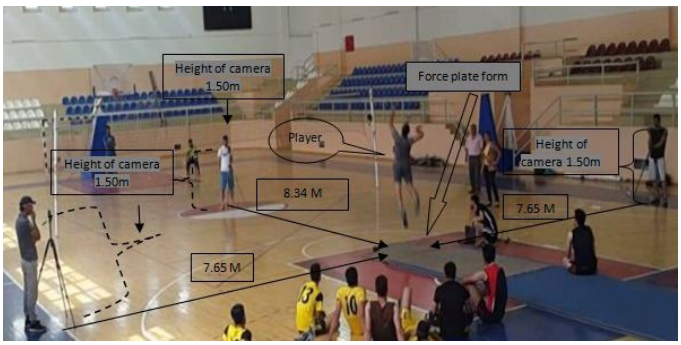

Figure 4: Field position of research main experiment.

Collision Phase

Angle of right knee: is the limited angle between the thigh and the right leg, when the player takes a second step of jump serve, and where the right leg is in the front and the left leg in the back where the right foot hits the platform.

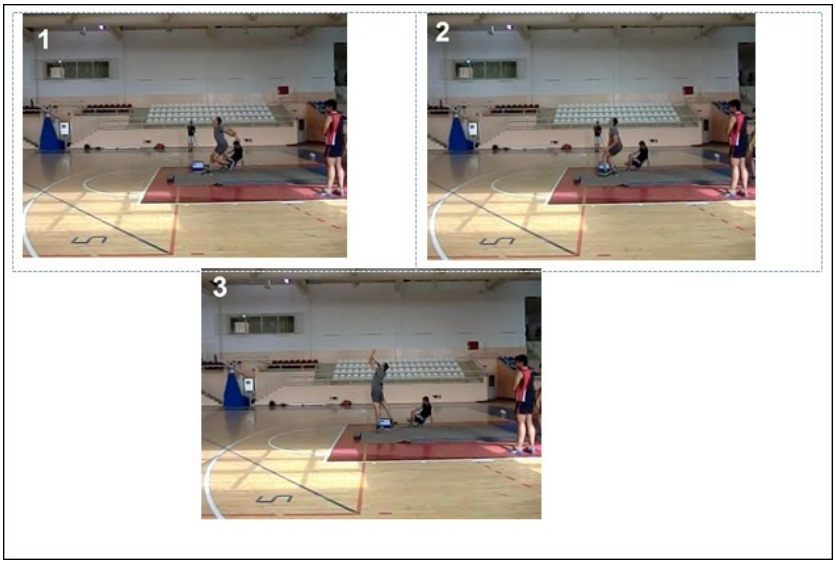

Figure 5: The sequence of player jump serves on the platform from left side.

Angle of right shoulder: is the limited angle between the arm and forearm of the right arm, when the player takes a second step of jump serve, and where the right leg is in the front and the left leg in the back where the right foot hits the platform.

Angle of right hip: is the limited angle between the right thigh and the right trunk, when the player takes a second step of jump serve, and where the right leg is in the front and the left leg in the back where the right foot hits the platform.

The height of C.G.: it is measured height between centre of gravity and ground in vertical way, when the player takes a second step of jump serve, and where the right leg is in the front and the left leg in the back where the right foot hits the platform.

Absorption Phase

Angle of right knee: it is the limited angle between thigh and leg of the right leg, when the player is in second step and the middle part of it, in which the player tilts his body down to save potential energy to get ready to jump.

Angle of right shoulder: it is the limited angle between upper arm and hand of the right arm, when the player is in second step and the middle part of it, in which the player tilts his body down to save potential energy to get ready to jump.

Angle of right hip: it is the limited angle between right leg and right trunk, when the player is in second step and the middle part of it, in which the player tilts his body down to save potential energy to get ready to jump.

The height of C.G.: it is the measured height between player center of gravity and ground in vertical way, when the player is in second step and the middle part of it, in which the player tilts his body down to save potential energy to get ready to jump.

Angle of left hip: it is the limited angle between left leg and trunk, when the player is in second step and the middle part of it, in which the player tilts his body down to save potential energy to get ready to jump.

Pushing Phase

Angle of tendency: It is the limited angle between vertical lines of middle of the trunk with vertical line from center of gravity in a straight way, when the player is in the last part of the stage of the second step when all the joints are stretched up.

Angle of tendency for trunk C.G. with horizon: it is the limited angle between center lines of trunk horizontal line stretched from center of gravity in parallel with the ground, when the player is in the last part of the stage of the second step when all the joints are stretched up.

Angle of right shoulder from forward: it is the limited angle between arm and hand of the right arm, when the player is in the last part of the stage of the second step when all the joints are stretched up.

Angle of right shoulder: it is the limited angle between arm and hand of right arm, when the player is in the last part of the stage of the second step when all the joints are stretched up.

Angle of right knee: it is the limited angle between thigh and leg of right leg, when the player is in the last part of the stage of the second step when all the joints are stretched up.

Angle of right hip: it is the limited angle between right thigh and right trunk, when the player is in the last part of the stage of the second step when all the joints are stretched up.

The height of C.G.: it is the measured height between player center of gravity and ground in vertical way, when the player is in the last part of the stage of the second step when all the joints are stretched up.

Synchronization between force platform device and recording cameras

Synchronization between three cameras and force measurement platform has been done, beginning from the moment of touching, as the platform shows the moment of touching for the first height of force-time function curve, also a videotaping device specified to force measurement platform device was connected to a computer by universal serial bus, as it shows on the programs screen the moment of touching by video and the curve of force-time function in addition to digital values that climb every time touching happens on the left side of the screen of the program (logger pro), in sort of data tables shows contents of force and time.

Scaling tool

Scaling tool utilizes Scale bars providing a visual indication of the size of features, and distance between features, on an image. Scale bar in general is a line or bar divided into parts. It is labeled with its ground length, usually in multiples of image units. When capturing an image, it appears less than its actual size. So, it should be modified by using the following formula (Omer, 2013) (Mushin, 2008).

MAXTRAQ scaling tool

Analyzing motion does not need to be expensive or hard to use. MaxTRAQ 3D is a flexible solution for your budget.

The researcher has used the statistical program (SPSS), which depends the following role: Mean, Standard Division, Simple correlation (person).

Results

In this chapter, the required information that answers the research questions is discussed. Mean, standard deviation, Pearson correlation measures that is a linear correlation between two variables x and y was used to measure the correlation between kinematic variables for jump serve stages with collision force variable on platform for volleyball players, The relationship of selected kinematic variables with force function-time of jump serve in volleyball was calculated by using Pearson's product moment correlation and for testing the hypothesis level of significance at $p \leq 0.05$.

Mean and standard deviation analysis

Standard deviation is defined as a measure of the dispersion of a set of data from its mean. If the data points are further from the mean, there is higher deviation within the data set. Thus, the standard deviation for the kinematic variables and strength function time is presented.

Pearson correlation analysis

Correlation analysis was carried out to know the degree of association and relationship between kinematic variables and the strengths function-time variables. In statistics, correlation r measures the strength and direction of a linear relationship between two variables. Pearson's Product moment correlation was used to find out the relationship of selected kinematics variables and strength function-time of jump serve in volleyball. The level of significance in order to check the relationship was set at $p \leq 0.05$.

The score of each kinematic variable were correlated strength function-time of jump serve in volleyball. In order to ascertain the relationship of selected biomechanical variables namely angle of right knee, angle of right shoulder, height of center of gravity etc. with the strength function-time of jump serve in volleyball, the Pearson's correlation was calculated. The values of co-efficient of correlations are presented in tables (Tables 3-6).

Table 3: Mean and standard deviation of force function-time.

n	Variables	x̄	Sd
	Minimum force(N)	804.60	176.76
	force of pushing (N)	2780.18	338.22
	The time of pushing force (sec)	0.20	0.03

Table 4: Correlation between Kinematic variables for jump serves stage with minimum force variable on platform of volleyball players.

Stages	n	Variables	r	p
Collision	1	Angle of Right Knee	.41	.24
	2	Angle of Right Shoulder	.29	.40
	3	Angle of Right Hip	.37	.28
	4	The height of C. G	.14	.69
Absorption	7	Angle of Right Knee	-.61	.06
	8	Angle of Right Shoulder	-.39	.26
	9	Angle of Right Hip	-.55	.09
	10	The height of C. G	.22	.52
	11	Angle of Left Hip	-.17	.63
Pushing	13	Angle of Tendency	.09	.79
	14	Angle of Tendency for hip C.G with Horizon	.10	.76
	15	Right Shoulder with Horizon	-.34	.32
	16	Angle of Right Knee	.10	.78
	17	Angle of Right Shoulder	.16	.65
	18	Angle of Right Hip	-.69	.02*
	19	The height of C. G	.47	.16
*significant at $p \leq 0.05$ level				

Table 5: Correlation between Kinematic variables for jump serves stages with pushing force on platform of volleyball players.

Stages	n	Variables	r	p
Collision	1	Angle of Right Knee	-.11	.76
	2	Angle of Right Shoulder	.07	.84
	3	Angle of Right Hip	-.14	.69
	4	The height of C. G	.20	.57
Absorption	7	Angle of Right Knee	-.15	.66
	8	Angle of Right Shoulder	-.03	.93
	9	Angle of Right Hip	-.34	.33
	10	The height of C. G	.21	.54
	11	Angle of Left Hip	.03	.92
Pushing	13	Angle of Tendency	-.11	.76
	14	Angle of Tendency for hip C.G with Horizon	.15	.67
	15	Right Shoulder with Horizon	.16	.64
	16	Angle of Right Knee	-.47	.16
	17	Angle of Right Shoulder	-.13	.72
	18	Angle of Right Hip	-.24	.49
	19	The height of C. G	.23	.51

Table 6: Correlation between Kinematic variables for jump serve stages with time of pushing force on platform of volleyball players.

Stages	n	Variables	r	p
Collision	1	Angle of Right Knee	.40	.24
	2	Angle of Right Shoulder	.05	.87
	3	Angle of Right Hip	.48	.15
	4	The height of C. G	-.02	.95
Absorption	7	Angle of Right Knee	-.46	.18
	8	Angle of Right Shoulder	-.46	.17
	9	Angle of Right Hip	.07	.83
	10	The height of C. G	-.03	.93
	11	Angle of Left Hip	-.12	.74
Pushing	13	Angle of Tendency	-.30	.38
	14	Angle of Tendency for hip C.G with Horizon	.11	.77
	15	Right Shoulder with Horizon	-.30	.39
	16	Angle of Right Knee	.53	.11
	17	Angle of Right Shoulder	-.03	.91
	18	Angle of Right Hip	-.24	.49
	19	The height of C. G	.19	.59
*significant at $p \leq 0.05$ level				

From table 3 above, the correlation between the kinematic variables for jump serve stages with collision force variable on the platform for volleyball is presented. The results show insignificant relationship between kinematic variables for jump serves stages with collision force variable on platform for Volleyball players. Thus, the research hypothesis, H1 was rejected.

In table 4 above, the correlation between the kinematic variables for jump serve stages with collision force variable on the platform for volleyball is presented. The results show insignificant relationship between kinematic variables for jump serves stages with minimum force variable on platform for Volleyball players, except for angle of right hip with significant relation at $r = -0.69 (p < 0.026$. However, the research hypothesis was accepted for one variable and rejected for the remaining variables.

Table 5 reveals the correlation between the kinematic variables for jump serve stages with collision force variable on the platform for volleyball is presented. The results show insignificant relationship between kinematic variables for jump serves stages with pushing force on platform for Volleyball players. However, the research hypothesis was rejected.

In table 6 above, the correlation between the kinematic variables for jump serve stages with collision force variable on the platform for volleyball is presented. The results show insignificant relationship between kinematic variables for jump serves stages with push force time on platform for Volleyball players.

Discussion

The study investigated and compared the relationship between the kinematic variables and strength function-time during jump serve of Erbil club male volleyball players.

Table 5 shows there is a negative significant relationship between angle of right hip at the moment of push with minimum force on platform The researcher attributes that volleyball players of the study sample affirm to extend the body's front joints up for the purpose of getting the center of gravity to the height and extending the arm to its highest point to get a good push to the ball through the reliance on athlete's mass and correlate with the momentum of platform at the moment of absorption (for the purpose of benefiting from physics concept that confirms the dealing body mass with the speed) (Al-Khaledi, 2010), as well as showing that there is no significant correlation between other kinematic variables and less module force on the platform, but some values recorded a greater value but did not rise to the level of significance, and confirmed the relationship between the variable of right ankle at the moment collision with less force on the jump platform and the foot was 0.60, and this we attribute that the athlete (volleyball player) trying to raise up to the top to get rid of the absorption process and prepare to hit, as well as a value of correlation between the right knee at the moment of absorption was recorded to us -0.61, and this we attribute that athletes increase the value of the knee angle at this moment and the lack of emphasis on absorption of down force.

Their correlation t between the two variables and the value of r value of 0.61, which is high value but it did not raise to the significance, and this we may

attribute that athlete when his body tilts to the side that means the athlete will move away parts of his body from the virtual vertical line of gravity and thus will increase the resistance at the expense of force because the athlete when a lot of mass that interact with the focal is been taking out with final outcome will decrease the value of the force generated that matches with the third law of dynamics.

In the table 6 the researcher attributes the lack of significant connectivity kinematic variables of jump serve and push force on platform to some of player's joints angles didn't get to the required extend at push stage, as some volleyball sources confirm that players body joints should be at maximum extension just before raising.

The researcher also attributes the cause of the non-existence of correlation link between push force on platform with the measured bio-kinematic variables, but players of the study sample did not get to the required power at push moment on the platform, and this is because of inability of the study sample players to store the full energy for the moment of absorption very well and convert it to kinetic energy when pushing up.

Finally, a volleyball player demands generally to face the net and perform his jump serve by tilting his body at the phase of jumping. He demands also muscular strength at jumping since it correlates to the higher CG during his jump serve. In addition, accuracy and speed during his jump serve are very critical demand components.

However, the results of the study have shown that only in case of relation between kinematic variables for jump serve with minimum force variable on the platform of volleyball players, only one variable for pushing (angle of right hip), for relation between kinematic variables for jump serve with time of minimum force variable on the platform of volleyball player.

Conclusions and Recommendations

Conclusions

The analysis of the results revealed that only nine variables the include relation between kinematic variables for jump serve with minimum force variable on the platform of volleyball players, only one variable for pushing (angle of right hip), for relation between kinematic variables for jump serve with time of minimum force variable on the platform of volleyball players,(angle of right shoulder to forward) for relation between kinematic variables for jump serve with push force variable on the platform of volleyball players, only for relation between kinematic variables for jump serve with touch time on the platform of volleyball players with collision (angle of right knee), and angle of tendency for hip center of gravity with horizon) show significant relation. Therefore, these variables accept the hypothesis. Thus, other variables in the study reject the hypothesis at p≤0.05 level of significance as stated below.

- For jump serve stages with minimum force variable on platform, there is one significant negative difference (r=-0.69, p≤0.02) between angle of right hip at the moment of push with less force on platform.
- For jump serve stages with time of Minimum force variable on platform
- For jump serve stages with pushing force on platform, there are no significant differences (p≤0.05) between Kinematic variables with collision time variable on platform.
- For jump serve stages with push force time on platform, there is one significant negative difference (r=-0.65, p≤0.03) between angle of tendency with a vertical line.

Recommendations

- It would be valuable to consider the effects bio kinematic variables and strength function-time on change of jump serve in volleyball.
- The significant relationship between certain bio kinematic variables in function of strength-time jump serve in volleyball should be of concern to coaches, sport biomechanics and other experts working closely with volleyball sport.
- The bio kinematic variables in function of strength-time jump serve should be concerned and listed in the criteria of selecting a volleyball player.
- The bio kinematic variables in function of strength-time jump serve should be concerned and emphasized in training programs in order to reach higher levels.

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