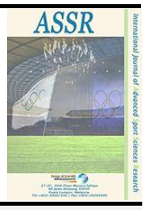

The Percentage Contribution of some Biomechanical Variables in Strength and Accuracy of Forehand and Backhand Strokes for Tennis Players

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Abstract

The research aims to investigate the correlation between the strength of forehand, backhand strokes and some biomechanical variables as well as investigate the correlation between accuracy of forehand, backhand strokes and some of biomechanical variables, also toknow the percentage contribution of some biomechanical variables in strength and accuracy of forehand and backhand strokes performance. The researchers used the descriptive method by (Evaluation Associatively relations style). The sample of research consisted of 12 advanced tennis players in Karbala city above 18 years.Theresearchers used observation (video photography, kinetic analysis) and objective tests as a means for collecting the information. Foranalyzing the data statistically, researchers used the (SPSS) statistical package. The researchersconcluded there is a significant negative correlation between the strength of the forehand stroke in tennis and the angular velocity of the arm, as well as There is a significant correlation between accuracy of forehand stroke in tennis and the angular velocity of the trunk. In addition, there is a significant positive correlation between the strength of the backhand stroke and Angular velocity of the arm, as well as there is a significant contribution of strength of stroke and speed of starting in accuracy of backhand stroke in tennis.

Key words*:* percentage contribution, biomechanical variables, forehand and backhand strokes.

1. Introduction

Tennis one of the games which needs to long time for reaching to good sports level, it is necessary to improve the physical fitness beside the special technic and tactic of tennis because the performance of skills requires special physical abilities, for example the performance of forehand and backhand strokes need to speedy strength , endurance speed , flexibility and agility. There are many researches refers to positive correlation between physical fitness and accuracy of skills performance. Biomechanics is one of important sports sciences, which provides suitable motor solutions by using the kinetic analysis to make the better achievement in variable sports game and evens as tennis, biomechanics specify the important biomechanical variables, which influence in performance and final achievement.

The importance of research is to know the know percentage contribution of some biomechanical variables in strength and accuracy of forehand and backhand strokes performance by kinetic analysis for preparing suitable physical and technical solutions to be effective training facilities used by trainers and players to develop the receiving skill.The research aims to investigate the correlation between the strength of forehand, backhand strokes and some biomechanical variables, also investigate the correlation between accuracy of forehand, backhand strokes and some of biomechanical variables, as well as knowing the percentage contribution of some biomechanical variables in strength and accuracy of forehand and backhand strokes performance.

2. Methodology

The researcher used the descriptive method by (Evaluation Associatively relations method) to solve the problem of research.

2.1 participants

The researchers selected the participantsof research by random method from advanced players in Karbala city above 18 years, participates consisted of 12 players had formed 66.66% from community of research.

2.2 Measurements

2.2.1 Test of strength, accuracy of forehand and backhand strokes.

- **Aim of test**: measure the strength, accuracy of forehand and backhand strokes.
- The highest degree of the test = 84 (accuracy36+strength48).

-Testing procedures:

1-suitab warmup.

2- The player performs six strokes one forehand and the other backhand stroke. The player must hit the ball strait inside the single court.

3-The player performs anothersix strokes one forehand and the other backhand stroke. The player must hit the ball diagonal inside the single court.
4- The assistant should throw the ball into middle between the serve line and the base line; the participant can refuse the bad throw, which falls outside the right area (International Tennis Federation).

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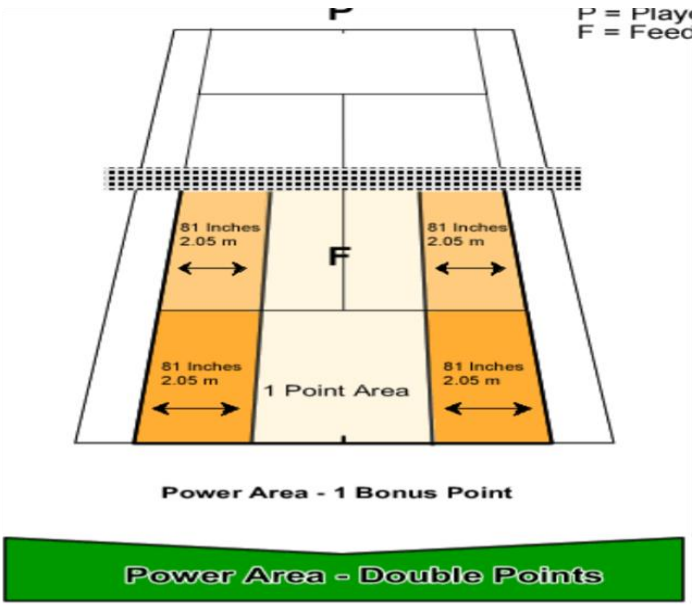
-calculation of accuracy degrees:

1-one degree when the ball falls outside the specific areas for accuracy.
2-tow degrees when the ball falls inside the specific area located by the serve line.
3-three degrees when the ball falls inside the rear area in the single court.

-calculation of strength degrees:

1-one degree when the ball falls inside the single court and the second rebound behind the base line (between the base line and strength line).
2-the degrees multiplied when the ball of the second rebound falls inside the second strength area.
3-the participant gate zero when the ball at the first rebound falls outside the single court.
4-the participant gates one degree extra for each correct stroke (the stability in perform of strokes).



2.2.2 Measurement of biomechanical variables.

2.2.2.1Video photography

For recording the performances, the researchers used three cameras as follow:
1- First camera (25 images per second) on the vertical axis of the player's body, hanging up 6.80 m from the ground to watch the performance of the player from the top.
2- second camera (240 images per second) on the deep axis of the player's body , high 1m , 6.5 m after mid of the performance field , for watching the player's body from the right side during the perform of front strike .
3- third camera (240 images per second) on the deep axis of the player's body , high 1m , 6.5 m after mid of the performance field , for watching the player's body from the left side during the perform of back strike .

2.2.2.1 Program of kinetic analysis (Kinovea).

Kinovea is a special program used to analysis the biomechanical variables, after photographing the performance data collected by a specialist kinetic analysis (Prof. Dr. Srih. Abdul Karim Al-Fadhli .College of sport education. Baghdad University).

2.3 Statistical analysis

To analyze the data statistically the researchers used (SPSS) statistical package for the social science, by using (means, standard deviations, person correlation and regression).

3. Results and Discussion

3. 1 display the results

After data collection and statistical treatment for the purpose of achieving the aims of the research and testing of hypothesis, researcher found a number of results presented in tabular form as follows:

Table (1)
Shows the mean value and standard deviation for forehand ground stroke results

Sequence	variables	Measurement Unit	Mean	Std. Deviation
1	Strength of stroke	Point	14.66	2.46
2	Accuracy of stroke	point	8.41	1.50
3	Speed of stroke	m / s	119.30	13.02
4	Angular velocity of the arm	d / s	193.19	7.34
5	Peripheral speed of the racket	m / s	5.09	0.25
6	Angular velocity of the trunk	Kg.m2.d/s	463.22	16.87
7	Angular momentum of the trunk	Kg.m2.d/s	6445.90	368.35
8	Angular momentum of the arm	d / s	1818.77	129.74
9	Speed of starting	m / s	19.19	1.46

Table (2)
Shows the mean value and standard deviation for backhand ground stroke results

Sequence	variables	Measurement Unit	Mean	Std. Deviation
1	Strength of stroke	Point	9.33	2.18
2	Accuracy of stroke	point	8.16	2.88
3	Speed of stroke	m / s	113.98	12.18
4	Angular velocity of the arm	d / s	202.53	5.67
5	Peripheral speed of the racket	m / s	5.28	0.25
6	Angular velocity of the trunk	Kg.m2.d/s	470.07	27.15
7	Angular momentum of the trunk	Kg.m2.d/s	6519.01	409.84
8	Angular momentum of the arm	d / s	1895.42	128.75
9	Speed of starting	m / s	16.89	1.57

Table (3)
Shows the correlation between the strength of the forehand stroke and accuracy, biomechanical variables

variables	R	sig	Type of sig
accuracy of stroke	- 0.40	0.09	Not signed
Speed of stroke	- 0.24	0.22	Not signed
Angular velocity of the arm	- 0.50 *	0.04	signed
Peripheral speed of the racket	- 0. 32	0.14	Not signed
Angular velocity of the trunk	- 0.008	0.49	Not signed
Angular momentum of the trunk	- 0.30	0.16	Not signed
Angular momentum of the arm	- 0.22	0.24	Not signed
Speed of starting	- 0.49 *	0.05	Signed

N = 12 Sig = 0.05

Table (3) shows:

- A significant negative correlation between the Strength of the forehand stroke and the Angular velocity of the arm.
- A significant negative correlation between the Strength of the forehand stroke and the Speed of starting.

Table (4)
Shows the correlation between the accuracy of the forehand stroke and strength, biomechanical variables

variables	R	sig	Type of sig
Strength of stroke	- 0.40	0.09	Not signed
Speed of stroke	0.41	0.09	Not signed
Angular velocity of the arm	0.06	0.42	Not signed
Peripheral speed of the racket	0.25	0.21	Not signed
Angular velocity of the trunk	0.53 *	0.03	signed
Angular momentum of the trunk	0.25	0.21	Not signed
Angular momentum of the arm	- 0.08	0.39	Not signed
Speed of starting	- 0.24	0.22	Not signed

N = 12 Sig = 0.05

Table (4) Shows:

- A significant positive correlation between Accuracy of forehand stroke in tennis and the Angular velocity of the trunk.

Table (5)
Shows the correlation between the strength of the backhand stroke and accuracy, biomechanical variables

variables	R	sig	Type of sig
accuracy of stroke	0.65	0.01	Not signed
Speed of stroke	0.30	0.16	Not signed
Angular velocity of the arm	0.51 *	0.04	signed
Peripheral speed of the racket	- 0.13	0.33	Not signed
Angular velocity of the trunk	0.52 *	0.04	signed
Angular momentum of the trunk	0.44	0.07	Not signed
Angular momentum of the arm	- 0.13	0.33	Not signed
Speed of starting	0.32	0.14	Not Signed

N = 12 Sig = 0.05

Table (5) shows:

- A significant positive correlation between the Strength of the backhand stroke and Angular velocity of the arm
- A significant positive correlation between the Strength of the backhand stroke and Angular velocity of the trunk.

Table (6)
Shows the correlation between the accuracy of the backhand stroke and strength, biomechanical variables

variables	R	sig	Type of sig
Strength of stroke	0.65	0.01	Not signed
Speed of stroke	0.23	0.23	Not signed
Angular velocity of the arm	0.24	0.22	Not signed
Peripheral speed of the racket	- 0.09	0.38	Not signed
Angular velocity of the trunk	- 0.09	0.39	Not signed
Angular momentum of the trunk	0.15	0.31	Not signed
Angular momentum of the arm	- 0.001	0.49	Not signed
Speed of starting	- 0.22	0.23	Not signed

N = 12 Sig = 0.05

The percentage contribution of accuracy and biomechanical variables in strength of forehand stroke by (enter) method was (0.37).the researcher extracted a prediction formula for strength of forehand stroke as follow:

Strength of forehand stroke = 104.67 + (0.74. accuracy) + (0.17 .Speed of stroke) + (0.33 .Angular velocity of the arm) + (-2.15. Peripheral speed of the racket) + (-0.01 .Angular velocity of the trunk + (-0.005 .Angular momentum of the trunk) + (0.014. Angular momentum of the arm) + (-0.73. Speed of starting).

For extraction, the significant components of the percentage contribution of the strength of forehand stroke the researcher used linear regression by (stepwise) method. The researcher did not find a significant component from researched variables.

Table (7)
Shows the percentage contribution of accuracy and biomechanical variables in strength of forehand stroke by (enter) method

variables	percentage contribution
accuracy of stroke	0.374
Speed of stroke	
Angular velocity of the arm	
Peripheral speed of the racket	
Angular velocity of the trunk	
Angular momentum of the trunk	
Angular momentum of the arm	
Speed of starting	

The percentage contribution of strength and biomechanical variables in accuracy of forehand stroke by (enter) method was (2.18).the researcher extracted a prediction formula for accuracy of forehand stroke as follow**:**

Accuracy of forehand stroke = 37.23 + (0,54. strength of stroke) + (0.06 . Speed of starting) + (-0.07. Angular velocity of the arm) + (-0.42. Peripheral speed of the racket) + (-0.02. Angular velocity of the trunk) + (-0.002. Angular momentum of the trunk) + (0.002. Angular momentum of the arm) + (-0.60. Speed of starting).

For extraction, the significant components of the percentage contribution of the accuracy of forehand stroke the researcher used linear regression by (stepwise) method. The researcher did not find a significant component from researched variables.

Table (8)
Shows the percentage contribution of strength and biomechanical variables in accuracy of forehand stroke by (enter) method

variables	percentage contribution
strength of stroke	2.18
Speed of stroke	
Angular velocity of the arm	
Peripheral speed of the racket	
Angular velocity of the trunk	
Angular momentum of the trunk	
Angular momentum of the arm	
Speed of starting	

The percentage contribution of accuracy and biomechanical variables in strength of backhand stroke by (enter) method was (0.97).the researcher extracted a prediction formula for strength of backhand stroke as follow:

Strength of backhand stroke = (-14) + (0.16 . accuracy) + (0.08 .Speed of stroke) + (0.21 .Angular velocity of the arm) + (-2.27 . Peripheral speed of the racket) + (-0.03 .Angular velocity of the trunk + (0.002 . Angular momentum of the trunk + (-0.01 . Angular momentum of the arm) + (-0.55. Speed of starting).

Table (9)
Shows the percentage contribution of accuracy and biomechanical variables in strength of backhand stroke by (enter) method

variables	percentage contribution
accuracy of stroke	0.97
Speed of stroke	
Angular velocity of the arm	
Peripheral speed of the racket	
Angular velocity of the trunk	
Angular momentum of the trunk	
Angular momentum of the arm	
Speed of starting	

For extraction, the significant components of the percentage contribution of the strength of backhand stroke the researcher used linear regression by (stepwise) method. The researcher found a significant component from researched variables as shown in the table (10).

The researcher extracted a prediction formula for strength of backhand stroke as follow:

Strength of backhand stroke = 7.22+ (0.58. accuracy) + (0.69. Speed of starting).

Table (10)
Shows the percentage contribution of accuracy and biomechanical variables in strength of backhand stroke by (step wise) method

variables	percentage contribution
accuracy of stroke	0.368
Speed of starting	0.224

The percentage contribution of strength and biomechanical variables in accuracy of backhand stroke by (enter) method was (0.61).the researcher extracted a prediction formula for accuracy of backhand stroke as follow:

Accuracy of backhand stroke = 68.43 + (4.44. strength of stroke) + (-0.35. Speed of starting) + (-0.87. Angular velocity of the arm) + (-12.05. Peripheral speed of the racket) + (-0.15. Angular velocity of the trunk) + (-0.011. Angular momentum of the trunk) + (0.074. Angular momentum of the arm) + (-2.079. Speed of starting).

Table (11)
Shows the percentage contribution of strength and biomechanical variables in accuracy of backhand stroke by (enter) method

variables	percentage contribution
strength of stroke	0.61
Speed of stroke	
Angular velocity of the arm	
Peripheral speed of the racket	
Angular velocity of the trunk	
Angular momentum of the trunk	
Angular momentum of the arm	
Speed of starting	

For extraction, the significant components of the percentage contribution of the accuracy of backhand stroke the researcher used linear regression by (stepwise) method. The researcher found a significant component from researched variables as shown in the table (12).

Table (12)
Shows the percentage contribution of strength and biomechanical variables in accuracy of backhand stroke by (step wise) method

variables	percentage contribution
strength of stroke	0.368
Speed of starting	0.224

The researcher extracted a prediction formula for strength of backhand stroke as follow:

Accuracy of backhand stroke = 13.47+ (1.076 . strength of stroke) + (-0.909 . speed of starting).

The researcher attributes the existence of an inverse and negative relationship between the strength of the forehand stroke and the angular velocity of the arm to the weakness of player's abilities to guide the ball with increasing speed of performance, especially given that the test of strength depends on the strength of the balls rebound from the pitch.
The researcher attributes relationship between accuracy of forehand strokes and the angular velocity of the trunk to rule of mass and strength of trunks muscles in guide the arm then the directing of the ball into the selected position.

While the researcher attributed the significant relationship between strength and accuracy of backhand stroke to increasing the players ability of control and guidance with the increasing of backhand stroke strength. The researcher believes that increasing the angular velocity of the arm and trunk contributed effectively in the production of suitable power to perform the backhand stroke accurately. As pointed out (Thomas) (Access to the highest amount of strength must be consistent with the match doses of this strength with the required movement, and to the time of performance, which should be suitable for the use of strength by considerations of speed of movement). (Thomas & Barney, 1992). The Practice and training have a significant role, the increasing in the duration of practice improve and develop accuracy in skillful performance for all the basic skills (Jensey and fisher, 1979).

4. Conclusion

There is a significant negative correlation between the strength of the forehand stroke in tennis and the angular velocity of the arm. There is a significant negative correlation between the Strength of the forehand stroke and the Speed of starting. There is a significant correlation between accuracy of forehand stroke in tennis and the angular velocity of the trunk. There is a significant positive correlation between the Strength of the backhand stroke and Angular velocity of the arm. There is a significant positive correlation between the Strength of the backhand stroke and Angular velocity of the trunk. There is a significant contribution of the accuracy and speed of starting in strength of the backhand stroke in tennis. There is a significant contribution of strength of stroke and speed of starting in accuracy of backhand stroke in tennis.

References

International Tennis Federation.

Jensey G.R. and fisher A.G: (1979). Scientific of athletic condixloning, 2nd Philadelphia, P, 54.

Thomas R. Baeechle & Barney R. Groves: (1992). Weight Training, Steps to Success, USA, (Champaign, IIIInois, p, 134.