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Explosive Power of Legs and its Relationship to Some Mechanical Variables to Spike for the Volleyball Players

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ABSTRACT

The importance of research lies to identify the muscles power of the legs muscles for the attackers, who have to get a good jump to hit the ball, this carried out through tests to measure this character in steadiness and movement, where it is similar to the game's conditions. Also, figure out many of the mechanical values for the stages of Diagonal and Fronting spikes in volleyball, then work out to identify the values those are expected to be happened through the relationship to the explosive power of legs for volleyball players. The objectives of the research were to identify the explosive power values for the legs muscles to jump high and forward in stabile for Erbil Volleyball Club, and find out the relationship of the explosive power values for the legs muscles to jump high and forward in stabile with some biomechanical values of Diagonal and Fronting spikes in volleyball. The research community is consisted of Erbil club volleyball players and research sample represented of (6) players after excluding Setters and Libero. The performance of test was video recorded from two sides on the left of the performance and perpendicularly. The camera was set 3m away to the progress of the performance after that the data was entered to the laptop and analyzed by conducting two software Kinovea and Maxtraq. It has been concluded that a significant relationship between the vertical explosive power of the legs muscles with some important biomechanical variables in Fronting and Diagonal spike, for example a back chord stretches arc, hip angle from behind the best of the arc. Also there was a significant relationship between the steady explosive power of the legs muscles with some biomechanical variables in Fronting and Diagonal spike like arm angle, angular velocity for beating.

Keywords: Biomechanic, explosive, volleyball spike

INTRODUCTION

There is no doubt that many of the general and specific physical characters in volleyball especially strength, where it is an essential and important variable which contribute to increase the proficiency of the performance for volleyball skills overall and spike particularly for both kinds Fronting and Diagonal because both of them are attacking skills and have a positive and psychological effect to increase through them the team balance points and that lead the team to win. Inasmuch there is a fundamental relationship for all kinds of strength especially explosive power which need to be improved and increase the possibility of reaching to high level of importance in performing Diagonal spike in volleyball. As well as, the optimal performance of spike needs a good and correct preparation by using many biomechanical variables which start at the beginning of the set to spike, until the completion of a strike successful and influential, in role this needs to be accurate in performing and possessing players of these variables that could be seen by eyes

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which prompting this should examine these variables using the imaging video technique then analysis the movement, which is one of the things that cannot be ignored in the scientific research, Through the above it can be seen that Biomechanical as it is science which study the technique of movement and the performance of movement visually and causally for succeeding the performance of the skill perfectly and this needs a big muscular strength from the group muscles of the lower limbs of the body to elevate the player to the level that qualifies the player to do the strike perfectly and influential. From here we can define the importance of research to identify the muscle strength of the legs muscles for the attackers who have to get a good jump to hit the ball, this carried out through tests to measure this character in steadiness and movement, where it is similar to the game's conditions. Also, figure out many of the biomechanical values for the stages of Diagonal and Fronting spikes in volleyball, then work out to identify the values those are expected to be happened through the relationship to the explosive power of legs for volleyball players to reach throughout desirable results which contribute for improving the game and set some suitable recommendations for it.

There is no disagreement of the important role of muscle strength in the process of jumping the player to the top and get the possible of bump the body to the height which can lead to perform the Fronting spike and other physical elements like speed, flexibility and agility in the performance of spike and considering this skill as an important and fundamental skill whereby the team can win. the problem of the research can be defined in studying the physical and biomechanical variables for the purpose of reaching through the search to find a role and position of strength in the performance of this offensive movement and whether this relationship between the strength of jumping high and front will reach the degree significant with the rest of biomechanical variables for the stages of Diagonal and Fronting spike for volleyball players, as well as access through this relationship to the know biomechanical values will contribute to success of this skill process. While Research object were:

1. To identify the values of explosive power for the legs muscles for steady jump to the top for volleyball players to the club Erbil.
2. To identify the values of explosive power for the legs muscles for steady jump to the front for volleyball players to the club Erbil.
3. To find the relationship between the explosive power for the legs muscles for steady jump to the top with some biomechanical variables of Diagonal and Fronting spike for volleyball players to the club Erbil.
4. To find the relationship between the explosive power for the legs muscles for steady jump to the front with some biomechanical variables of Diagonal and Fronting spike for volleyball players to the club Erbil.

MATERIALS AND METHODS

The descriptive manner survey was used to conduct this research because it is suitable for the research nature, while The research community consisted of (12) volleyball players from Erbil Volleyball Club, the research samples was included (6) players after excluding Setters and Libero, where the sample represent 50% of research community.so the Equipment and Tools used in the research:

(medicine ball 3 KG, tape measurement, 3.tape, Laptop, A camera speed 25 picture in a second, Camera stand, Volleyball court, Volleyball Balls (10), Ball Holder). Research tests were:

- The test of straight spike in Volleyball: (Mohammad, 2005)
- The test of fronting Diagonal spike in volleyball: (Ralph & Bob, 1982)
- Vertical jump test (Sargent test): (Ahmouda & Jassim, 1987)
- Standing Broad Jump test: (Albotani, 2012).

The Exploratory Experience

the purpose of exploratory experience to Identifying the work obstacles that may face the march of field experiment procedures, the researcher conducted a pilot experiment on players from Erbil Club at the same imaging day and using a video camera on Tuesday, 07/11/2014 at 4 pm and in the interior chamber of the club Erbil, The aim of the exploratory experiment is to make sure the following matters:

(1) How efficiently to use the camera in the main experiment.
(2) Make sure of the power of tools.
(3) Identify the height of camera from the ground and the distance away from the performance place.
(4) The extent to understand and respond to the sample for tests.

(5) Guarantee rationing exercises used and the validity of the research sample.

The Main Experience

The implementation of the research experience on the same day of exploratory experiment 07.11.2014, physical tests and test the skill was conducted for the sample in indoor Erbil Club Hall, and the performance of test was video recorded from two sides on the left of the performance and perpendicularly where the height of camera was 120 cm and was set 3m away to the progress of the performance.

While the Measured Mechanical Variables were:

1. High center of gravity of the body (CGB): Is the distance measured from the center of gravity of the body to the ground.
2. Hip angle: Is the angle measured between three points and that determines the shoulder joint, hip and knee joint and is measured from the front or from behind.
3. The leg angle: Is the angle at which a leg crosses between two phases.
4. The arm angle: Is the angle at which an arm crosses between two phases.
5. Back arc depth (flight stage) is a straight line connecting the stretched bow of the back and the connecting line from the shoulder joint to the knee joint.
6. The horizontal distance of the center of gravity of the body: Is the horizontal distance crosses by the center of gravity of the body horizontally between two phases.
7. Vertical distance: It is the distance that measured vertically of the center of gravity of the body, which is calculated from the triangle that represents the horizontal distance and the outcome of the center of gravity between the two phases.
8. The horizontal distance between the take-off and landing: It is the line that linking the take-off points (the moment of leaving the ground) and a point of landing on the ground.
9. The time of the movement: The movement time was extracted by application of the following law: Total movement time = (number of aliasing images of the movement -1) × time per photo. (Abdel Wahab 1999.85).
10. Vertical Velocity: It is dividing the vertical distance by the time.
11. Horizontal velocity: It is dividing horizontal distance on time.
12. Ability: A multiplying mass to speed divided by the time.
13. Potential energy: It is multiplied the height of the center of gravity by the body weight.
14. Kinetic energy: It is multiplied the square of speed to the half of mass.
15. The work: It is dividing displacement completed by the time.
16. Angular velocity: A dividing angular distance crossed on time.
17. Pushing: It is the amount of movement which is measured through law of pushing = strength x time.

After conducting the video process, the data was entered to the laptop and was selected leg length as a measure of the drawing for each player individually and the best attempt was chosen in terms of technique and precision for the purpose of the analysis, then the following programs were used, each according to their function:(Kinovea program,Maxtraq program).

The following statistical methods were used Statistical:(Mean,The standard deviation,The coefficient of variation (r)). A computer was used for the purpose of processing the data statistically and physically using the following programs: - Microsoft Office Excel 2010 and (SPSS).

RESULTS AND DISCUSSION

This chapter show and discussion the results of relationships between spike with long jump and with high jump, the results were put in tables and discuses these results to reach the achievement of the goals of research.

From Table 1 show the values of biomechanical variables for the spike skillful test and its relationship with the vertical jump from the stability to the Straight spike in fronting area so that there was a positive relationship for the back arc variable in the flying stage with the vertical jump test, as it appeared the ratio of significant (0.05) when an error ratio is (0.05) and this attributed to the strong link of high level of explosive power for the leg muscle lead to the greater back arc distance due to the possibility of swinging arms backward in flying that will help push the trunk back more in the flying stage as swinging arms in the last touch of the land equal to the sum of swings for stages that preceded it and subsequently will increase the explosive power to push the body to the top and arch the back to back.

Table 1: Statistical descriptive of some measuring biomechanical variables for the skillful test and its relationship with the vertical jump from the stability of the sample to the straight spike skill

S. No.	Variables	Unit	Skillful test		r person		Significant
1	The horizontal distance between take-off and hitting	Centimeter	51.50	8.57	–0.41	0.43	Not significant
2	Potential energy of CGB in the last touch	Joule	9210.50	599.29	0.01	0.98	Not significant
3	Potential energy of CGB at maximum arc	Joule	13273.66	1670.13	0.15	0.78	Not significant
4	Pushing from take-off to the maximum arc	Kg. x m/sec.	186.82	41.46	–0.17	0.74	Not significant
5	Pushing from take-off to landing	Kg. x m/sec.	508.91	69.76	–0.07	0.90	Not significant
6	The angular velocity of the leg in the hitting	Degree	260.78	57.47	0.42	0.40	Not significant
7	The arc of the back in the maximum arc	Centimeter	23.83	13.56	0.81	0.05	Significant
8	Hip angle from behind the maximum arc	Degree	163.33	8.71	–0.91	0.01	Significant
9	Arm angle to hitting	Degree	53.67	7.06	0.32	0.54	Not significant
10	He angular velocity of the arm hitting	Degree/sec.	1788.88	236.33	0.32	0.54	Not significant
11	The height of the CGB in the take-off	Centimeter	112.33	3.33	–0.22	0.68	Not significant
12	The height of the CGB in the maximum arc flying	Centimeter	161.17	5.98	0.28	0.59	Not significant
13	Power	Newton	805.23	73.97	0.08	0.88	Not significant
14	Work between take-off and landing	Watt	1276.96	74.92	0.42	0.41	Not significant
15	Hip angle of the hitting in front	Degree	142.33	12.75	–0.73	0.09	Not significant

The significance level value of the error rate ≤ (0.05)

Table 2: Statistical descriptive of some measuring biomechanical variables for the skillful test and its relationship with the long jump from the stability of the sample to the straight spike skill

S.No.	Variables	Unit	Skillful test		r person		Significant
1	The horizontal distance between take-off and hitting	Centimeter	51.50	8.57	–0.58	0.23	Not significant
2	Potential energy of CGB in the last touch	Joule	9210.50	599.29	0.11	0.84	Not significant
3	Potential energy of CGB at maximum arc	Joule	13273.66	1670.13	0.09	0.86	Not significant
4	Pushing from take-off to the maximum arc	Kg. x m/sec.	186.82	41.46	0.15	0.77	Not significant
5	Pushing from take-off to landing	Kg. x m/sec.	508.91	69.76	0.17	0.75	Not significant
6	The angular velocity of the leg in the hitting	Degree	260.78	57.47	–0.25	0.63	Not significant
7	The arc of the back in the maximum arc	Centimeter	23.83	13.56	–0.09	0.87	Not significant
8	Hip angle from behind the maximum arc	Degree	163.33	8.71	–0.54	0.27	Not significant
9	Arm angle to hitting	Degree	53.67	7.06	0.92	0.00	Significant
10	He angular velocity of the arm hitting	Degree/sec.	1788.88	236.33	0.92	0.00	Significant
11	The height of the CGB in the take-off	Centimeter	112.33	3.33	–0.39	0.44	Not significant
12	The height of the CGB in the maximum arc flying	Centimeter	161.17	5.98	–0.12	0.82	Not significant
13	Power	Newton	805.23	73.97	0.18	0.73	Not significant
14	Work between take-off and landing	Watt	1276.96	74.92	0.18	0.73	Not significant
15	Hip angle of the hitting in front	Degree	142.33	12.75	–0.49	0.33	Not significant

The significance level value of the error rate ≤ (0.05)

A reverse significant correlation for the hip angle from behind in the flying stage with the explosive power test of the legs in standing, it was appeared that the ratio of significance is (0.01) when an error ratio (0.05) and this attributed to the strong link of high level of explosive power for the leg muscle which lead to less hip angle from the back, also affected the flexibility of the trunk, as well as help the swinging arms back in the flying stage to push the trunk back more in the flying stage, where the swinging arms in the last touch of the land equal to the sum of swings for stages that preceded it and subsequently will increase the explosive power to push the body to the top and decrease the hip angle back.

There was any correlation appear with the rest of variables.

Table 2 show and discussion the values of biomechanical variables for the skillful test and its relationship with the long jump from the stability to the Straight spike in fronting area so that there was a positive relationship for the arm angle variable in hitting with the long jump steady test, as it appeared the ratio of significant (0.00) when an error ratio is (0.05), also there was a positive relationship for the angular velocity in hitting with the long jump steady test, as it appeared the ratio of significant (0.00) when an error ratio is (0.05) and this attributed to the strong link of high level of explosive power for the leg muscle due to the increasing of the stop time in the air and possibility of swinging arms backward in flying that will help push the trunk back more in the flying stage as swinging arms in the last touch of the land equal to the sum of swings for stages that preceded it and subsequently will increase the explosive power to push the body to the top and arch the back to back.

CONCLUSIONS

- There were significant relationships between the explosive power for the legs to vertical jump with some important biomechanical variables in the spike, a stretched chord arc back, hip angle from behind the arc.
- There were significant relationships between the explosive power of the leg in long jump with some important biomechanical variables in the spike arm angle in hitting, angular velocity in hitting.
- The explosive power of the legs, both horizontally and vertically is necessary factor for the volleyball player in Fronting and Diagonal spike straight.

RECOMMENDATIONS

First: Interest in special physical elements of the volleyball player, including:

- Vertical explosive power of the legs.
- Horizontal explosive power of the legs.

Second: Interest in biomechanical aspects for the skill of spike because they increase the efficiency of performance, including:

- Arc stretched back in flying
- Hip angle in flying
- Angular velocity of the hitting arm
- The arm angle in hitting.

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