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Explosive power of the arms and its relationship with the speed of the arm movement, the angle of ball flight and the accuracy of spiking in volleyball players

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ABSTRACT

This study aimed to identify the relationships between the explosive force of the arms, the speed of the arm angle, the ball's flight angle, and the accuracy of the spiking skill in volleyball players, as well as how each factor impacted the others. A descriptive approach using the survey method was employed. A total of thirty players from Imam Al-Muttaqin, Al-Hussainiya, and Al-Hur clubs participated in the study, selected through random sampling. The following tests were conducted: Medicine Ball Throw Test, Overpowering Hit Accuracy Skill Test, and the Kenova program to measure the velocity of the arm angle and the angle of the ball's flight. Statistically significant correlations were found between explosive power and angular velocity ($p<0.05$), explosive power and the ball's flight angle ($p<0.05$), as well as explosive power and spiking accuracy ($p<0.05$). The study suggests incorporating physical fitness components into training sessions led by coaches.

KEYWORDS

Explosive Power; Angular Velocity; Ball Flight Angle; Spiking Skill; Volleyball Players

1. INTRODUCTION

Sports training aims to enhance the various foundations and factors that play an active role in developing the athletic level across multiple sports. One such foundation is physical fitness statistics, which are fundamental for improving players' various biological and psychological characteristics, whether in team or individual games, and whose development inevitably affects players' skill levels Since the elements of physical fitness are central to the success of any team, they provide players with the physical attributes necessary to consolidate and master skills for optimal performance. The

consolidation of the player's skill performance depends highly on the physical preparation and the availability of physical fitness elements present when the player performs the different skills (Hussein & Nassif, 1987).

Volleyball is one of the sports characterized by a significant dependence on muscular strength because the required skills demand such physical performance. For instance, volleyball attack skills, including the crush skill, rely on general muscular power, specifically the explosive power component of muscular strength. This powerful offensive skill is considered essential for achieving significant results and making any team a top performer. The performance of volleyball skills is influenced by the biomechanical conditions accompanying them, which reflect the ideal and correct execution of these skills according to their kinetic context. The application of these skills is affected by specific factors that are directly related to each other. The final mechanical ability and other biomechanical variables are among the primary factors.

This study aims to identify the relationship between the explosive force of the arms, the speed of the arm angle, the ball's flight angle, and the accuracy of the spiking skill in volleyball players, as well as how each factor impacts the others.

2. METHODS

2.1. Study design and participants

The study used a descriptive approach with the survey method. A total of thirty players from Imam Al-Muttaqin, Al-Hussainiya, and Al-Hur clubs participated in the study, selected using a random sampling method.

2.2. Tests performed

2.2.1. Medicine ball throw test

A 2 kg medicine ball was thrown over the head from a seated position to measure explosive arm force. Two attempts were made, and the best distance achieved was recorded.

- **Test objective**: To measure the explosive force of both arms.
- **Tools**: Flat surface, small rope, chair, medicine ball (2 kg), measuring tape.
- **Test description**: The subject sits on the chair, holding the medicine ball with both hands above the head. The upper body is placed on the edge of the chair. A small rope is tied around the chest to prevent the subject from moving forward when the ball is thrown with the hands. The ball must be thrown using the hands only (without using the torso).

- **Performance conditions**: Two consecutive attempts. It allows the tester to attempt the test independently as a performance training exercise. If the test person vibrates or the chair moves during one of the attempts, the result will not count, and a new attempt will be given in its place.
- **Results recording**: The score for each trial is: the distance between the front edge of the chair and the point on the floor nearest to where the ball hits the chair; the laboratory score is determined by the best result from the two attempts.

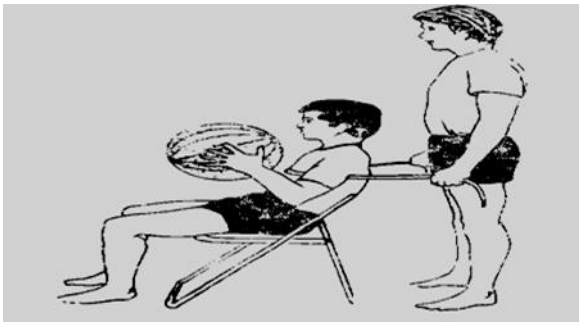

Figure 1. Throwing a medical ball (2 kg) with both hands from above the head while sitting on a chair

2.2.2. Kenova program

The velocity of the arm angle and the angle of the ball's flight were measured using the Kenova program.

2.2.3. Overpowering hit accuracy skill test

- **Test objective:** To measure the accuracy of the spiking skill in volleyball.
- **Tools**: legal volleyball court, (5) legal balls, coloured tape to divide the field as shown in the figure.
- **Test description**: The tested player performs the crushing strike from position No. (4)) while the coach counts the ball from position no. (3), and the player performs the skill.
- **Performance conditions:** Each player has (5) attempts in the A zone. Each player has (5) attempts in the B zone.
- **Results recording**: (4) points for each attempt in which the ball falls in the (A) or (B) zone; (3) points for each attempt by which the ball falls on the coloured area; (2) Two points for each attempt in which the ball falls in zone (a) or (b) (zero for each attempt in which the ball falls outside the court).
- **Maximum angle degree:** (20) degrees for each zone, so the maximum angle degree is (40).
- **N.B:** The setting must be reasonable; otherwise, a new attempt is in order.

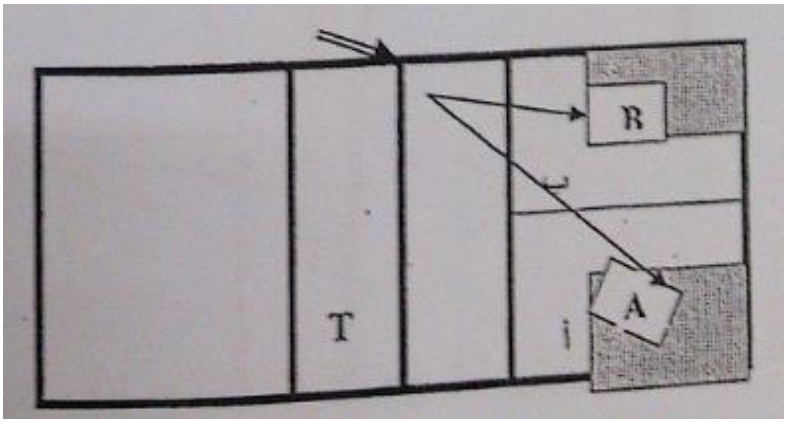

Figure 2. Accuracy of spiking skill of volleyball

2.3. Equipment used

- Volleyball court
- Computer
- Kenova program,
- Camera
- 2 kg medical ball
- Legal volleyballs
- Magic pens

2.4. Exploratory experiment

An exploratory experiment, during which the necessary tests for the research sample were conducted, took place on 1.12.2020. The data were then collected and statistically processed to obtain scientific results from the tests. The researchers used SPSS (Statistical Package for the Social Sciences) version 24 to calculate means, standard deviations, and correlations. The significance level was set at $p < 0.05$.

3. RESULTS AND DISCUSSION

Table 1 presents the results of the relationship between the reflexive force of the arms and the speed of the arm. The results indicate a statistically significant correlation between the reflexive force of the arms and the speed of the arm ($p= 0.02$, <0.05).

Table 1. The relationship between the reflexive force of the arms and the speed of the arm

N	Variables	Unit of measure	Arithmetic Mean	Standard deviation	Correlation coefficient	R. Calculated	*p*
1	Medical ball throwing	Kg	16.24	6.33	0.79	3.14	0.02
2	Arm angle speed	M/second	0.092	0.014			

Table 2 shows the relationship between the explosive force of both arms and the angle of the ball's flight. The results indicate a statistically significant correlation between the explosive force of both arms and the angle of the ball's flight (p=0.00, <0.05)

Table 2. The relationship between the explosive force of both arms and the angle of the ball's flight

N	Variables	Unit of measure	Arithmetic Mean	Standard deviation	Correlation coefficient	t	*p*
1	Medical ball throwing	Kg	16.24	6.33	0.90	6.13	0.00
2	Ball's flight angle	Degree	13.38	5.3			

In the following, Table 3 present the results of the relationship between the explosive power of both arms and the accuracy of spiking skill. The results indicate a statistically significant correlation between these two variables (p=0.01, <0.05)

Table 3. The relationship between the explosive power of both arms and the accuracy of spiking skill

N	Variables	Unit of measure	Arithmetic Mean	Standard deviation	Correlation coefficient	t	*p*
1	Medical ball throwing	Kg	16.24	6.33	0.89	5.13	0.01
2	Spiking accuracy	Degree	26.13	7.30			

The researcher emphasizes the existence of a direct relationship between explosive power and performance accuracy, highlighting the need for coaches to focus on the physical fitness requirements of the game.

The more accurate and ideal the player's motor path is when performing the spiking motion, the higher the levels of these two biokinetic variables, leading to the explosive power required to hit the ball towards the opposing team's area to score a point. Additionally, coaches should consider the individual differences of the players during training, incorporating various training methods and scenarios. All of this is aimed at developing the players' skill levels, achieving higher performance,

and meeting the goals set in training. This skill, in particular, requires players to have explosive power, as it plays a significant role in the motor performance of the skill, in addition to other physical attributes (Al-Hourani, 1996; Saleh Al-Thubaini, 2022; Naji Zwayen, 2022).

4. CONCLUSIONS

There is a significant correlation between explosive force and angular velocity, indicating that as explosive force increases, so does the angular velocity. Additionally, a significant correlation exists between explosive force and the ball's flight angle, suggesting that greater explosive force influences the trajectory of the ball. Moreover, a significant relationship was found between explosive power and the accuracy of the spiking skill, highlighting that higher explosive power enhances the precision of spiking in volleyball.

5. RECOMMENDATIONS

The authors recommend the following: 1) During training sessions, coaches should emphasize the importance of physical fitness elements to enhance performance. 2) It is advisable to adopt modern training methods that incorporate various techniques to improve skill development and overall athletic performance.

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AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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