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Bio kinematic study of the spike in school badminton players from Villa Clara

Abstract

The work analyzes the spike technique in school badminton players from Villa Clara, considering the influence of basic motor skills, the phases and justification of the spike technique, as well as the influence of the main physical abilities to determine the progression of the exercises for improvement. The research has been structured in three parts, the objectives and methods applied are distributed, the entire training process was observed and surveys were applied to the population of coaches of this sport in the municipality of Santa Clara, to obtain information on teaching and training practice in these categories. A workshop was also held with three other coaches who are intentionally selected for their experience and sports results. For the study we rely on the theories of Karl Hainaut and Moral and Rodríguez to analyze the kinematics of the spike movement and the action of its main muscle planes; fundamental technical movement in this sport. The exercises selected for technical improvement, allow providing a more objective and variable training according to the criteria of the consulted specialists.

Keywords: phases, technical structure of spikes, exercises

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Introduction

Badminton is an individual sport, with an opponent and a racket, also conceived as a recreational, educational and competitive activity where we find different game modalities.[1] It is a very versatile sport that makes enormous demands from the technical-tactical, physical and psychological points of view. Its activity consists of surpassing a shuttlecock (synthetic or feather) above a ned, located at a height of 1.55 m, with the hitting of a sport-specific racket, the objective of which is to win the point, being the fundamental objective of the game.

In this sport there are four game situations to win the play and score points:

1) Pass the shuttlecock over the net, placing it within the limits of the opponent's field of play, where he cannot return the shuttlecock.
2) If the shuttlecock hits the opponent.
3) The opponent places the shuttlecock outside the limits of the playing field.
4) The opponent commits a violation of the regulations.

The basic motor skills that occur in the game are: movement, jumping, manipulation and turning. Characterizing each of them, it can be stated that movements are the movements to move from one point to another on the court. Its fundamental actions are: career and changes of direction. For their part, jumps have a previous phase, an impulse, a flight phase and cushioning. Specifically we find these actions in finishing, although these can also be done without jumping. In the manipulations, hits are produced, paying attention to the correct way to grip the racket, a basic aspect for the effective execution of each type of hit. That is why the technical skill chosen to analyze has been the shot, as it constitutes an important offensive blow. It is executed with a flat hit from any part of the court and always with the hand as high as possible. This can be done parallel or crossed, in a downward trajectory so that the shuttlecock can fall in the middle of the court or at the bottom at high speed and with a straight path.

For its effectiveness, the auction must keep in mind:

1) The power of the hit, in order to determine the exit speed of the shuttlecock.
2) The angle of fall must be as steep as possible.
3) The drop areas of the steering wheel, being ideal for the lateral lines.

This technical skill is a complex movement since it involves the participation of the lower extremities and the upper extremities performed at maximum execution speed.

Phases and justification of the technique

The shot is a blow that is made with power and speed towards the opponent's court. The angle and inclination of the shuttle's trajectory will make it difficult to be defended by the opponent. It is distinguished by different phases; a preparation phase where the position of our limbs must be optimal to link the next phase, that of hitting. Both must be clearly defined with the objective of optimizing learning and obtaining a greater result. After the shot we must return to the center of the court to be able to face the opponent's blows, below we detail the phases:

Preparation phase: the body, hips and shoulders are positioned perpendicular to the ned with the foot opposite the executing arm forward and the weight of the body on the rear leg with the knee slightly bent. The arm opposite the racket is raised and with the elbow slightly flexed it points towards the trajectory of the shuttlecock, while the executing arm is abducted, with the elbow flexed and directed towards the ground.

Execution phase: the elbow of the executing arm is raised and directed towards the front, and the racket makes a trajectory above

the head towards the shuttlecock, accompanied by a movement of the trunk, with the rotation of the shoulders and hips to advance the weight of the body and hit the steering wheel as high as possible and perpendicular to the body. The non-executing arm with the elbow flexed and close to the side extends the shoulder to help distort the trunk in the direction of the strike and improve the balance of the movement.

Recovery phase: after contact, the executing arm continues the movement, intertwining in front of the body, at the same time that the leg of the executing arm cushions the continuation of the movement to regain balance and follow the actions of the game.

Written and graphic description of the global motor task and each of the motor actions that form it.

The gesture has been fragmented into the three previous phases describing the most significant characteristics:

The joints involved are almost all those that make up the functional structure of the human body, starting with the cephalocaudal or proximal distal principle; shoulders, elbows, wrists, trunk, hips, knees and ankles.

The movements they perform are very diverse in this gesture, both in the sagittal, transverse and frontal planes: flexion, extension, abduction, adduction and internal and external rotation mainly.

As for the participating musculature, it is very varied and complex, since the motor actions are very varied due to joint involvement. The most important muscles and triggers in the action are those corresponding to the upper limbs since the elastic-explosive force applied in the movement will determine the result, if we achieve the goal.

Regarding the type of contraction manifested, say that the muscles intervene both concentrically and eccentrically. The descriptive-graphic analysis of the proposed motor action, from a mechanical-muscular dimension, indicates the type of movement, the joints involved, the participating muscles and finally the type of muscular contraction.

The topic addressed is varied and extensive, but there are absences of theoretical and analytical content of the movement for this sport from the base of the sports pyramid in our country, aspects that should be part of the Comprehensive Athlete Preparation Program (PIPD). All of which means that, despite technological growth worldwide, these studies still lack in our country and with the somatotypical characteristics of the Cuban badminton player.

These aspects lead us to the following **problematic situation**, which focuses on deficiencies in the use of exercises for the technical improvement of the auction. For what we consider as **a scientific problem:** What exercises should be used in technical preparation, considering the kinematics of the spike in the school badminton players of Villa Clara?

The **object of study** of our research focuses on the technical preparation of school badminton players, while the **field of action** is framed in the exercises for the technical improvement of the spike according to its kinematics.

For them we draw the following System Goals:

1. Analyze the theoretical-methodological guiding elements for the technical preparation of school badminton players.
2. Relate the muscles involved in the technical movement of finishing through the analysis of its kinematics.
3. Select exercises for the technical improvement of school badminton players.
4. Assess the selected exercises based on the criteria of specialists.

We worked with two populations, one composed of six athletes who make up the badminton team of the municipality of Santa Clara in Villa Clara, of them three men and three females, a second population by the three coaches responsible for the teams of the municipality itself and the intentional selection of three other coaches of the sport of badminton in the province of Villa Clara (1 Sagua la Grande, 1 Camajuaní and 1 Ranchuelo), who, due to their experience and sports results, serve as specialists.[2]

Methodology

To comply with the established objectives, different methods and/or techniques were selected.

Analytical-Synthetic and Inductive-Deductive were applied, and the empirical level, Document analysis, participant observation, interview, triangulation by source, workshop and specialist criteria. The technique applied was **biokinematic** analysis.

Given the need to update the exercise selection process for the technical improvement of the spike in Badminton, in search of the rationality of the means, the direct work on the muscles that intervene in the technical gesture of spike; Supported by a biokinematic study of the technique, it is observed how it is worked in the school category, as this is the initial age for continuous technical improvement.

The research is carried out in three interrelated phases. In the first phase, the guiding methodological elements for the technical preparation of school badminton players were diagnosed. In this phase the methods used are: participant observation, due to its direct link with the team studied. A survey is applied to the three coaches responsible for teams in the Municipalities of Sagua la Grande, Camajuaní and Ranchuelo, as they are municipalities where there is systematic practice of the sport and present relevant results.

At this same stage, a bibliographic review of the athlete preparation programs for the 2017 and 2022 cycles was carried out, which provided information on how this activity is oriented at the country level, triangulated by the sources of information (Observation, Survey and Bibliography) to corroborate the information received, allowing us to reach conclusions.

In the second investigative phase, the bibliographic review is carried out and the workshop with the three coaches of the category analyzes the biomechanical study of the technical gesture of finishing based on the theoretical elements provided by the Spanish Moral and Rodríguez in 2009, who report on the initiation sports in Badminton, as well as the aspects offered by the Belgian doctor Karl Haitnaut in his book Introduction to Biomechanics from 1976, which allowed us to select the proposed exercises.[3]

In the third phase of the research, the criteria of the specialists will be assessed through a survey about the exercises for the technical improvement of the spike in the school badminton players of Villa Clara (**Table 1**).[4,5]

Other informational, conditional and motor elements that significantly intervene in the practice of badminton and influence the technical movement of the spike are:

1) **The perception mechanism:** so important, because the player at all times has to be aware of the opponent's movements, his location on the court, in addition to the trajectory and speed of the shuttlecock, all through the continuous exchange of blows. Therefore, the player must react at high speed.

2) **The decision mechanism:** This is also very important. The decisions the player makes must be in milliseconds and the most correct. Taking into account where the opponent is on the court to select the type of hit and where to place the shuttlecock.

3) **Execution mechanism:** This technical aspect is very important. It is necessary to know and correctly perform the techniques of hitting the steering wheel. Yes, a shot with perfect biomechanics is not required, but it is necessary for the player to be able to adapt his shots to the different game situations in which he finds himself. To do this, you must measure the speed at which the shuttlecock travels, where you want to place it, adapt to those hits and be able to perform them in real game situations.

4) **Psychological factors:** A badminton player has to have great confidence in himself, after the hard work he has to do, he must be aware that he can achieve his goals. On the other hand, concentration is essential due to the speed of the actions. Also an important psychological factor is resistance to external pressure that competition may exert.

Conditional factors

Explosive force

a) Manifest the maximum possible force in a very short time interval, at the maximum speed, determined by the actions of this sport.

b) Displacements are usually 1-4 m. from standstill with medium loads. With strong accelerations and changes of direction.

c) Basic factors: Maximum strength: Apply the maximum force under very high loads with the maximum frequency of nerve stimulation and the maximum recruitment of muscle fibers, to transfer it to the competition with the aim of recruiting more muscle fibers than those that would be recruited without The maximum force is taken into account, given low loads and at a maximum frequency of nerve stimulation.

Explosive elastic force

a) It is based on the principles of explosive strength, but also adds the elastic component (muscle pre-stretching) due to the eccentric phase.

b) Hits in which maximum power is not used enough, such as sometimes drop shots, some remains and some defensive blows.

c) Basic factors: Maximum strength and explosive strength.

Explosive elastic reflex force

a) In addition to the contractile force of the muscle, from the use of elastic energy we add the force produced by the myotatic reflex, which intervenes due to the nature of the stretch-shortening cycle (CEA), much faster since the weight of the racket and the shuttlecock They are mild, which favors making the most of this cycle.

b) Basic factors: Maximum strength, explosive strength and elastic-explosive strength.

Resistance to explosive force of the lower extremities

a) Ability to resist an intermittent manifestation of explosive force.

b) The movements in which the explosive force of the lower body predominates, continue throughout the entire match without a complete recovery between each one.

c) Basic factors: Hypertrophy maximum strength, Max strength. neural, Explosive force, Explosive elastic force.

Resistance to explosive reflex-elastic force of the upper extremities

a) Ability to resist an intermittent manifestation of explosive elastic reflex force.

b) The hits in which the explosive elastic reflex force intervenes are repeated throughout the match without a complete recovery between them.

c) Basic factors: Maximum upper body strength, Upper body explosive strength, Upper body explosive elastic strength, explosive reflex-elastic strength.

Resistance to explosive elastic force of the upper extremities

a) Ability to resist an intermittent manifestation of explosive elastic force.

b) It is about maintaining the intensity of the technical gestures carried out thanks to the explosive elastic force of the upper body despite fatigue conditions, which will ensure greater performance and greater chances of success.

c) The type of blows in which explosive elastic force intervenes will occur throughout the entire match and, logically, there will not be a complete recovery between them.

d) Basic factors: Maximum upper body strength, Upper body explosive strength, Upper body explosive elastic strength.

Dynamic flexibility

a) This is the degree of mobility of a joint due to the contraction of the subject.

b) In a large number of actions, the player has to take advantage of the muscle elongation of both his legs and arms to reach and reach the shuttlecock.

c) Basic factor: Static flexibility.

d) Focusing on the auction, the main aspects to take into account are the following:

Results and discussion

After having defined the phases of the movement, the joints involved and the muscles that act for each phase, considering the weaknesses detected in the observations and corroborating what is oriented, we move on to complete the third objective, which is the choice of exercises to the technical improvement of the auction.

The solution proposal that comes from the second investigative phase, where considering the biokinematic study that participates in the finishing gesture, the selection of the exercises is carried out, for this the criteria provided by Moral and Rodríguez (2009) were taken into account, these propose a group of theoretical contents for Badminton,

which were taken into consideration for the selection according to the technical phases and in search of variability in training:[6]

Teaching exercise progression

The proposed exercises are general and isolated, so it will be the teacher's job to adapt them to their students so that all of this will form a unit with complete meaning in a specific and characteristic context.

Exercises to perfect the finishing technique

a) Throw shuttlecocks to your partner, passing the executing arm above the head.

b) Hitting a hanging shuttlecock overhead.

c) Throw a shuttlecock up and hit it overhead.

d) Hit the steering wheel overhead and in front.

e) Hit the shuttlecock above your head and in front, accompanying the hit until the end, performing the correct coordination of arms and legs.

Exercises in game situations

a) Real individual match situations with special direct observation of the badminton player in the execution of spikes.

Identification of essential tactical aspects

By working on the tactical aspects related to technique we can become more effective in the game. To do this we will have to influence the following aspects:

a) Speed of movement: it will allow you to get behind the wheel faster and in better condition to be able to defend it in a better location.

b) Variety in hitting: possessing technical skills to correctly solve various game situations.

c) Safety when hitting: essential in delicate situations and when defining matches.

d) Precision in hitting: We will achieve it with the experience acquired.

If you master these aspects of the game, you will have fewer unforced errors which can determine the outcome of a game. From the shot, special attention will be paid to the execution of this gesture by: hitting the shuttlecock at the highest possible point, synchronizing the hit with the aerial phase and raising the elbow as much as possible to stretch the arm well. At first we can mechanize the gesture without performing the flight phase so that the activity is easier. When there are no problems in the execution of the hit, we will include the aerial phase.[7]

Conclusion

The weaknesses detected in the guiding methodological elements and what is applied in the technical exercises for finishing in school badminton players are mainly concentrated in the little information for their planning, in the types of exercises that are used for their improvement, in addition to not contemplate the muscles involved in the finishing gesture.

The selection of exercises to improve the spike in the school badminton players of Villa Clara has a theoretical basis from previous studies, a biokinematic analysis of their technical gesture and an assessment of the phased exercises that can be used and make the training a moment more pleasant, varied and adjusted to the needs of badminton players in training.

The proposed exercises caused the coaches to agree that they are necessary and useful for the technical improvement of finishing, thus contributing to the variability of the training and its personalization, taking into account objectivity and the lack of means for its practice.

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Conflicts of interest

The authors declare that there are no conflicts of interest.

References

1. Cabello Manrique D. *Analysis of the characteristics of the game in competitive badminton. Its application to training.* University of Granada. 2000.
2. Spanish badminton federation. *Rules of the game*. 2000.
3. Haitnaut K. *Introduction to biomechanics*. JIMS publishing. Barcelona. Spain. 1976.
4. Hernández Vázquez M. *Enjoy your free time with badminton*. CSD. 1984.
5. Iguacel Linares M. *Introduction to badminton.* CEPID. Saragossa. 1990.
6. Moral Abásolo A, Rodríguez García, José A. *Systematic analysis of the spike in badminton, decomposition of the motor task and progression of exercises for its teaching.* 2009.
7. Comprehensive badminton athlete program. 2022.