Test to evaluate the shot accuracy in a penalty situation of Water Polo athletes

Abstract
The Water Polo players perform many actions during a match, such as swimming at high intensities, fighting actions, driving the ball, shooting among others. It is intended by means of the study, to elaborate and to value preliminary the quality of tests for the verification of the shot accuracy in penalty situation of Water Polo players. The objective of this research is to propose a test that, based on the particularities of the competition, confirms the accuracy in the shot in a penalty situation in youth Water Polo players. A potential test situation is selected from the catalog of motor actions of the player, which is part of the technical arsenal of the athlete in this sport. The potential test situation accomplish the fundamental requirements for the competitive exercise chosen as the driving content of the test that is developed: culminating with a shot on goal. Methods, such as survey, documents analysis, scientific structure observation, measurement and evaluation for specialist criterion. Based on these budgets, it is possible to prepare the test that is subsequently submitted to the preliminary evaluation process. A sample made up of eight Water Polo specialists from Villa Clara province was used for this investigative task. The result of the applied survey made it possible to gather conclusive elements of the preliminary evaluation process, concluding that the proposed tests allow to verify the accuracy of the shot in a penalty situation in high-level Water Polo players.

Keywords: *test, shot, penalty, accuracy*

Introduction

There are many actions that players perform during a Water Polo match such as swimming at high intensities, fighting actions, driving the ball, shooting, interceptions, receptions and feints, just to mention a few.

The study carried out by sports researchers about the behavior of players during competitive activity through quantitative analysis, has revealed timing, intensity, and frequency of appearance, the results of which have allowed their use in the training schedule. Training and controlling how you compete is a necessity in contemporary sport.

However, during training it is also necessary to attend to and adjust the actions that lead to the achievement of the motor objective pursued by sports teams, in order to win the sports fight they establish with their opponents (score in the opposite goal). The shot at

goal, as well as the plays that precede it and enable the player in possession of the ball to carry out this type of terminal actions during a match, allow the executing team to appropriate marked possibilities of success during it. They are link actions due to the quality that the players involved in them and in the launch as a finishing action can exhibit in these skills.

The completions of the attack plays in team sports are determining situations of the encounters, since they define success or failure, influencing the final position of each team in the tournaments. This is why Lozano (2016) considers that the effectiveness of the launch is a fundamental variable for performance.

Gómez, Cejuela and Sellés (2020) consider that recently more interest is being shown in the study of the actions that occur in a Water Polo match and that among them there are studies of the different types of launches, in this sense the results are observed de Lupo, Tessitore, and Capranica (2010) who, in their analysis of 30 elite Water Polo players, recorded a greater number of throws in the zone in front of 5 meters.

Also in this direction Peñaloza et al (2016) and González (2016) consider that in order to have a good casting quality, psychological aspects must be taken into account, the fact of having a greater or lesser effectiveness in the launches is also directly related with their speed and precision (Manchado, Tortosa-Martínez, Vila, Ferragut and Platen, 2013).

All these factors previously exposed condition the quality of the throw and therefore, it is important to know the effectiveness of the throw for each of the possible game zones, which helps to establish game strategies and better understand the dynamics of the same. It is evident that a determining skill in the Water Polo is the shot on goal, as it is the only one through which the player tries to score the goal (Vila, 2016), so verifying the accuracy of the shot on goal is a revealing element. the level of sports preparation acquired by an athlete to achieve results in a goal sport.

The launch in a penalty situation is a fundamentally important basis for adding annotations to the final score of the match, since its execution is carried out in an area very close to the goal and in highly profitable conditions for the player who materializes it, since its condition declares his fight only before the goalkeeper. When carrying out an extensive bibliographic review in search of the procedures used by the coaches of this sport to satisfy the claim of the verification of this ability, it was found that the resources conceived for this objective are scarce.

Other aspects that reaffirm the current state of the subject under study and constitute reference for analysis when raising the foundations of the research, are the result of surveys and interviews carried out with sports teachers of this discipline, when developing behavioral models of competitive activity where the lack of instruments and means of control are manifested for the verification of the effectiveness of the precision in the launch in a penalty situation in the Water Polo players.

The objective that directs this research is to propose a test that, based on the particularities of the competition, confirms the precision in the launch in a penalty situation in young Water Polo players.

Methodology

The population under study was made up of the 12 Water Polo athletes belonging to the youth team of the Héctor Ruiz Pérez Sports Initiation School (SIS). This population is conceived as an object of study, since it will be subjected to the basic quality criteria for the preliminary validation of the test.

Other populations and samples that are described below were used in the research process:

• A sample of 8 specialists who collaborated in its preliminary phase. They are professionals who have trained sports teams in this discipline, having as a precondition having more than 5 years of experience as a sports coach. These trainers, who functioned as specialists in the construction of the proposal, participated in three tasks of the investigative process.

• A population of 10 trainers in this discipline to whom a survey was applied that functioned as a diagnosis of the current state of the variable under study.

The following scientific methods were used:

Survey: it was applied to the high-performance Water Polo coaches in the province of Villa Clara to find out the theoretical and practical references they have about the knowledge of the routes used to measure the precision of the throws.

Review of official documents: it allowed to study and analyze the documents related to the preparation of the athlete in the Water Polo (IPSP), to know the methodological indications to comply with in the training, particularly how the precision in shooting on goal is measured in the plans training, how this skill is controlled, in what moments of the preparation, what means are used to work it and if there are guidelines for the coaches to work on this skill.

Structured scientific observation: It was used to know the number of launches that penetrate the areas enabled for this purpose in the precision network. The number of goals achieved that penetrate for each preset angle, for each series of work were counted. An observation protocol was enabled that allowed the annotation of the shots made and those recorded by each of the zones into which the precision net is divided.
Measurement: It allowed the results themselves to be expressed in numbers. The total number of shots scored in the goal enabled with the precision net was counted. Mathematical-statistical: Different calculation formulas were used to provide quantitative indices that characterized the effectiveness of the sports foundation studied.
To conjecture the effectiveness of the shots, the ratio (the quotient of two numbers or two comparable magnitudes, which reflects their proportion) between the number of goals scored and the number of shots taken was calculated.

$$\text{Shooting efficiency} = \frac{\text{Number of goals scored}}{\text{Number of launches}}$$

For the calculation of the percentage of defects, the calculation formula proposed by Utkin (1988) in his book "Biomechanical aspects of sports tactics" was used where by means of the quotient of two numbers (the number of failures and the total number of actions performed) its proportion is obtained.

Below is this:

$$\text{Percentage of defects} = \frac{\text{Number of failures}}{\text{Total number of launches made}}$$

Evaluation by criteria of Specialists: Those who have a high degree of current experience in the matter for which it is required are considered by the theory as specialists. The specialists were selected based on the accumulated experience in sports training tasks for Water Polo players, their academic qualifications and the results of these coaches with teams of this sport in order to guarantee their ability to offer assessments about the validity of the content of the tests.

In addition, specialists in this sport were employed, who at this time do not act as coaches, but teach at the Faculty of Physical Culture of the "Marta Abreu" University of Las Villas and were athletes of national teams or coaches of provincial teams of this sport. These requirements for their selection are attributes that guarantee experience, training and real and objective potentialities to make value judgments about the subject under study.

To fulfill the research task, a model (estimate endorsement) was used that explained the content validity, where the key question referred to whether the task posed in the test actually measures what it says and wants to measure. The specialist may be based on three categories: efficient, relatively efficient and inefficient to express his considerations. It was applied with the aim of enabling the verification of one of the main quality criteria. Once the test was built, these specialists were again used in order for them to assess the potential possibilities that the tasks grouped together in the selected test situation to be applied in sports practice. They made their judgments on the basis of two groups of criteria that were called: acceptance criteria and questionability criteria depending on the meaning of their evaluations.

Results and Discussion

Results obtained in the diagnosis made to the SIS Water Polo coaches "Héctor Ruiz Pérez"

Below are the main results obtained from the survey applied to the Water Polo coaches with the aim of knowing the current status of the object of study. These results are presented by organizing them based on the order given to the questions asked in the applied instrument.

a. The 100% of the coaches surveyed consider that precision in the shot at goal is important as a distinctive quality of the Water Polo player

When justifying their answer, the main reasons raised refer to:

• The victory in the Water Polo as a sport of invasion and goal is materialized through goals and these are the product or are achieved through shots on goal.

• When skillful goalkeepers are found in their actions, they can only be beaten by throwing with a high degree of precision.

• Many consider the strength and speed of the shot as a determining factor in the production of goals; however, the accuracy of the shot to one of the corners of the goal plays a fundamental role in the vulnerable conditions of goalkeepers.

• Placing the shot at one of the door angles makes the goalkeepers' task more difficult.

b. Although they recognize the importance as a distinctive quality of the Water Polo player, precision in the shot on goal, only 30% of the coaches surveyed train shots on goal with precision requirements as a preparation task. These coaches who express training as a training task the accuracy of the shot on goal say they do it once a week,

although they admit that they are not aware of an institutionalized work methodology to train this quality of the technical foundation of the shot on goal.

c. 100% of those surveyed refer that the Water Polo Athlete's Comprehensive Preparation Program as a guiding document does not guide or conceive the performance of tests to assess accuracy in the shot at goal.

d. 80% of the coaches surveyed state that they do not know elaborate tests to measure precision. The remaining 20% state that they have read references in the scientific literature about tests to measure casting precision, but which in turn lack standardization protocols, which makes it almost impossible to reproduce the referenced procedure.

Structure of the specialized test used to verify the accuracy of the shot on goal

The structure of the specialized test used to verify the accuracy of the goal throw is based on the one proposed by Morales (1995). The potential test situation selected is chosen from the behavioral model of the competitive activity of the high-level Water Polo player (de la Celda and García, 2016). The test is composed of the chaining of several game actions that constitutes a microsituation that concludes with a shot on goal, an aspect considered as the main objective of this work, as well as the object of study of the research.

Name of the event: Precision shots at goal with both members with the ball from the water.

Objective of the test: To verify the precision in a shot at goal from the introduction of the ball into the goal through the holes arranged in the net for precision training.

Task: Throw the ball into goal with the greatest possible precision with each limb (depleted limb and dominant limb) without performing feints.

Standardization Guidance

First: Carry out a previous warm-up on land and in water. That of water was mainly made up of the technical foundations that were evaluated in the performance of this test.

Second: Always do it from 9:00 am to 11:00 am.

Third: Once the playing field has been set up with a dimension of 30 meters long by 20 meters wide (official measurements and regulated by FINA). We proceeded to the location of the signs that allowed the athletes to execute the exercise with perfect orientation clarity. The athlete positioned himself for the first series of throws at a distance of 4 meters from the goal, being guided by the line that marks the four meters, always seeking to find himself in the direction of the center of the gate. He executed five throws, lifting the ball from the water first with the dominant member and after a

five-minute break he repeats the series respecting the enabled methodology, but with the member in depletion. To carry out the throws to the goal, a precision training net was used. (Figure 1) The net has five holes (each of them has a surface area of 40x40 centimeters) distributed as follows:

• Two top angles (right and left)

• Two lower angles (right and left)

• An upper middle zone

This net is placed in one of the goals and the shot is made from the two positions described above (first series of shots from the penalty spot lifting the ball out of the water and making the foundation selected first with the dominant member and then repeated that action making another series of five throws this time with the member in depletion). Fourth: The exercises were demonstrated to the athlete.

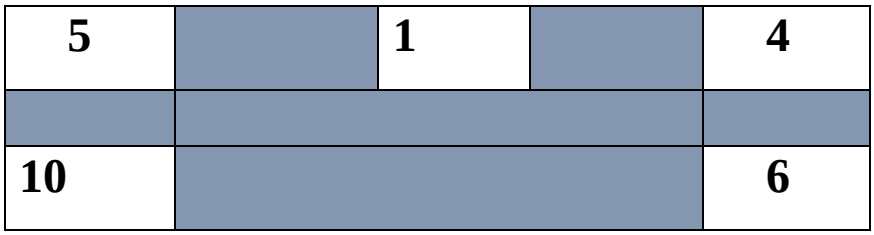

Figure 1. Pre-set zones in the training network

Fith The test was made in the following way-

Starting position: To perform the first series of throws: position of preparation for lifting the body ready to execute a shot at goal from four meters (penalty spot).

Procedure: It will be placed on the four-meter line and at the teacher's signal the athlete must begin to perform the throws, continuously. A player will be located near the player who will reach the balls to make the throw. This player facilitating the action has the five balls close to him so that the performer does not have to move to look for them and thus the concentration of his attention is on the performance of the test.

Once this first series of five pitches is completed, they are given five minutes of rest to go on to make the second series of pitches. The series must be carried out taking into account that the player must not repeat the throw to the same hole of the precision net. If the throw to the same hole of the precision net is repeated, the throw will be annulled and it will obtain the qualification of zero points.

The first series is carried out with the right-handed member and the second with the depleted member. The balls that do not penetrate the holes during the attempts made by the player performing the test receive a score of zero. Only the ball that penetrates through one of the holes of the precision training net scores for the final result of the test.

Methodological indications

• Ensure that the requirements implicit in the test are met.

• If the athlete is not able to carry out the sequence of throws continuously as explained in the description given, due to not being able to catch the ball at the time of executing the action, he is allowed to continue once he has controlled the ball through his grip.

• Always insist on the correct methodological execution of the test in relation to not repeating a shot at the same hole in the precision net in the series of throws.

• It is suggested, in order to organize the series of throws and respect the established methodology to carry out the test, first throw to the holes in the upper area of the goal (upper left corner, upper central angle, upper right corner) and then to the holes in the lower area of the door (lower right corner and then lower left corner).

Sixth: It is proceeded to quantify the number of throws scored in the holes delimited by the precision net used.

Means and Instruments

• Playing field used for official FINA competitions.

• Five Mikaza 6009 Water Polo balls.

• Signs made on a wooden base by placing a flag on its base, a detail that makes it visible to athletes and coaches, being placed on the edge of the pool.

• Precision training network for shots on goal.

Qualification form

• The shots scored in the holes delimited by the precision net used.The quantity is quantified noting this in the protocol developed to follow the incidence of the test.A point rating is awarded to each ball that penetrates for each assigned angle.

Researchers: Three

• Two researchers to ensure compliance with the standardization conditions.One on the four-meter line and the other observed and specified the number of throws made by the holes.

• An investigator to record the incidents of the test in the protocol.

Protocol:

Record of shots scored by the player during the test of precision shots on goal with both members with the ball from the water.

Table 1. Launch control protocol

Player	**First series of throws**					**Second series of releases**				
	1	2	3	4	5	1	2	3	4	5

Acceptance and questionability criteria. Once the test is prepared, it is collected through the survey for criteria of criteria of selected specialists, about the potentialities that the procedure presents to achieve the objective for which it is intended. The opinions offered by the specialists were condensed, grouping and organizing their relationship into two groups: acceptance criteria and questionability criteria. **Criteria o of acceptance**.

a.The selected test is directed and consumes a necessary and unavoidable process of sports preparation: the control of a very important property that is little controlled by coaches in the training process.

b. The test execution methodology and its components are within the reach of the trainers, they do not require a sophisticated apparatus for its implementation.

c. The contents of the tests are selected from the Water Polo player's own training context. Appropriate exercises were used and typical of the player's work in his sports specialty, which bases his suitability.

d. The stated methodology to operationalize the test is standardized and functionally efficient.

e. The declared test can enrich the arsenal of ways of a coach to verify properties and abilities of the Water Polo player in addition to benefiting the specialized bibliography on the subject dealt with.

Criteria for questionability.

a.It is suggested to graph the methodologies for carrying out the tests, which contributes to enriching the analysis that is made about their construction and their application dynamics.

b. Although it was considered that the declared methodology to operationalize the tests is standardized and functionally efficient, the setbacks that the nature of the property that is verified must be taken into account for the validation process.

Basic quality criteria.

García (2017) when referring to the test validation processes reflected on the use of basic criteria to start a preliminary validation process. In this regard, he stated that there are moments in which the validation process of a test situation passes in which the researcher preliminarily assumes basic criteria that he manipulates to conjecture about the quality of the test. Elements such as:

That accomplish with the content information level (**logical**). The content analysis of the level of information by seasoned and experienced specialists in the sport under study allows the always important question: does the task to develop in the potential test situation, from the analysis of its content measure what it says to size?

The inclusion of specific content depends on the judgment of the author of the test. An expert enough person can make a first assessment of what a test measures by examining its content. This validity is invoked when it becomes immediately apparent that the condition tests themselves represent the best possible criterion for the conditional faculty or rationale under study.

Discriminatory validity can be used. Here it is talked firstly about the possibilities of the test, to point out the minimal differences between the athletes and secondly about the quality of the tests that ensure that the results obtained in this test unequivocally demonstrate the presence of the subject. in the range that the test claims to measure, since no other capacity or attribute of the foundation, other than the one indicated by the test, could allow to achieve similar results.

Compliance with basic quality criteria

First criterion: Does the constructed test meet the content information level (logical)? By responding to the estimate endorsement, the specialists are responding to the problem faced by the researchers in this work, consisting of determining whether the task set out in the test adequately represents the way to obtain an indicator that distinguishes the precision in the shot at goal. in youth Water Polo players. 100% of those surveyed gave a favorable evaluation of what the proposed test measures considering its content. All responded that the proposed task fully corresponds to the objective for which it is applied, which is why they awarded the category of efficient to the content of the test and obtaining an indicator that distinguishes the precision in the shot at goal in youth players of Water Polo. The test has content information level.

Its practical application allows issuing reliable criteria about the properties of the test to distinguish it as a procedure.

Second criterion: Is there discriminative validity for the test subjected to preliminary validation?

Is the result obtained when applying the test capable of pointing out the minimum differences between the athletes and locating it within a group using the discrimination tendency of the subjects according to their abilities?

Table 2 below shows the results obtained in the quantitative indices used (efficiency of the throws and the percentage of defects) to demonstrate the potential of the procedure to discriminate the athlete in a group from the results of the applied test, we can affirm the existence of this type of validity as a basic quality criterion.

Table 2. Efficacy of the launches and the Percentage of defects

Athletes	**Throwing efficiency**	**Position occupied within the group**	**Percentage of defects**	**Position occupied within the group**
1	2 / 10=0,2	3	80	20
2	2 / 10=0,2	3	80	20
3	4 / 10=0,4	1	60	40
4	2 / 10=0,2	3	80	20
5	2 / 10=0,2	3	80	20
6	2 / 10=0,2	3	80	20
7	2 / 10=0,2	3	80	20
8	3 / 10=0,3	2	70	30
9	2 / 10=0,2	3	80	20
10	2 / 10=0,2	3	80	20
11	2 / 10=0,2	3	80	20
12	2 / 10=0,2	3	80	20
1	2 / 10=0,2	3	80	20
2	2 / 10=0,2	3	80	20

Although, due to the characteristics and content of the test, there are several athletes in the team with the same values of effectiveness and percentage of defects in the throw, which may not allow in the individuals concentrated in the center of the list of results to establish with The trend is clear, it is possible to know the most advantaged and the least advantaged in the controlled foundation.

Other elements that the scoring system manages to provide can be considered in order to improve the clarification of the trend, which does not affect the content of the indicator established to measure the quality of the attribute of the rationale for control.

Conclusions

A test was built to verify the precision in the shot on goal in the Water Polo from a potential situation extracted from the behavioral model of the Water Polo player called: Precision shots on goal in a penalty situation with both members with the ball from the water.

The application of the basic scientific-methodological criteria to preliminarily assess the quality of the constructed test, allowed to affirm that it meets the primary quality conditions to be considered a test that could reliably verify the precision of the shot on goal in a situation of Penalty in water polo youth players.

References

From the Cell, A; Garcia Luis. (2015). Behavioral model of the competitive activity of the Water Polo player. Digital magazine: https://www.efdeportes.com. year 20 - Nº 205https: //www.efdeportes.com/efd205/actividad-competitiva-del-polo-acuatico.htm García, L. (2017). Basic criteria for starting a preliminary validation process in the tests. First Convention of the Central University "Marta Abreu de las Villas" https://www.researchgate.net/publication/335868267

González, J., & Valadez, A. (2016). Personality and psychological response in athletes. Temporal and adaptive representation of the person-sport process. Challenges. New Trends in Physical Education, Sports and Recreation, (30), https://dialnet.unirioja.es/descarga/articulo/5529628.pdf

Gómez, J., Cejuela, R., Sellés, S. (2020) Analysis of performance factors in elite male Water polo TRANCES Magazine of Transmission of Educational Knowledge and Health 2020; 12 (2) https://www.researchgate.net/publication/340900039

Lozano, D., Camerino, O., Hileno, R. (2016). Dynamic Offensive Interaction in High Performance Handball. Apunts. Physical Education and Sports, 125. https://doi.org/10.5672/apunts.2014-0983.

Lupo, C., Tessitore, and Capranica, L. (2010). Notational Analysis of Elite and Sub-Elite Water Polo Marches. The Journal of Strength and Conditioning Research 24 (1), 223-229. http://dx.doi.org/10.1519/JSC.0b013e3181c27d36.

Manchado, C., Tortosa-Martínez, J., Vila, H., Ferragut, C., & Platen, P. (2013). Performance Factors in Women¼s Team Handball. Physical and physiological aspects - A review. Journal of Strength and Conditioning Research, 27 (6), https: //pubmed.ncbi.nlm.nih.gov/23439330/

Morales, A. (1995). Specific tests for the control of the development of the cognitive processes of the fencer 14 - 16 years old. Thesis of Doctor of Pedagogical Sciences. ISP. Havana

Peñaloza, R., Jaenes, J. C., &Jaenes, P. (2016). The explanatory power of anxiety in the mood of Spanish athletes. Challenges. New Trends in Physical Education, Sports and Recreation, (30), https://dialnet.unirioja.es/servlet/articulo?codigo=5529627

Utkin, V. (1988). Biomechanical aspects of sports tactics. Moscow: Vneshtorgizdat Publisher.

Vila, M. (2016). Cross-sectional studies of the assessment of specific force in water polo. Apunts. Physical Education Sports Digital Magazine. (118) 4th quarter 59-67.https: //revista-apunts.com/