

## METHODOLOGY FOR MONITORING THE EFFECTIVENESS OF THROWING TECHNIQUES IN THE JUMP OF HANDBALL PLAYERS OF DIFFERENT QUALIFICATIONS

**Azizov Sobitkhon Valiyevich**

Namangan Pedagogical Institute candidate of Pedagogical Sciences Associate Professor

*Email:* [azizovsobitkhon@mail.ru](mailto:azizovsobitkhon@mail.ru)

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**Abstract:** in this article, in addition to information about the speed of athletes in the performance of handball techniques, movement coordination, speed of the ball, height of the jump, the methodology for controlling the effectiveness of the shooting techniques of qualified handball players in the jump is described.

**Keyword:** handball, highly qualified, athletes, coordination, quick strength, physical qualities, jumping, technique, shooting, efficiency.

## МЕТОДИКА КОНТРОЛЯ ЭФФЕКТИВНОСТИ БРОСКОВОЙ ТЕХНИКИ В ПРЫЖКЕ У ГАНДБОЛИСТОВ РАЗНОЙ КВАЛИФИКАЦИИ

**Аннотация:** в данной статье, помимо информации о скорости спортсменов при выполнении гандбольных приемов, координации движений, скорости мяча, высоте прыжка, разработана методика контроля эффективности бросковой техники квалифицированных гандболистов в описан прыжок.

**Ключевые слова:** гандбол, высокая квалификация, спортсмены, координация, быстрая сила, физические качества, прыжки, техника, стрельба, результативность.

## RELEVANCE OF THE TOPIC

Currently, the scientific substantiation of the process of improving highly qualified athletes and the development of effective methods of managing the training process are gaining leading importance. For effective management of the training process, information is needed on quantitative indicators and qualitative analysis of the interrelationships of various characteristics of motor actions. Among the most pressing issues of training athletes in sports games is the control of technical and tactical skills, the level of which largely determines the result of competitive activity. For the successful improvement of technology, it is important to identify those criteria by which the level of their technical skill can be assessed.

In modern women's handball, the strength and accuracy of shots at the goal have significantly increased with an increased pace of play. Therefore, there was a need for an in-depth study of the structure of the throw and the development of new technologies to improve the technical training of handball players. This, in turn, imposes requirements for the development of training programs taking into account the individual level of mastery of the throwing technique and the motor qualities realized in it. The construction of movements when performing a jump throw is characterized by considerable complexity, therefore the pedagogical process of improvement is lengthy. In this regard, one of the urgent problems of modern handball is the optimization of the process of improving the handball throw based on the study of its biomechanical structure. Research in this direction is of great practical importance, as they meet the demands of sports practice.

**The object of the study** was the process of technical training of handball players of different qualifications.

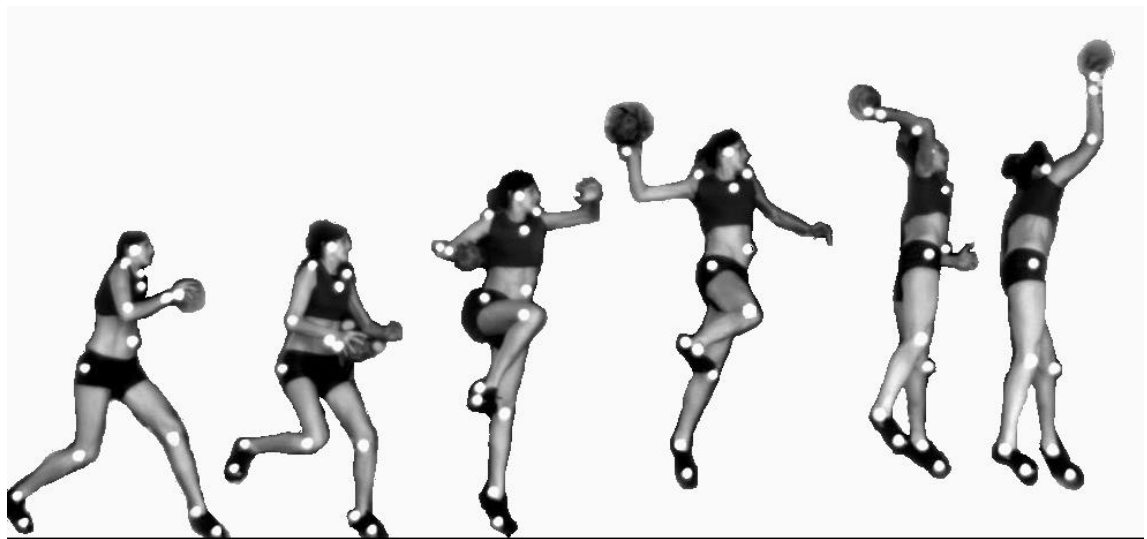
**The purpose of the study** is to evaluate the effectiveness of the handball throw technique in the jump and experimentally test the methodology of its improvement.

In order to achieve this goal and verify the hypothesis put forward, the following tasks are defined:

1. To investigate the kinematic structure of the technique of throwing in the jump of handball players and to determine the indicators of its absolute effectiveness.
2. To study the technique of throwing in a jump from handball players of different qualifications and to identify indicators of its comparative effectiveness.
3. To determine the individual level of the implementation efficiency of the technique of throwing in a jump based on the study of the relationship between the speed of the ball departure and the indicators of physical fitness of handball players.
4. Develop practical recommendations for improving and controlling the technique of throwing in a jump.

**The theoretical basis is the work** of specialists in the general theory of sports V.K. Balsevich, Yu.V. Verkhoshansky, Yu.K. Gaverdovsky, L.P. Matveev, V.P. Platonov, etc.; specialists in biomechanics of sports D.D. Donskoy, M.A. Godik, V.M. Zatsiorsky, G.I. Popov, N.G. Suchilin, A.A. Shalmanov, etc.; handball specialists A.A. Akramova, A.G. Danilova, S.I. Dorokhova, V.Ya. Ignatieva, I.V. Petracheva, V.I. Tkhoreva, etc.

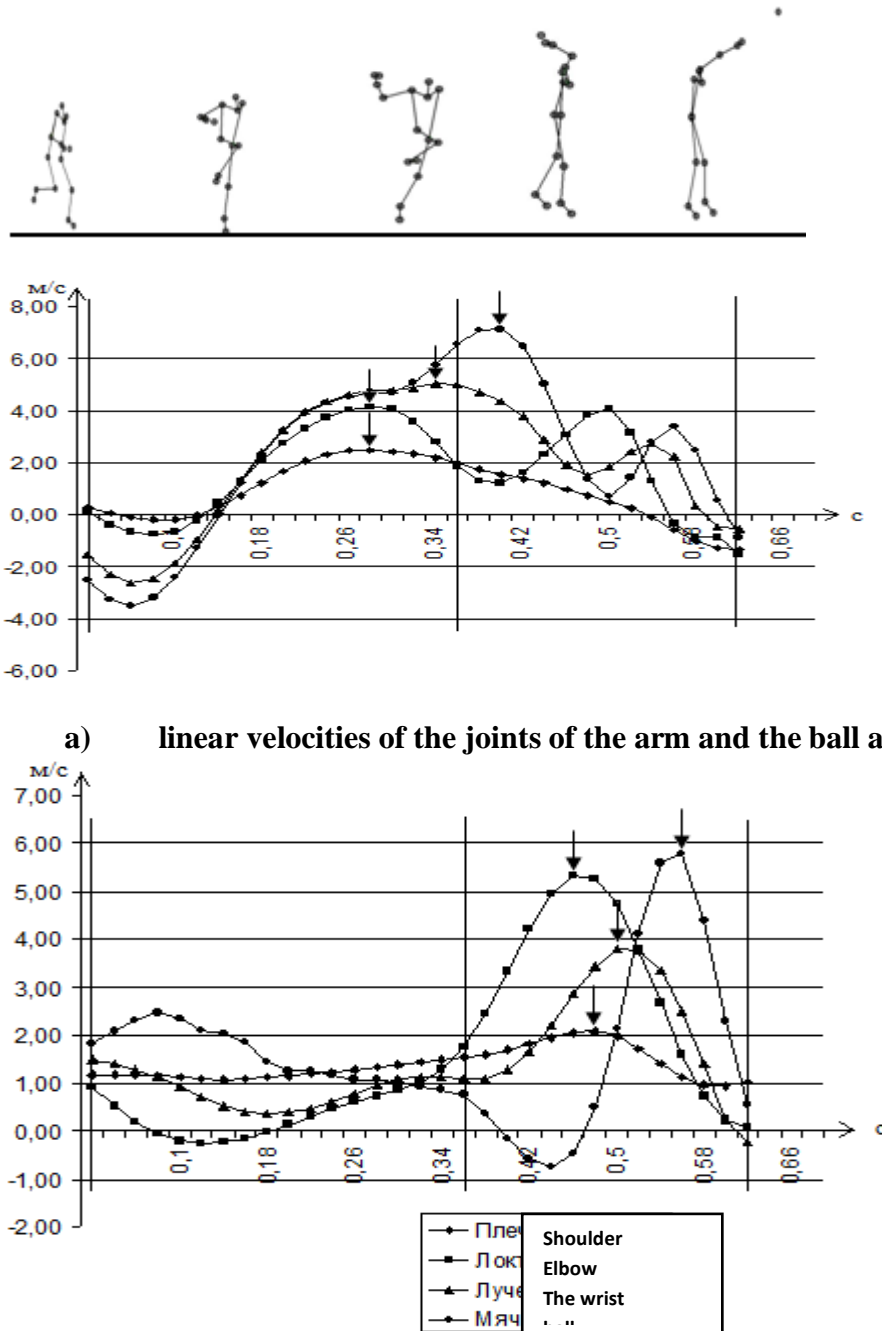
**The main content of the work** a jump throw is a complex technical technique consisting of several consecutive elements: run-up, push-off, swing and kick-off, flight, swing, acceleration of the hand with the ball, release of the ball and landing (Fig.1).



**Fig.1. The sequence of the phases of the throw in the jump of highly qualified handball players.**

The average speed of the ball departure from the handball players was 22.28 m / s, and in the best attempts this speed reached a value of 23.54 m / s. Experimental data indicate that the movements and changes in the velocities of individual parts of the body have a very complex character (Fig.2). When performing a throw, a sequential acceleration of individual parts of the body is traced. With the proximal-distal sequence of inclusion of the body links, the speed of the ball increases dramatically by the time of release, when all previous movements of the links provide a whip-like movement of the hand. There is a consistent inclusion in the work of the links of the hand with the ball and an increase in the speeds of individual links. The average index of

the maximum values of horizontal velocities of the wrist joint was 12.09 m/s, elbow joint – 10.42 m/s, shoulder joint – 3.97 m/s.



**Fig. 2. Linear velocities of the joints of the arm and the ball along the X, Y, Z axes.**

The vertical velocity of the elbow joint decreases with an increase in the values of the velocities of the ball and the wrist joint, the transition from the pre-tension phase in the "stretched bow" position to an active effect on the ball is carried out. In the phase of the final effort, a sequential acceleration of the links of the arm is carried out and by the time the ball departs, its speed reaches maximum values.

The correlation coefficients between the speed of the ball's departure and the indicators of the technique of throwing in the jump were calculated (Table.1). The closest relationship between the speed of the ball departure is observed with the values of the horizontal maximum speeds of the links of the arm in the final effort. The correlation coefficient with the maximum velocity of the wrist joint was 0.82, elbow – 0.67, shoulder – 0.59.

**Table 1**

**Correlation coefficients of the ball departure velocity with kinematic characteristics of the technique of throwing in the jump of handball players (n=33,  $p<0.05$ )**

№	Biomechanical characteristics of the throwing technique	<i>r</i>
1.	Horizontal maximum velocity of the wrist joint	0,82
2.	Horizontal maximum speed of the elbow joint	0,67
3.	Horizontal maximum speed of the shoulder joint	0,59
4.	The maximum vertical speed of the knee joint of the flywheel leg when performing a swing	0,94
5.	Maximum horizontal speed of the knee joint of the flywheel leg	0,75
6.	Length of the last run-up step	0,44
7.	Horizontal movement of the upper chest point from the moment of repulsion to the moment of departure of the ball	0,55

These data convincingly prove the relationship between the speed of the ball's departure and kinematic indicators, including footwork indicators. The analysis of these relationships confirmed the importance of the active setting of the thrust leg, the optimal depth of flexion of the leg during the period of depreciation, a wide range of motion and an increase in the speed of the knee joint of the swing leg forward-upward. The correlation coefficients of time indicators have negative values. The shorter the duration of the throw, the time from the setting of the pushing leg to the position of the "stretched bow", the shorter the duration of the repulsion, the greater the speed of the ball departure.

### CONCLUSIONS

The analysis of the relationship between the speed of the ball departure and the kinematic characteristics of the throwing technique confirmed the importance of the active setting of the thrust leg, the optimal depth of leg flexion during the depreciation period, a wide amplitude of movement and an increase in the vertical speed of the knee joint of the flywheel leg when performing the throw. The closest relationship between the speed of the ball departure is observed with the maximum values of the horizontal speeds of the links of the arm in the final effort. The correlation coefficient with the maximum velocity of the wrist joint was 0.82, elbow–0.67, shoulder– 0.59 ( $p<0.05$ ). The maximum value of the vertical velocity of the knee joint of the flywheel leg is interrelated with the length of the last run-up step ( $r=0.62$ ) and with the maximum value of the horizontal velocity of the knee joint of the flywheel leg ( $r=0.68$ ).

The players of the national team had the highest motor potential and demonstrated the highest indicators of implementation efficiency, and the participants of the pedagogical experiment, the handball players of the Luch super league team had low implementation efficiency for such a level of athletes. The use of specially developed pedagogical programs in the pedagogical experiment eliminated the identified individual shortcomings of the technique, as a result, the ball departure rate and the level of implementation efficiency increased.

The conducted research of the kinematic mechanisms of the jump throw allowed us to formulate pedagogical requirements that are necessary for training and improving the throw: perform a throw at an optimal take-off speed; place the thrust leg on a support with an optimal angle of flexion in the knee joint; perform active extension of the thrust leg and straightening of the trunk; perform a quick swing with the foot up. Special attention should be paid to special exercises aimed at improving the movement of the legs when performing push-off and swing movements.

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