The kinematic characteristics of a «click» strike are shown in table 2.

Table 2

Kinematic impact characteristics by «click»

Kinematic characteristics	Indicator value x±δ
Swing (s)	0.197±0.021
Impact action (s)	0.290±0.035
Shock interaction (c)	0.186±0.031
Post-impact action (c)	0.125±0.021
Casting time (s)	0.798±0.27
Angle of the club when swinging (to the horizontal) (degree)	37.1±3,.8
The angle between the stick and the floor surface at the moment of its touch (degree)	62.3±2.9
Speed of movement in the shoulder joint (m/s)	4.87±0.07
Speed of movement in the elbow joint (m/s)	9.74±0.09
Speed of movement in the wrist joint (m/s)	11.6±0.8

The revealed biomechanical features of the «sweeping» throw and impact by the «click» method make it possible to determine the rational technique of the action in floorball. This can be used in teaching and improving the elements of the game in floorball.

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BIOMECHANICAL ANALYSIS OF ADAPTATION PROCESSES IN SKELETARY MUSCLES OF PLAYERS IN HANDBALL

Key words: *myometrium, functional condition, skeletal muscles, load parameters.*

Abstract. *The aim of this work was to determine qualitative and quantitative parameters of physical loads of female handball players, based on biomechanical parameters of muscular activity. Parameters used technical-tactical training exercises must be based on the nature of their perception by the ath-*

lete's body. Excessive physical activity may lead to overstrain of the functional systems of the body. This can affect not only the effectiveness of conducting training sessions, but also the result of competitive activities.

In team sports games, effective competitive activity, corresponding to a high sports result, makes certain demands, primarily to the collective interactions underlying the creation of favorable game situations for the victory over an opponent. Therefore, the criteria for assessing the effectiveness of real collective activities should be the parameters of the team's competitive activities, contributing to the achievement of victory in both a separate match and in a series of games.

At the same time, the effectiveness of collective interactions is largely due to the level of individual preparedness of individual athletes, which is the basis of not only the creation but also the realization of beneficial situations [2,9]. Obviously, this fact determines the existence of certain requirements for the status and competitive activity of individual players in accordance with their role [3]. Consequently, these requirements, aimed at achieving a high sports result, can also serve as criteria, but already an assessment of the real indicators of the individual preparedness of the players [1,4].

The evaluation of training influences obeys to the processes of adaptation to intense muscular activity. In this regard, the rationing of training loads should be based on a comprehensive analysis [6].

The structure of training loads of female handball players is determined by qualitative and quantitative parameters. These parameters are based on the criteria for the immediate and long-term adaptation of skeletal muscles in the performance of special training methods [5,7]. It seems that the requirements specified in the analysis of information for improving the effectiveness of collective and individual competitive activities, as well as the level of the players state allow to begin the immediate planning of the training process at the next stage of management.

The aim of the research: increasing the effectiveness of training and competitive activities on the basis of objective biomechanical assessments of the adaptive capabilities of athletes.

Objectives of the study:

1. Identify the criteria for training loads of female handball players.
2. To determine the relationship between the means and methods of training in handball on the basis of a biomechanical analysis of the actions performed.
3. To prove experimentally the structure of training loads of female handball players.

It was assumed that the programming of the training process of handball players, based on an objective biomechanical assessment of the athletes' adaptive capabilities, will ensure a systematic increase in the level of physical and technical-tactical preparedness.

Change in the level of physical and technical-tactical training handball players taking into account the biomechanical characteristics of skeletal muscles.

The main method of research during the scientific work, at the first stage was the myometrium during the physical exercises.

At the second stage, a pedagogical experiment was conducted to assess the impact of the experimental program on the athletic result.

The study involved 18 female handball players belonging to the handball club «Gomel».

Means of data collection and devices used:

1. Myometr «Mioton — 3»
2. System of video analysis of movements «KinoVea».

The research was carried out at the laboratory of physical culture and sports of Francisk Skorina Gomel State University. The exploration have been conducted in the framework of the State Program of Scientific Research of the Republic of Belarus «Convergence-2020».

The functional state of skeletal muscles, when performing special exercises in handball, was performed in Vivo, based on the data obtained in previous studies [7,8,10,11]. Myometric studies were conducted on *m. biceps brahii, m. triceps brahii, m. extensor Capri radialis longus, m.biceps femoris, m. rectus femoris, m. gastrocnemius (caput laterale and caput mediale*). From the functionality of skeletal muscles, evaluated by the indicators of muscle tone (by the difference in frequency of oscillations in the muscle (frequency) in a relaxed and stressed state), the adequate ability of the muscle to resist the changes in its shape as a result of the action of external forces, determined by the stiffness index of muscle tissue in the relaxed and stressed state of decrement and the strength potential of the skeletal muscle, determined by the stiffness parameters in the relaxed and stressed state, is substantially dependent on the individual response of health to the performance of the subsequent load.

As an example of the behavioral response of the skeletal muscle and the change in its functional state over time, we give the loading data *m. triceps brahii* in the repeated serial work of making throws at the target. The exercise was carried out from a two-point starting position. Operating mode — 30 seconds of active work after 1 min of rest. Functional state of skeletal muscles was performed at the end of each series of exercises, and, also, every subsequent 24 hours after the exercise.

According to the results of the conducted experiment, it was revealed:

— tonic tension of the skeletal muscle is in the state of normal (by the difference in the index in the relaxed and stressed state) during the first three series.

— beginning from the 4th series, there is a decrease in the index in the state of tension, which is a consequence of the coming fatigue;

— refusal of work is noted after the 10th series. 24 hours after the exercise, there is a high level of muscle tone in the relaxed state, which indicates a low level of recovery of skeletal muscle and its unavailability to exercise;

— recovery of muscle tone to normal occurs after 48 hours.

— after the second repetition, the elasticity index of the skeletal muscle decreases, the worst state of which is observed after the eighth repetition. In the future, there is an improvement in this indicator, which, in our opinion, is a consequence of the activity of recovery mechanisms. Restoration of the elasticity index to the normal level is observed after 48 hours.

The adequate ability of the muscle to resist the changes in its shape as a result of the action of external forces, determined by the stiffness of muscle tissue in a relaxed and stressed state, has a negative index after the fourth repetition, which indicates the onset of fatigue and the inability of the skeletal muscle to recover mechanical energy. Over the next six repetitions, this indicator continues to decline. The worst indicators of this parameter, determining the power capabilities of the skeletal muscle at a given time, are noted 24 hours after the end of the load. Restoration of the stiffness properties of the muscle to the normal level occurs after 48 hours. However, this time is not enough to restore to the initial level, marked before the start of the load.

Based on the results obtained in the preliminary experiment on the quantitative parameters of training loads, an experimental program of training sessions for the sports season was developed and approbated.

In the course of the study pedagogical testing was conducted to study the indicators of technical-tactical preparedness of handball players. Table 1 shows the mean group values used in the experiment of the subjects.

To assess the technical preparedness, the most informative tests were used: running a ball with a stroke of obstacles, 20 assists in a pair and 5 throws at the gate from a line of free throws.

In the analysis of the results, significant differences were found in all the control tests: running a ball with a stroke of obstacles (before the experiment: 58.3 ± 0.7, after the experiment: 53.6 ± 0.5), 20 assists in pair (before the experiment: 1.05 ± 0.36, after the experiment: $1.02.1 \pm 0.48$), 5 throws at the gate from a line of free throws (before the experiment: 44.0 ± 0.8, after the experiment: 41.0 ± 0.2).

Taking into account the obtained data, it can be concluded that the level of physical and technical preparedness has significantly increased during the period of the experiment. In connection with the foregoing, it can be stated that the application of the experimental program has a positive dynamics on the level of technical-tactical preparedness of handball players.

Also, in addition to pedagogical research, the dynamics of the level of technical preparedness can be judged by the percentage of victories and defeats in the playing season (the gain of victorious games was 13 %).

1. As the leading special physical qualities of female handball players of high qualification, the leading physical qualities were singled out: coordination, speed of execution of single movement and special endurance;

2. The main principles of programming the training process include: the use of different options for building training sessions, which depends on the period in the annual cycle of the training process (selective (contributing to the predominant development of certain properties and abilities that determine the level of special preparedness of handball players — speed or strength, anaerobic or aerobic performance, special endurance, etc.) and complex orientation (suggest the use of training exercises that help solve several problems).

3. The implementation of the experimental training program was accompanied by a reliable increase in the rates of speed, strength, endurance, and indicators of the level of technical preparedness of female handball players.

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MODEL PARAMETERS OF LOSS AND SHOCK IN FLOORBOL

Key words: *floorball, kinematic characteristics, biomechanics, skeletal muscles*

Annotation. *The success of gaming activity depends on the readiness of skeletal muscles to effectively carry out technical action. The article shows the biomechanical parameters of the «sweeping» throw and impact with a «click» in the floorball.*

Blows are an effective way to attack the team's actions. Despite the simplicity of the game, the floorball technique is very complex. This complexity is determined by the fact that all the technical methods of the game are performed with a brief contact of the club and the ball. These techniques need to be carried out always effectively when the conditions of the game change [5].

Floorball makes high demands on the technical skills of athletes. Technical training in floorball is of great importance.

Model parameters of movement in sports games are determined by the stability of the actions, regardless of the nature of the game [2,6,11]. Model parameters of motion are associated with a change in the functional state of skeletal muscles during fatigue [4,10,12].

Evaluation of the biomechanical parameters of training and competitive activities is very important [1,3,8,9].

The model characteristics of motion in floorball were determined using video analysis of game exercises. The functional state of skeletal muscles was also taken into account [7, 13]. For this purpose, video cameras and software «KinoVea» were used.

With the help of video analysis, we registered:

— the speed of the shoulder joint;

— velocity of the elbow joint;

— speed of the wrist joint;

— the maximum speed of the club; average speed of the club when the ball is dispersed;

— angle of the club when swinging (to the horizontal);

— the angle between the stick and the floor surface at the moment of its touch.

As a technical technique, we investigated: a throw with a long acceleration of the ball — a «sweeping throw» and a «click» strike. A shot and a stroke were performed in a serial manner. In each series, each player performed 10 attempts. In total, each player was executed for 4 series.

The analysis of the conducted research revealed the model parameters of the equipment:

— average speed of the club when the ball is dispersed — 6.54 ± 0.79 (m/s);

— speed of movement in the shoulder joint at the throw –5.01 ± 0.02 (m/s);

— speed of movement in the elbow joint at the throw — 8.69 ± 0.11 (m/s);

— speed of movement in the wrist joint at the throw — 9,9 ± 0,2 (m/s);

— the maximum speed of the club when cast — 27.4 (m/s);

— angle of inclination of the club when swinging (to the horizontal) — 37.1 ± 3.8 (degrees);

— the angle between the stick and the floor surface at the moment of its touch — 62.3 ± 2.9 (degrees);