

# Characteristics of indicators of bioelectric activity of muscles in the implementation of motor actions of athletes who have completed their careers

UDC 796.015



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## Abstract

**Objective of the study** was to evaluate the parameters of the activity of the neuromuscular apparatus during the performance of various technical elements by athletes who have completed their careers.

**Methods and structure of the study.** The scientific experiment was carried out in the laboratory of neurophysiology (Scientific Research Institute of Problems of Sports and health-improving physical Culture, Velikiye Luki) with the participation of a male contingent with many years of experience in competitive activity in speed-strength sports in the past. Qualification - Master of Sports and Master of Sports of International Class. The registration of muscle activity parameters was carried out using modern automated equipment when performing special motor actions and was evaluated by the following criteria: frequency, amplitude, integral. Processing of the results of the study was carried out with a special computer program MegaWin.

**Results and conclusions.** In the course of the experiment, objective information was obtained on the parameters of the activity of the neuromuscular apparatus during the performance of technical elements of varying coordination complexity. The results of the study allowed us to draw the following conclusions: in game activities, when performing technical elements, the main work is performed by 70.5-75.2% of active skeletal muscles. The mechanisms for regulating the activity of the muscles that receive the main movement have specific features, taking into account the type of activity and are an argument for scientific support for the organization of a motor regimen of a health-improving orientation for athletes who have completed their careers in elite sports.

**Keywords:** *bioelectric activity of muscles, neuromuscular apparatus, muscles, athletes who have completed their careers.*

**Introduction.** A sports career is fleeting, and after its completion there are always problems associated with overcoming the transitional period of the athlete's adaptation to a different social status. However, in the field of scientific research, due attention is not given to the problem associated with the adaptation processes occurring in the neuromuscular apparatus of athletes, namely after a long period of retirement [1-3]. Therefore, one of the important fragments in solving this issue is the study of the activity of the neuromuscular apparatus in a complex monitoring system for assessing the psychophysiological state of the body of athletes after the termination of a sports career [1-3].

**Objective of the study** was to evaluate the parameters of the activity of the neuromuscular apparatus

during the performance of various technical elements by athletes who have completed their careers.

**Methods and structure of the study.** In the laboratory of neurophysiology (Scientific Research Institute of Problems of Sports and health-improving physical Culture, Velikiye Luki), using modern automated equipment (16-channel MegaWin ME 6000), a study of the functional state of the neuromuscular apparatus was carried out, the assessment of which took into account the criteria: frequency, amplitude, integral. The study involved athletes (men) who completed their sports career and had many years of experience in competitive activities in speed-strength sports in the past, who confirmed their survey with informed consent. Age - 35-45 years old, sports title - Master

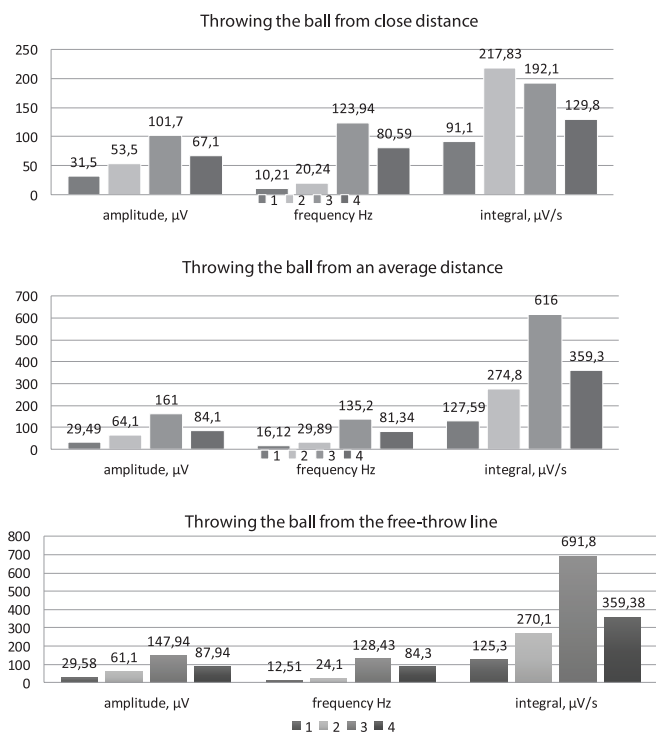
of Sports (n=7) and Master of Sports of International Class (n=5).

The following parameters were recorded: four skeletal muscles of the upper limb when throwing a basketball into the basket from a place from a different distance from the basket (number of participants: n=6); ten muscles involved in kicking a soccer ball with the instep of the midfoot and the inside of the foot (n=6). When recording electromyograms (EMG), disposable disk electrodes with an interelectrode distance (2.0 cm) were used, which were located taking into account safety, the absence of interference with the movement of the studied area of the body and artifacts during recording [4, 6]. The registration of muscle activity parameters was evaluated by the following criteria: frequency, amplitude, integral. Processing of the results of the study was carried out with a special computer program MegaWin.

**Results of the study and their discussion.**

Analysis of the results of the study, conducted by E.N. Chernysheva and E.N. Karaseva [5, 6] allowed using electromyography to obtain information related to the recording of muscle activity when former athletes perform various types of motor activities:

• **In the first series of the study**, a recording of muscle activity was recorded when playing a basketball throw with one hand from a place:



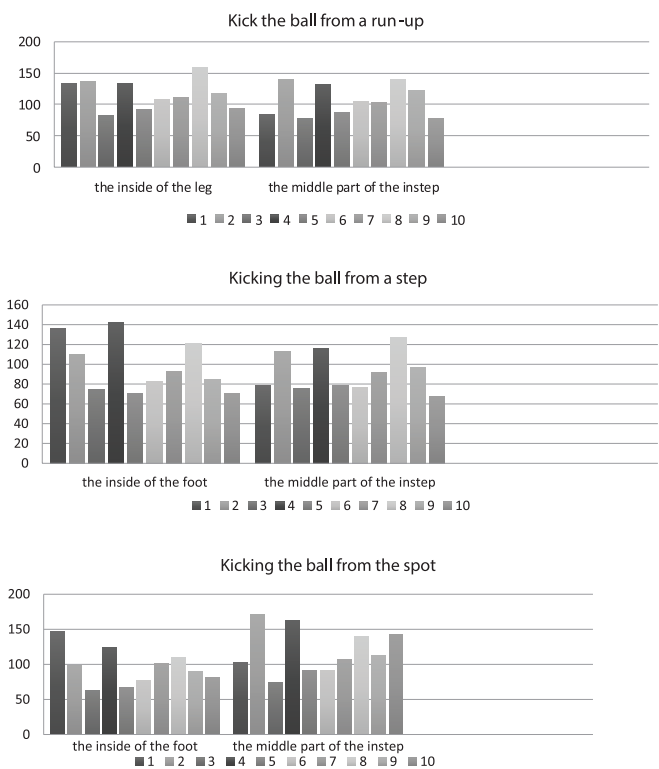
**Figure 1.** Total indicators of muscle activity when playing a basketball throw from different distances: 1 – biceps brachii; 2 - triceps muscle of the shoulder; 3 - radial flexor of the hand; 4 - ulnar extensor of the hand

– from a close distance: the highest total amplitude parameters were noted in the radial flexor of the hand (p<0.002); in the biceps muscle of the shoulder - lower (p> 0.001);

– from an average distance: the greatest activity in the muscles during the performance of work was shown by: the triceps of the shoulder, the radial flexor of the hand and the ulnar extensor of the hand (p<0.001); biceps shoulder - lesser degree (p>0.001);

– from the foul line: for all evaluation parameters: the highest activity was noted in the radial flexor of the hand (p<0.001) and the lowest activity was in the biceps muscle of the shoulder (p>0.002) (Figure 1).

Summarizing the parameters of the first series of the study, it should be noted that when playing throws: to a greater extent, the load is distributed on the radial flexor of the hand (its electrical activity determines the effectiveness); regardless of the distance to the basket, the muscles of the ulnar extensor of the hand and the triceps of the shoulder exert additional force; the muscles of the forearm (include the brush in the work) and the triceps of the shoulder (extends the elbow joint) regulate the accuracy of the ball hitting the ring;



**Figure 2.** Amplitude parameters of registration of muscle activity during the reproduction of a hit on the ball: 1 - anterior tibial muscle; 2 - soleus muscle; 3 - lateral head of the gastrocnemius muscle of the leg; 4 - medial head of the gastrocnemius muscle of the leg; 5 - lateral head of the quadriceps femur; 6 - biceps thigh; 7 - straight head of the quadriceps femur; 8 - tensioner of the wide fascia of the thigh; 9 - medial head of the quadriceps femur; 10 - large gluteal



with a change in the distance to the basket, the amplitude of movement increases during the swing and a more powerful effort is manifested when releasing the ball in the final phase of the throw.

• **The second series of the study** involved recording a recording of muscle activity when football players reproduced two types of technical actions performed from three positions (from a place, a step and a run) (Fig. 2):

– 1st position – hitting the ball from a place (with the inside of the foot and lifting the middle part of the foot) - the greatest average-amplitude muscle activity was shown by: anterior tibial, soleus (only the middle part), medial head of the gastrocnemius muscle of the leg, tensor fascia lata, medial the head of the quadriceps femur (only the middle part) ( $p < 0.001$ ); to a lesser extent, the straight head of the quadriceps femur ( $p > 0.001$ );

– 2nd position – hitting the ball from a step: the most active muscles are: tibialis anterior (only the inside of the foot), soleus, medial head of the gastrocnemius muscle of the leg, tensor fascia lata of the thigh ( $p < 0.001$ ); less active – lateral head of the gastrocnemius muscle of the leg, gluteus maximus muscle ( $p > 0.001$ );

– 3rd position - hitting the ball with a running start: a large degree of activity is displayed in: the medial head of the gastrocnemius muscle of the lower leg, soleus, tensor fascia lata, tibialis anterior muscle (for the inside of the foot) and the medial head of the quadriceps femoris muscle (for the middle part) ( $p > 0.001$ ); less active - rectus head of the quadriceps femoris, biceps femoris ( $p > 0.001$ ).

**Conclusions.** In game activities, when performing technical elements, the main work is performed by 70.5-75.2% of active skeletal muscles. The mechanisms for regulating the activity of the muscles that receive the main movement have specific features, taking into account the type of activity and are an argument for scientific support for the organization of a motor regimen of a health-improving orientation for athletes who have completed their careers in elite sports.

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