

FEATURES OF ELECTRICAL ACTIVITY OF THE MUSCLES OF THE LOWER LIMBS AT REST IN ADOLESCENT COMPETENTS.

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Annotation. The article presents the results of electroneuromyographic studies of the functional state of the lower extremities of teenage martial artists. A comparative analysis of the obtained data revealed differences between the studied groups of athletes (boxers, judokas and Greco-Roman wrestlers) in terms of parameters of neuromuscular transmission. It has been established that martial arts athletes who train primarily speed-strength qualities have indicator values that reflect higher excitability and conductivity of nerve cells; Boxers, compared to wrestlers and judokas, have higher values of bioelectrical activity of muscle fibers. Also, using the ENMG method, lesions with changes in the speed of nerve impulse transmission were identified in athletes.

Keywords. Electroneuromyography, impulse conduction speed, athletes, muscles, M-response, foot, bioelectrical activity.

Introduction. Currently, the electromyography (EMG) method is used in various branches of scientific research and in medical practice [2,5]. Assessment of the electrical activity of muscles during contraction and at rest to identify neuromuscular dysfunctions can be carried out using the above method [1,6].

According to a number of researchers in the field of neurology, E- LMWH technology, with the help of which it is possible to conduct an objective study of the functional capabilities of the neuromuscular system in health and disease - a method that has found application in sports physiology to study the state of changes and functional activity of the neuromuscular system in the process training activities [3,5,7].

When performing ENMG, an electrode is inserted into a muscle, at the end of which a needle is mounted, which registers depolarization waves that occur during muscle contraction. The procedure consists of several components; based on the analysis of nerve conduction data along muscle fibers, diagnostic information can be obtained. The image of waves obtained by recording muscle contractions provides information about the shape, function of motor units, and their changes, which are characteristic of certain pathological conditions [1]. As a result of depolarization, the needle electrode records the sum of individual action potentials (APs) that occur close to the apex of the muscles. The change in waves during registration corresponds to the frequency of excitation of the neurons under study, i.e., the stronger the muscle contraction, the greater the number of motor neurons activated by the fibers of the corticospinal tract, i.e. higher excitation frequency [6]. When dysfunctions of the axon occur in the muscle, denervation-reinnervation processes develop, in which a decrease in the amplitude of the M-response is determined; with dysfunction of the myelin sheath, the threshold of the M-response increases and the residual latency [2].

Purpose of the study. In a comparative aspect, evaluate the neuromuscular activity of the lower extremities in adolescent martial artists.

Materials and methods of research. To achieve this goal, athletes were selected for the study groups. On the basis of children's and youth sports school No. 1 of the Sergili district of Tashkent, 63 athletes aged 10-15 years specializing in sports sections in boxing, judo and Greco-Roman wrestling whose sports experience ranged from the first teenage to the second adult category were examined. The athletes were assigned to the study groups according to their type of sport. Thus, the first group included 14 boxers, the second group included 24 judokas, and the third group included 25 Greco-Roman wrestlers. The assessment of the functional activity of the neuromuscular system was determined by ENMG

of the tibialis and peroneus extensor muscles of the big toe. Table 1 shows the normal values of the parameters of the M-response amplitude and SRT, as well as the upper limits of the norm of residual latency and the threshold of the M-response.

Table 1.

ENMG norm criteria for M-response amplitude and SRT

Indicators	Long nerves of the upper limbs	Long nerves of the lower limbs
M-response amplitude	>3.5 mV (median, radial) >6.0 mV (ulnar)	>3.5 mV
SRV	>50 m/s	>40 m/s
Residual latency	<2.5 ms	<3.0 ms
Threshold for evoking M-response	< 15 mA (200 ms)	<20 mA (200 ms)

The obtained research results were statistically calculated using standard methods for biomedical research.

Research results. A study of the changes identified using ENMG in martial arts athletes showed a decrease in M-response parameters during stimulation ENMG, which was noted along the peroneal nerve, the amplitude decreased and the area increased in the area of the foot and the lateral epicondyle of the tibia with preservation in the proximal areas. Speed and latency parameters were preserved. When other areas of the nerves were tested, the parameters were within normal limits.

Thus, when conducting an ENMG study in athletes, it becomes possible to determine pre-pathological conditions that can be identified in the early stages only using these methods, while clinical manifestations may be absent, which is especially important among the sports contingent in order to preserve their health and ensure success of competitive activity.

Table 2.

Results of the M-response from the right extensor toe brevis in martial artists, right (ENMG)

Index		Kind of sport			R	N
	Box, n =6	Jud o, n =13	Struggle, n =13			
inner ankle						
Latency, ms	32.1±29.3	2.68±0.08	2.60±0.13	1-2 p≤0.05 1-3 p≤0.05	<3.5	
Amplitude, mW	18.90±2.73	13.69±1.09	14.3±1.77	-	>3.5 mV	
Duration, ms	5.71±0.34	5.56±0.14	5.69±0.17	-	-	
Area, mV×ms²	43.5±8.7	34.85±2.52	34.1±4.55	-	-	
Speed, ms	0.00	0.00	0.00	-	>40 m/s	
popliteal fossa						
Latency, ms	0.00	0.00	0.00	-	<3.5	
Amplitude, mW	16.7±1.64	11.11±0.76	12.4±0.95	1-2 p≤0.05 1-3 p≤0.05	>3.5 mV	
Duration, ms	6.42±0.26	6.60±0.23	6.38±0.22	-	-	
Area, mV×ms²	46.79±3.2	34.57±2.39	37.0±2.11	1-2 p≤0.05 1-3 p≤0.05	-	
Speed, ms	48.3±0.57	47.67±2.39	45.9±0.89	1-3 p≤0.05	>40 m/s	
Note: p ≤ 0.05 – significant differences between comparison groups, “-” - no significant differences between comparison groups						

At the point of stimulation “external epicondyle”, the stimulation ENMG indicators between the groups did not reveal any differences at the level of significance. However, it was found that the M-response amplitude values in judokas are higher compared to boxers and wrestlers, but not significantly. The smallest values of the M-response area were noted in the group of Greco-Roman style wrestlers compared to the other two groups. The M-response latency in judokas and wrestlers is lower compared to boxers, which reflects a higher speed of electrical impulse transmission (0.21±0.21 and 0.91±0.91) along non-myelinated fibers of axon terminals. The results indicate a short period of time

spent changing the membrane potential and the occurrence of excitation in nerve cells in response to electric current in boxers, in comparison with athletes of other sports. The amplitude of the M-response at the “head of the fibula” stimulation point in judokas is significantly higher than in boxers and wrestlers. The speed of impulse propagation along the nerve fiber in the segment “external epicondyle ” - “head of the fibula” in judokas and boxers is higher than in Greco-Roman wrestlers, while in all three groups this indicator corresponds to normative values. Electroneuromyography parameters recorded from the left extensor toe brevis at the points of stimulation of the peroneal nerve in martial arts athletes are shown in Table 3.

Table 3.

Results of the M-response from the right extensor toe brevis in martial artists, left (ENMG)

Index	Kind of sport			R	N
	Box, n =6	Ju - do , n =13	g/ Roman wrestling , n = 13		
peroneus muscle recorded from the foot					
Latency, ms	3.04±0.11	2.91±0.30	2.47±0.31	-	<3.5
Amplitude, mW	7.60±1.03	6.18±0.66	7.06±0.93	-	>3.5 mV
Duration, ms	6.81±0.65	5.93±0.27	5.76±0.62	-	-
Area, mV×ms 2	28.71±5.70	21.24±2.10	23.23±3.64	-	-
Speed, ms	0.00	4.27±4.27	4.27±4.27	-	>40 m/s
peroneus muscle recorded from the lateral epicondyle					
Latency, ms	0.00	0.23±0.23	0.43±0.29	-	<3.5
Amplitude, mW	6.03±0.83	5.85±0.53	6.59±0.76	-	>3.5 mV
Duration, ms	6.69±0.34	6.55±0.30	6.49±0.26	-	-
Area, mV×ms 2	21.70±2.78	19.88±1.93	21.93±2.52	-	-
Speed, ms	48.55±1.69	50.43±2.58	39.33±4.90	2-3 p≤0.05	>40 m/s
peroneus muscle recorded from the popliteal fossa					
Latency, ms	0.00	0.00	0.00	-	<3.5

Amplitude, mV	9.22±1.13	7.71±0.71	8.14±1.04	-	>3.5 mV
Duration, ms	6.84±0.46	6.76±0.34	6.29±0.60	-	-
Area, mV×ms 2	34.77±6.29	25.81±2.50	29.98±4.56	-	-
Speed, ms	53.66±3.53	54.20±7.01	50.17±4.99	-	>40 m/s
Note: $p \leq 0.05$ – significant differences between comparison groups, “-” - no significant differences between comparison groups					

Comparison of the parameters of the M-response recorded from the left extensor toe brevis muscle during stimulation of the peroneal nerve at the “foot” point did not show significant differences in neuromuscular transmission in martial arts athletes. However, at the “head of the fibula” stimulation point, the latency values of the M-response in boxers are higher than in judokas and Greco-Roman wrestlers. The same trend was observed with stimulation of the peroneal nerve on the right. In addition, the speed of impulse conduction along the nerve fiber in judokas and wrestlers is higher than in boxers, but in all athletes of the three study groups this parameter is lower than the normative values. The duration and area of the M-response in the group of boxers is higher compared to judokas and wrestlers. At the stimulation point “external epicondyle ” of the peroneal nerve on the left, the M-response latency value is also lower in boxers than in judokas and Greco-Roman wrestlers. The amplitude of the M-response is lower in the group of judokas, as is the area. The duration of the response to electric current in the three study groups did not differ (on average 6.0 ms). The occurrence of the M-response in Greco-Roman wrestlers in terms of the speed of impulse conduction in the area “head of the fibula” - “external epicondyle ” is lower than in boxers and judokas, and also below the normative values. At the “popliteal fossa” stimulation point, the M-response latency value in the three study groups is zero. The amplitude and duration of the M response in all athletes were within normal limits; no significant differences were identified. The smallest value of the parameter “Area M - response” was noted in the group of judokas, the largest - in boxers. Despite the

rather short time between the presentation of the stimulus and the occurrence of the M-response in Greco-Roman wrestlers, the “Speed” in the area “head of the fibula” - “popliteal fossa” is lower than in judokas and boxers, while corresponding to standard values.

Conclusion. A comparative analysis of the obtained data revealed differences between the studied groups of athletes in terms of parameters of neuromuscular transmission. Thus, in martial arts athletes who train mainly speed-strength qualities, indicator values were noted that reflect higher excitability and conductivity of nerve cells. It was found that boxers, compared to wrestlers and judokas, have higher values of the bioelectric activity of muscle fibers “Amplitude”, “Area” and “Duration” of the M-response.

The use of the ENMG method in athletes allows us to identify lesions with changes in the speed of transmission of the nerve impulse. To identify and carry out topical diagnostics of lesions at the level of nerve endings, as well as to obtain a full assessment of the functional activity of the IMA with the identification of pathological foci.

Taking into account the available modern research methods, ENMG is of great interest due to the possibility of its use in sports populations, because with its help, it is possible to identify emerging changes in the neuromuscular system in the early stages. This will allow maintaining the structural integrity of the central nervous system, as well as neuromuscular fibers and the overall health of the athlete, which ensures high performance, strength, speed and coordination of movements so necessary for the success of martial arts athletes.

Based on the studied material, it was determined that martial arts athletes experience various changes in the parameters of the amplitude of the M-response and the speed of motor conduction, depending on the existing level of damage.

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