ASPECTS OF NERVOUS MOTOR CONDUCTION VELOCITY AND MOTOR RESPONSE AT ATHLETES

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Abstract: Purpose of our study was to measure nervous motor conduction velocity and motor response, important indicators of peripheral motor nerve function, in order to show their significant differences at girls and boys athletes.
Studied group was formed of 27 athletes, 14 boys and 13 girls, with an experience, in one of the practiced sports: fence or handball, for minimum 5 years, sports where the use of upper limbs is different.
Using the Nihon-Kohden MEB 9100 device, was measured the nervous motor conduction velocity, by stimulating the median nerve, at three levels: proximal (bicipital groove = level 3), elbow (level 2) and distal (radiocarpal joint = level 1) successively, at both arms. The motor response was recorded at abductor pollicis brevis muscle, using surface electrodes placed at a distance of at least 20 millimeters between them.
Were analyzed latency, duration, amplitude, area and interval and were statistically processed using Student and Pearson tests. The obtained results showed significant statistic differences at girls-boys comparison, for proximal segment, at both hands and for distal segment, only at right hand.
The results emphasized highly significant statistic differences at studied athletes, for amplitude and area parameters, at elbow and bicipital groove levels and for latency, in case of proximal stimulation.
Both studied parameters, revealed their extremely important role in pointing out, the neurophysiologic differences between girls and boys professional athletes.
Keywords: nervous motor conduction velocity, motor response, girls and boys professional athletes.

Introduction

An objective index of the peripheral motor nerve function, beside the motor response (M response) is nervous motor conduction velocity.
The motor conduction velocity (MCV) measure is performed by stimulating the motor nerve at two levels and is obtain by calculating the ratio between the distance (from one stimulation point to the other) and the time necessary to cover this distance.
M response (compound muscle action potential - CMAP) corresponds to a potential recorded from a muscle, through surface electrodes (superficial muscle), as a response to a unique stimulus applied on a motor nerve, and represents an action potentials' sum of motor unit and is characterized by latency, amplitude, duration, surface (area) and shape [1].
Purpose of our study was to measure nervous motor conduction velocity and motor response, important indicators of peripheral motor nerve function, in order to show their significant differences at girls and boys athletes.

Material and methods

Studied group was formed of 27 athletes, 14 boys and 13 girls, with an experience, in one of the practiced sports: fence or

handball, for minimum 5 years, sports where the use of upper limbs is different and the training type is characteristic. Age homogeneity was remarked, as well as the athletes height.

All subjects were informed of the study procedure, purposes and knowing risks, in order to obtain their informed consent. Each individual was initially screened for any history, signs or symptoms of either peripheral neuropathy or compression syndrome of the upper extremities.

Reaction time, coordination and nervous conduction velocity influence the level of sportive performance, therefore, being essential for measuring and tracking them in sports activities [2]. K. Takano et al. in 1991 obtained clear results, due to the large number of investigated subjects, over the correlation of conduction' velocity with the tested subjects' height, higher velocity being recorded at the shortest tested subjects [3].

Motor conduction velocity was tested by stimulating the median nerve, at three levels: proximal - bicipital groove (3), elbow (2), distal - near the brachialis artery and radiocarpian articulation (1) between the tendons of the flexor carpi radialis and palmaris longus muscles, successively, for both arms.

The stimulation device was provided by the Nihon-Kohden firm, for this test was used Neuropack M1 MEP-9200 apparatus. Muscular response was recorded at the level of the tenar muscles (abductor pollicis brevis), using surface electrodes with a diameter of 8 mm placed at a distance of at least 20 mm between them. Stimulation was made at a distance of at least 70 mm from proximal recording electrode.

By stimulation from the three levels, the following was obtained: for level 1 motor response latency, the actual MCV values being obtained through latency differences 2-1 (distal MCV) and 3-2 (proximal MCV. Data obtained by recording the muscular response were processed separately, proving values for: latency, duration, amplitude, area. The software was also used for measuring the latency differences of motor responses, recorded after stimulation at the three levels: distal (radiocarpian articulation = level 1), elbow = level 2 and proximal (bicipital groove = level 3). The interval, as shown by the program for level 1, is, in fact, the latency of response, following that only for levels 2 and 3 to represent the actual latency differences.

Results

The interpretation of the data characteristic to CMAP (compound muscle action potential) has shown modifications at every tested segment, for both upper limbs. The following parameters were analyzed: latency, duration, amplitude, area and interval (the last one represents the difference between latencies from segments of the same limb) and statistically processed, by using Student and Pearson tests.

Statistical analyze has shown that most significant differences are between values recorded for sportsmen, compared to those from sportswomen.

Were noticed significant statistical differences at comparison girls-boys, both at left hand and right one, for the proximal segment, regarding the distal one, the recorded differences were significant only for the right hand (Table 1).

Table 1. Statistical comparison for interval and MCV values

	1		2		3		2-1		3-2	
	Interval	VCM	Interval	VCM	Interval	VCM	Interval	VCM	Interval	VCM
	Right hand									
"p" comparison girls- boys	0.062						0.066	0.044	0.876	0.032
"p" comparison left - right	0.862	0.302	0.565	0.256	0.189	0.491	0.437	0.510	0.250	0.584
correlation left -right	0.132	-0.218	0.166	0.352	0.501	0.413	0.124	0.417	-0.132	0.425
	Left hand									
"p" comparison girls- boys	0.216						0.299	0.196	0.551	0.047
"p" comparison left- right	0.942	0.302	0.455	0.256	0.189	0.491	0.337	0.490	0.250	0.584
correlation left- right	0.130	-0.21	0.166	0.462	0.501	0.393	0.124	0.397	-0.132	0.425

Unlike the latency of motor response, which presents significant differences between the two subgroups (boys-girls) only for stimulation of elbow and bicipital groove at the right hand, the values of amplitude and area presented highly significant differences for all levels of stimulation and for both upper limbs (Figure 1 and Figure 2).

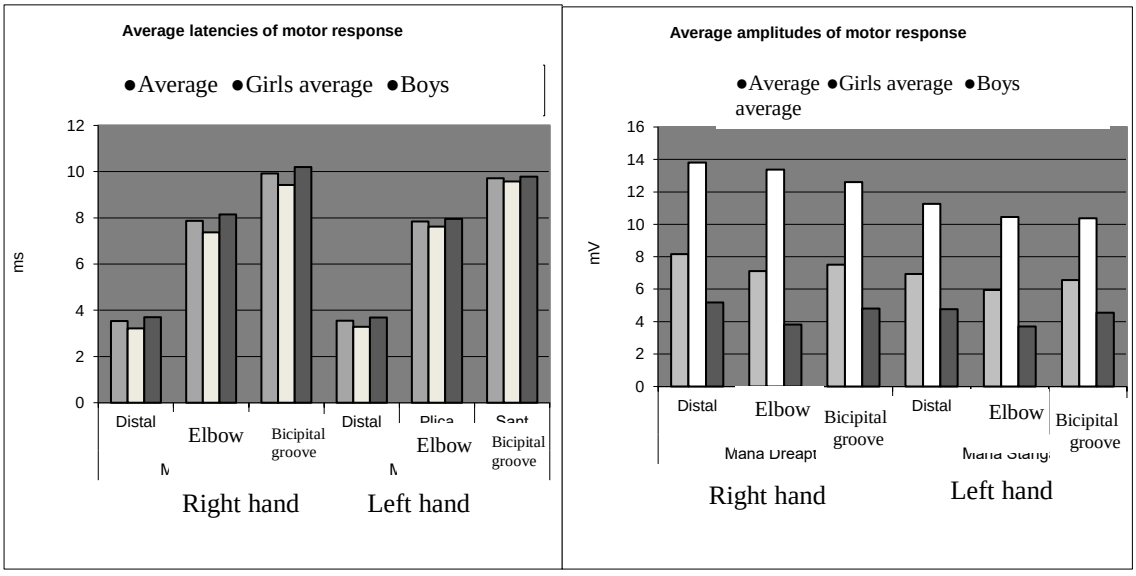

Figure. 1 Graphics of motor response' average latencies and amplitudes

Regarding the duration of motor response, when comparing sportsmen with sportswomen, significant differences are only recorded for stimulation of left hand' elbow (Figure 2).

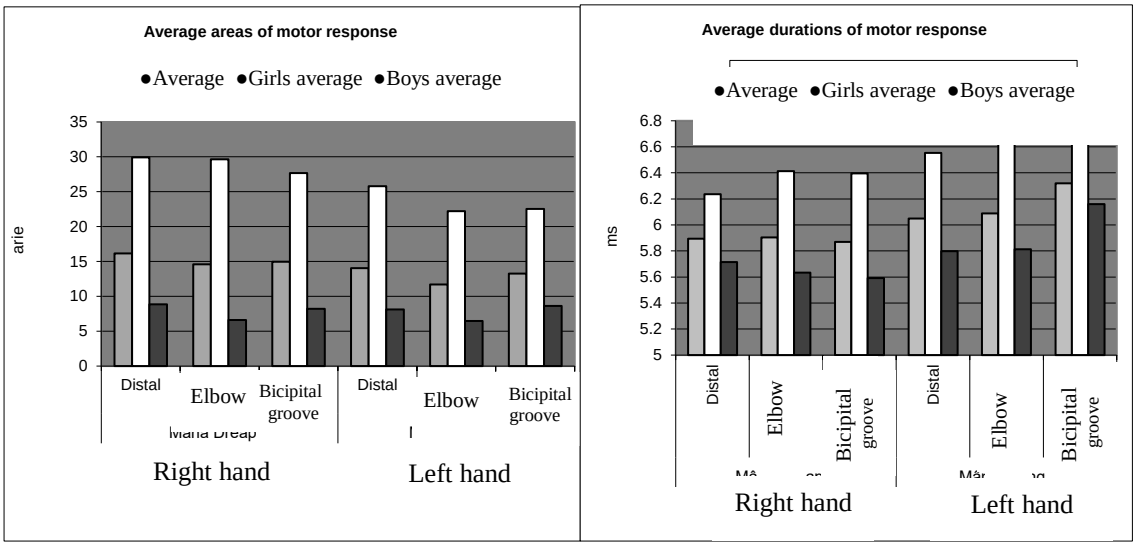

Figure. 2 Graphics of motor response' average areas and duration

Electroneurographic testing has only targeted the motor aspect, which is determining MCV by stimulating the median nerve.

No significant differences for the values of motor conduction velocity were noticed, when statistically comparing boys to girls, both arms and for all tested segments (Table 2).

Table 2. The average values of MCV for the entire group, sportswomen and sportsmen

	RIGHT HAND		LEFT HAND	
	Distal	Proximal	Distal	Proximal
Entire group's average	55.87	62.18	57.28	60.15
Sportswomen	58.76	66.31	58.87	65.28
Sportsmen	54.25	59.32	56.44	56.86

Discussions

As previously shown, the latencies of the motor response, when comparing sportsmen and sportswomen, shows significant differences only when stimulating the median nerve at the elbow and the bicipital groove, with girls presenting lower latencies than boys and slightly higher MCV values.

Takano, when performing a study in 1991, on a group of 650 volunteers, found slightly higher MCV values for girls compared to boys and for shorter subjects compared to taller ones, the relation being easy to notice between the mentioned aspects [3].

In case of latencies and MCV values, the significant differences between sportsmen and sportswomen can be partially explained by the intersex height differences [4].

Measuring the Pearson correlation coefficient between the height of all our subjects and the values of MCV, did not yield results that sustain those ascertained by Takano.

What is interesting to reveal, also, when comparing boys-girls, are the statistic differences between the values of amplitudes, areas and duration of the motor response, obtained at all three levels of stimulation, for both upper limbs. Higher values recorded for sportswomen compared to sportsmen can be explain by possible functional adaptive modifications (hypertrophy), more reduced for girls, that allows the stimulation of a higher number of axonic fibers, with more developed motor responses, of a higher duration and evidently with a larger area.

This aspect of intersex differences can also be commented, in the light of discoveries made during games and contests of fencing, where the ones between sportsmen require higher force and engagement, characterized by an increased risk of lesions, even if only subclinical ones.

Thus, these subclinical lesions, more numerous for boys, can explain the lower values of amplitudes, areas and CMAP duration recorded on them. This revealed aspect is in concordance with that observed by Stecker, whom, through experimental researches, has shown the sensibility of CMAP parameters at minimal compression, revealing decreases up to 50% of the motor response amplitude. For the same level of compression, the author does not signal MCV changes higher than 5% [5].

Conclusions

Obtained values of nervous motor conduction velocity revealed significant statistical differences at sportsmen and sportswomen at proximal level and right forearm.

Specific training, performed on a large scale, induce both structural and functional changes, which provide variations of the CMAP parameters, influencing the values of MCV in a small measure. Simultaneously, these determinations can highlight functional abnormalities, which represent subclinical neuropathies.

Both studied parameters, revealed their extremely important role in pointing out, the neurophysiologic differences between girls and boys professional athletes.

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