THE INFLUENCE OF SPECIAL PHYSICAL EXERCISES TO BIOMECHANICAL PROPERTIES OF JUDO-WRESTLERS' SKELETAL MUSCLES

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INTRODUCTION

Judo is distinguished by high requirements for different aspects of athletes' training on modern stage of development. Many specialists guess that physical, psychological training of wrestlers is manifested within their technical actions and the success of athletes' performance during competitions is depended ultimately from perfection level of technical actions. The force training is of special importance in different kinds of wrestling, and this allows the athlete to perform successfully the combinations, to use the counter-ways in good time and thanks to these the reliability of technical actions is essentially increased.

Special physical exercises are used in modern training of highly skilled wrestlers. The biomechanical structure of these exercises corresponds to structure of judo technique. However the complexity of coordination structure of judo technique does not always allow to choose adequately the special exercises for athletes and this decreases the results of training process.

The hypothesis of this investigation is based on the supposition about that a special physical exercises, which are necessary for technical training of judoists, may exert the effective influence onto athletes' skeletal musculature. So the diagnostics of biomechanical abilities of skeletal muscles in the training process may further the objectivity of pedagogical control and increase essentially the quality of wrestlers' special training by this.

METHODS

Researches were carried out according to general methodology of myotonometry modified by Laputin A.N. (1995). The following apparatuses: the inertial piezosensitive pick-up, the interface, the computer IBM 486 and the software were included to the procedure. The following biomechanical parameters of skeletal muscles: the frequency of weakened and strained muscles (ν_W and ν_S were measured in Hz), the energetics of background vibrations of strained and weakened muscles (Q_S and Q_W were measured in conventional units), the index of hardness ($I\nu$ was measured in Hz), the index of damping (I_Q was measured in conventional units) were registered during experiment. 15 athletes - Ukrainian champions, the prizers and winners of international competitions of 18-25 years old participated in the experiment.

The biomechanical characteristics of following muscles: m.deltoidens (1); m.biceps brahii (2); m.latissimus dorsi (3); m.crector spinali (4); m.biceps temoris (5); m.quadriceps temoris (6) which provided most actively with decision of motion tasks, were registered with athletes.

Biomechanical properties of judoists' skeletal muscles before and after a special standard physical loading were investigated. The executing of throw by catching of 45 times during 3 minutes with partner of the same weight was included to the content of special loading. The pulse before loading was 65±5 strokes/minute on average, and after loading - 170±10 strokes/minute. Besides the same athletes executed standard loading of general character after continuous rest and full recovery. This loading consisted of the lifting of weight that was equal 70% of athlete's mass providing the same pulse before and after loading. The state of the same muscles were fixed with athletes before and after loading.

RESULTS

The experiments showed that the contractile peculiarities of muscles 1, 3, 6 after a special and non-special loading are equal approximately. At the same time the contractile peculiarities of muscles 2, 4 increase after a special loading (Table 1).

It is set as the result of investigations that the values of hardness index of muscles 2, 3, 4, 5 increase more essentially after a special loading. This testifies about its more effective influence onto the functional state of these muscles. At the same time the hardness indices of muscle 1 after a special and non-special loading change equally.

Table 1.

a number of muscle	$\nu_{weakened}$, Hz			$Q_{weakened}$, convent. units			$\nu_{strained}$, Hz			$Q_{strained}$, convent. units		
	before loading	after a special loading	after a non-special loading	before loading	after a special loading	after a non-special loading	before loading	after a special loading	after a non-special loading	before loading	after a special loading	after a non-special loading
1	15.83	14.64	15.36	0.65	0.83	0.78	23.29	23.11	24.38	0.55	0.74	0.67
2	11.52	11.58	11.53	1.13	1.27	1.27	21.24	22.68	20.95	0.78	0.69	0.53
3	10.1	10.62	9.91	0.87	0.79	1.21	11.69	13.67	13.18	1.09	0.85	1.08
4	12.77	12.93	12.15	1.07	1.28	0.82	16.13	17.69	14.97	0.93	0.71	0.76
5	12.71	12.23	10.8	1.42	1.6	2.45	18.37	18.27	18.1	1.05	1.05	1.08
6	10.97	11.57	10.29	1.99	1.94	1.68	18.97	20.61	19.31	0.91	0.95	0.81

Table 2.

a number of muscle	The hardness index								
	x on the average, Hz			standard deviation, Hz			Student coeff.		
	before loading	after a special loading	after a non-special loading	before loading	after a special loading	after a non-special loading	before loading	after a special loading	after a non-special loading
1	0.48	0.59	0.59	0.22	0.22	0.17	0.348	0.159	0.199
2	0.87	0.96	0.84	0.20	0.24	0.25	0.186	0.001	0.027
3	0.14	0.36	0.34	0.11	0.31	0.23	0.629	0.143	0.016
4	0.26	0.34	0.22	0.17	0.19	0.14	0.382	0.142	0.612
5	0.43	0.49	0.46	0.15	0.13	0.20	0.044	0.547	0.099
6	0.72	0.79	0.92	0.27	0.33	0.42	0.850	0.145	0.043

Table 3.

a number of muscle	The damping index								
	x on the average, Hz			standard deviation, Hz			Student coeff.		
	before loading	after a special loading	after a non-special loading	before loading	after a special loading	after a non-special loading	before loading	after a special loading	after a non-special loading
1	1.19	1.36	1.39	0.15	0.24	0.48	0.314	0.083	0.036
2	2.39	1.65	1.89	1.24	0.44	0.57	1.177	0.072	0.001
3	0.76	1.11	1.21	0.26	0.32	0.69	1.679	0.002	0.163
4	1.38	1.59	1.18	0.51	0.46	0.17	0.002	0.212	0.759
5	1.31	1.20	1.70	0.29	0.30	0.89	0.046	0.319	0.139
6	1.42	1.58	1.61	0.31	0.67	0.45	0.263	0.080	0.191

It was set experimentally that the damping index of muscles 1, 2, 3, 5, 6 after a special loading did not increase so considerably as after a loading of general character. This testifies about its more purposeful and differential influence onto the athletes' skeletal musculature on the whole (Table 2,3).

CONCLUSION

Carried investigations testified the hypothesis of the research about that the special physical exercises exerted more effective influence onto the contractile properties of those muscle groups of athletes which participated most actively in the realization of basic technical actions of judo wrestling (the effect of special physical exercises onto wrestlers' skeletal musculature is 10% greater on average than the effect of exercises with general character).

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