TECHNICAL TRAINING OF QUALIFIED ATHLETES , SPECIALIZING IN THE HIGH JUMP WITH A RUNNING START, WITH ADDITIONAL FUNDS

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Annotation. *Purpose*: To improve the process of technical training of qualified athletes, specializing in the high jump with a running start on the basis of additional funds. *Material*: The study involved 12 athletes qualified I sports category and candidate masters age 18-20 years. Number of attempts varied from 12-15, depending on the degree of fatigue study. Determined the effect of electrical stimulation on muscle groups leading the kinematic and dynamic characteristics of the runway and repulsion, as well as athletic performance. *Results*: It was established that the integrated use of electrical stimulation affects more effectively to improve the biomechanical characteristics of high jump and effectiveness than using electrical stimulation during takeoff and repulsion separately. *Conclusions*: On the basis of the experimental data we can recommend the use of complex electrical, as an additional means for improving technical skills and improve performance athletes qualified.
Keywords: improvement, electrical, effectiveness, coordination, efficiency, biomechanics.

Introduction

Modern stage of elite sports' development, which is characterized by high sport results and constantly growing competition an international level, requires from sport scientists creative re-understanding of all complex of used, as on to-day, means and methods of sport training, as well as working out and foundation of training process's rationalization, which would ensure quicker and reliable achievement of high sport results.

Demand in development and implementation of new methods of movements' mastering is connected with the fact that increasing of trainings' scopes and intensity as on today can not be regarded as main ways to achievement of high sport results as far as increasing of load can not be unlimited [1, 2, 6, 7, 10].

Rising of effectiveness of qualified sportswomen's, who specialize in high running jumps, training process recent years has been realizing in two main directions. First – objectively grounded selection of training means and methods and their application, ensuring targeted influence on nervous-muscular system, seeking of criteria of sport techniques' effectiveness on the base of detail analysis of bio-mechanical structure of movements [4, 5, 8, 10].

In the base of other direction there is application of additional means in the process of sport training, videlicet: means of indication of movements' parameters and analysis of received information directly during training process, application of specialized simulators, permitting simulate and program interaction of sportswomen with external influences. This direction attracts more and more attention of researchers [2, 3, 5, 8–10]. It is explained by presence of significant reserves, which are manifested with application of additional means, oriented on guiding of sportswomen to higher results at the account of artificial conditions for simulation of sport exercises.

Among methods of creation of artificial conditions, permitting to program movement from the side of its inner content, the most perspective is considered to be method of artificial activation of muscles (electric stimulation) directly in the process of sport exercise. Here it is necessary to underline just that fact that electric activation of muscles if realized directly in sport movement, i.e., when stimulated muscles manifest natural tension.

The research has been fulfilled in compliance with topic 2.3.5.1п "Improvement of theoretical-methodic principles of sportsmen training system's management in speed-power kinds of sports" of combined plan of scientific-research work in sphere of physical culture and sports for 2006-2010 of Ministry of Ukraine of family, youth and sports (state registration number 0108U008210), and according to topic 2.11 "Theoretical-methodic principles of management of sportswomen's training in track and field jumps" of combined plan of scientific-research work in sphere of physical culture and sports for 2011-2015 of Ministry of Ukraine of family, youth and sports (state registration number 0111U003839).

Purpose, tasks of the work, material and methods

The purpose of the work is to improve the process of technical training of qualified sportswomen, who specialize in high running jumps on the base of additional means.

In compliance with the task of the research we determined influence of electric stimulation of main muscular groups, which participate in high jumps, on kinematic and dynamic characteristics of running and pushing off as well as on sport result. 12 qualified sportswomen of 1st sport grade and candidate masters of sports of 18-20 years old age took part in the research. Quantity of attempts varied within 12-15, depending on tiredness of the tested. Electric stimulation signals were emitted by stimulator with output signal of decaying shape. The value of impulse was selected for every sportswoman individually. Methodic of electrodes' application was bipolar.

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Automatic signals' feeding to muscles with the help of PC was realized in the moment of foot's contac6t with support. Relays P_1 or P_2 switched on turn by turn from contact sensors embedded in sportswomen's sport shoes. Contacts of these relays controlled impulses feeding to muscles, consequently to both feet.

Starting of electric stimulator with pushing off was realized by several ways:

– first method – in place of pushing off there was located one of contacts of external stimulator's switching on and other contact – on sole of sportswoman's shoeп. With such electric stimulator's work there was set required pause between "start" and signal's "outcome", which permitted for coach to start telemetric electric stimulator on his own, at required, in his opinion, moment.

– Other method – starting of electric stimulator from strain gauge platform, located in place of pushing off. The platform was connected with PC and with reaching of the set value of vertical component of effort, it started operation relay unit for switching electric stimulator on.

Thus, in our research we used complex of apparatus and instrumentation, which permitted to register kinematic characteristics of running, dynamic characteristics of pushing off (strain gauge platform) and process vertical component of effort with the help of PC and switch electric stimulator on.

Results of the research

In table 1 we present data of bio-mechanical characteristics of high running jumps with complex application of electric stimulation during technical training of qualified sportswomen and after effects.

Table 1

Influence of complex application of electric stimulation on bio-dynamic characteristics of high jump (with mathematical analysis) n = 12

Parameters		$\bar{X}$	%	$\bar{X} \pm m$	σ	t	P
Vertical strike effort, kg	OD	301.7	100	301.7 ± 6.5	21.5	–	–
	CA	163.3	54.1	163.3 ± 10.3	34.2	11.34	< 0.001
	AF	217.5	72.1	217.5 ± 10.9	36.1	6.64	< 0.001
Vertical effort of active push off, kg	OD	85.0	100	85.0 ± 2.9	9.6	–	–
	CA	152.5	179.4	152.5 ± 3.7	12.3	14.34	< 0.001
	AF	122.5	144.1	122.5 ± 4.6	15.3	6.88	< 0.001
Horizontal strike effort, kg	OD	85.0	100	85.0 ± 4.2	13.8	–	–
	CA	44.2	52.0	44.2 ± 3.1	10.4	7.83	< 0.001
	AF	55.8	65.7	55.8 ± 3.6	11.9	5.30	< 0.001
Horizontal effort of active push off, kg	OD	58.3	100	58.3 ± 2.4	8.0	–	–
	CA	31.7	54.3	31.7 ± 1.7	5.5	9.10	< 0.001
	AF	40.0	68.6	40.0 ± 2.1	7.1	5.70	< 0.001
Duration of pushing off, m.sec.	OD	240.0	100	240.0 ± 2.8	9.1	–	–
	CA	167.5	69.8	167.5 ± 3.5	11.6	16.26	< 0.001
	AF	193.3	80.6	193,3 ±3,1	10.3	11.26	< 0.001
Angle of gravity center taking off, degrees	OD	52	100	52 ± 1.9	6.5	–	–
	CA	61	117	61 ± 3.0	1.7	10.37	< 0.001
	AF	58	111	58 ± 2.3	1.5	8.60	< 0.001
Speed of gravity center taking off, degrees $m \cdot sec^{-1}$	OD	3.6	100	3.6 ± 1.5	0.01	–	–
	CA	4.8	133	4.8 ± 1.2	0.03	17.98	< 0.001
	AF	4.2	119	4.2 ± 1.5	0.02	9.84	< 0.001
Height of gravity center taking off, cm	OD	52.1	100	52.1 ± 0.2	0.6	–	–
	CA	62.6	120.2	62.6 ± 0.4	1.3	23.73	< 0.001
	AF	58.3	112.0	58.3 ± 0.4	1.2	14.79	< 0.001

Notes: OD– output data; CA– complex application of electric stimulator; AF– after effects.

As it is seen from the table above the highest change in percentage was, during electric stimulation influence, in indicators of pushing off duration. Duration of pushing off reduced in average by 30,2% in group. With it, speed of general gravity center's taking off increased by 33%, angle of gravity center's taking off – by 17% and sport result – by 6.1% that is witnessed by data in table 1.

Positive influence of complex application of electric stimulation was registered not only during its using but existed for certain period as after effects. I.e. after electric stimulation in 5-6 attempts all mentioned above indicators were higher than in ordinary conditions (see table 1).

Thus, results of the researches witness that complex application of electric stimulation more effectively influences on improvement of bio-mechanical characteristics of high jump than application of electric stimulation in running and separately at pushing off. Besides, complex application of electric stimulation results in musch higher increasing of efficiency.

Results of our researches also proved that among probable ways of improvement of qualified high running jumps sportswomen's training process it is not promising to hope only on increasing of loads' scope and

trainings' intensity. Great attention of coaches and sport scientists is attracted by prospects of application of technical aids, which can ensure more effective achievement of high results.

Attention to this direction is explained by presence of significant reserves, which can be realized with the help of additional means, by creating of artificial conditions.

Among methods, permitting to build movement on the base of its inner content the most perspective is application of artificial stimulation of muscles directly in the process of high running jump.

Experimental material witness that application of additional means is accompanied not only by improvement of bio-kinematic characteristics of running and bio-dynamic parameters of pushing off with high jump, but by clearly expressed after effects, which is maintained during several next trainings.

Positive influence of additional means on sportswomen's technical level and sport results is determined by the fact that they facilitate arranging of inter-muscular coordination at the account of limitation of action's intensity of muscles, which are not required in high jump as well as on the account of reducing of irrational movements' trajectories.

Conclusions:

Thus, on the base of all experimental data, obtained in our researches we can recommend complex application of muscles' electric stimulation as an additional mean for improvement of sportsmanship and increasing of efficiency of qualified sportswomen, who specialize in high running jumps.

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