BIOMECHANICAL PECULIARITIES OF THE BODY'S ORTHOGRADE POSE IN HIGHLY SKILLED LONG JUMPERS

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INTRODUCTION: The human motor system developed under the influence of earth's gravitational field on the evolutionary process. Modern techniques for jumps in track & field have developed on the basis of man's natural jump locomotions. The training process for long jumpers is based on the fundamentals of biomechanics of the human body's gravitational interactions, which in turn are realized by the athlete thanks to active moves of his body mass in the environment about the support accounted for by differential and highly-coordinated contraction of definite muscle groups. That is why the biomechanical control of those interactions in the training process of highly skilled athletes is of a great interest today. This gives a possibility to identify the mechanisms of the athlete's body mass interaction with support and to evaluate objectively their skeletal muscle condition during training for major competitions. The objective of this research is to study the possibilities of biomechanical control for efficiency increase in technical training of highly skilled long jumpers.

METHODS AND PROCEDURES: In order to reach the objectives of this research, special experiments were carried out with highly skilled long jumpers who have displayed an average result of 5.9-7.35m. The main anthropometrical parameters of the subjects were measured and their body masses' geometry defined. The parameters of their CM (center of mass) fluctuations in orthograde pose about the horizontal plane were measured using the stabilography method with the computer. Moreover, the biomechanical properties of the same athletes' large skeletal muscle groups, which realized the main components of technical actions in long jumping, were measured with a myotonometrical system consisting of a piezoelectric inertial accelerometer and analog-to-digital converters connected with a computer.

RESULTS AND DISCUSSION: Data on the specifics of highly skilled long jumpers' vertical pose have been obtained from the experiments. The amplitude and frequency of athletes' CM about the horizontal plane were identified. This gave a possibility to arrange the received parameters depending on jumpers' skills. (Figure 1, 2, Table 1). At the same time, for the same athletes, the biomechanical characteristics of those skeletal muscles which realize the basic elements of jump technique were registered. The results of this research testify that as a rule skeletal muscle hardness is higher and damping is lower for more qualified athletes (Table 2).

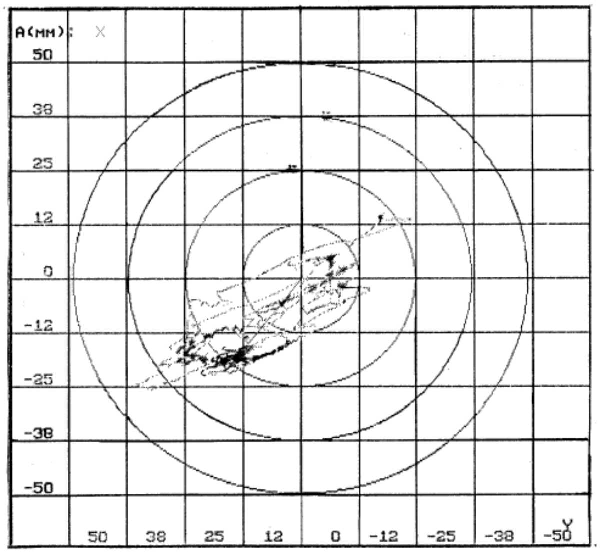

Figure 1. Stabilogram (The trained subject is G-o, jump result is 5.9 m). This is a printout of the computer screen. A - the amplitude of CM fluctuations in the horizontal plane XOY, mm.

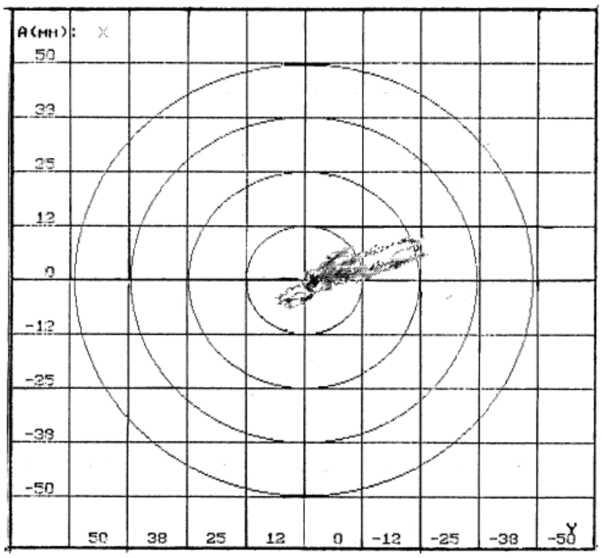

Figure 2. Stabilogram (The trained subject is K-ts, jump result is 7.35 m). This is a printout of the computer screen. A - the amplitude of CM fluctuations in the horizontal plane XOY, mm.

Table 1. Frequency-amplitude characteristics of the body's orthograde pose for highly skilled female long jumpers (N of subjects in group 1 and group 2 is 12).

Sport result, m	The height of general CM in basic standing pose, cm	Body's mass, kg	Maximum amplitude of general CM fluctuations A_{max}	Average amplitude of general CM fluctuations $A_{average}$	Average frequency of general CM fluctuations $f_{average}$
7.30-6.50	107.75±5.45	58.5±5.4	41.6±3.94	7.54±1.38	18.69±3.23
6.08±5.70	105.75±2.95	56.75±4.08	54.25±11.35	9.34±1.72	24.64±4.02

Table 2. The results of biomechanical control of skeletal muscle condition for female long jumpers of different qualifications

Muscle name		Sport result: 6.50 m - 7.30 m				Sport result: 5.70 m - 6.08 m			
		Hardness index		Damping index		Hardness index		Damping index	
		jumping leg	non-jumping leg	jumping leg	non-jumping leg	jumping leg	non-jumping leg	jumping leg	non-jumping leg
1	m. gastro-cnemius	0.945± 0.505	0,655± 0.457	0.865± 0.576	1.012± 0.371	0.688± 0.125	1.208± 0.606	1.108± 0.755	1.002± 0.423
2	m. biceps femoris	1.697± 0.901	1,938± 0.924	0.739± 0.598	0.924± 0.592	1.294± 0.355	1.116± 0.332	2.373± 1.607	1.940± 1.204
3	m. gluteus maximus	1.093± 0.883	1.718± 1.735	1.545± 1.019	0.842± 0.349	0.914± 0.358	0.838± 0.637	0.831± 0.377	1.425± 0.46
4	m. erector spinall	1.617± 1.005	1.47± 0.769	0.670± 0.374	0.715± 0.314	0.884± 0.776	1.01± 0.609	1.055± 0.606	1.105± 0.641
5	m. rectus femoris	0.938± 0.372	1.125± 0.708	0.949± 0.3	1.33± 1.143	1.12± 1.099	1.242± 0.456	1.57± 0.488	1.221± 0.557

CONCLUSIONS: The experimental results provide an opportunity to obtain reliable data in order to identify the subjects' motor abilities for the long jump and objectively appreciate the athletes' motor abilities during sport selection and also more effectively carry out biomechanical control during the jumpers' training for major competitions.

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