BIOMECHANICAL SPECIALITIES OF THE GRAVITATION INTERACTIONS WITHIN HUMAN BODY UNDER THE TRAINING BY SPORT TECHNIQUE

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INTRODUCTION

The studying of human movements concerning Earth gravitation is of great interest for the knowledge of regularities about human motion activity. Gravitation field as a field of force interactions concerning human body is characterized by its accelerations in any point of the space, by the force affected into any element of its mass being located in this point. So human body may be presented biomechanically as a set of these masses (Zatsiorsky V., 1983). The hypothesis of this work is based on the supposition about that the optimization of force, gravitation interactions within athlete's body would increase greatly the efficiency of training by the technique of physical exercises.

METHODS

Special hypergravitation overalls with a set of weights being positioned on human body so that natural geometry of body masses to keep was constructed during investigations. The tests of the device in biomechanical experiment under the using of videocomputer analysis were carried out. Videocomputer methods of the simulating of athletes' movements were used in this work. 5 highly skilled athletes-sprinters of 70 kg weight and of 170 cm height participated in the experiment. They executed the movement task that was to start with maximum velocity. The first 10 m of their running were recorded on the video. Kinematic and energetic characteristics of the running of each athlete were determined. Then after these materials the computer simulating of possible versions of the expenditure of mechanical energy by athlete who had the best results in various supposed conditions of gravitation interactions (within the hypergravitational suit by mass of 14% athlete's body mass (Laputin, A.N., 1981), with a weight of the same mass as the suit mass placed locally on the athlete's body or on the athlete's right and left legs (Tsarouchas, L., 1994)) carried out. The results of the simulating were used then as objective criteria during the constructing of a special physical loadings at the force training of athlete.

RESULTS

Carried investigations gave the possibility to evaluate the quality of the solving of movement task by all examinees accordingly to criteria of average velocity of the running and expenditures of mechanical energy (Table 1). One of the best examples of the solving of movement task (the athlete 5) was chosen on the base of these data. Then the imitative simulating of various conditions of the executing of movement actions by this athlete under the changing of dynamic structure of movements (under the keeping of the same kinematics of movements) have been done on the computer. It was achieved by the additional requirements conditioned by the changing (increasing) of his links' masses under the keeping of coordinates of his body's total mass centre (the hypergravitation conditions) and also by the

increasing of the mass of body only (a weight of the same mass placed locally) and by the increasing of legs' mass were included to the movement program.

Table 1.

	Start distance, m	time of the start, s	average velocity, m/s	average potential energy, joule	average kinetic energy, joule	average total energy, joule
athlete 1	5.49	0.64	8.58	680.28	4103.78	4764.96
athlete 2	5.59	0.68	8.22	653.61	3478.66	4114.64
athlete 3	5.48	0.70	7.82	900.69	3942.19	4819.66
athlete 4	5.65	0.72	7.84	584.71	4240.84	4812.14
athlete 5	5.40	0.58	9.30	644.6	3929.13	4556.13

Received data are reflected in the Table 2 and Fig.1. The condition A is the solving of movement task in natural conditions, the condition B is that within hypergravitation suit of mass m (kg); the condition C is that with a weight of mass m (kg) placed locally on the body; the condition D is that with a weights of 0.5 m (kg) placed on right and left legs.

Table 2.

Conditions	Potencial energy on the average, joule	Kinetic energy on the average, joule	Total mechanical energy on the average, joule
A	644.6	3929.13	4556.13
B	736.66	4496.49	5213.03
C	750.87	4365.63	5095.92
D	690.51	4558.54	5230.15

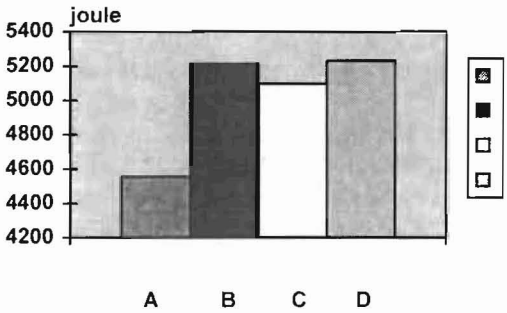

Fig.1. The expenditures of total mechanical energy by athlete 5.

CONCLUSION

The experiments showed the imitative simulating of various gravitation interactions at the solving of different complex movement tasks in the practice of technical training may be objective base for the constructing and programming of

training process. It gives the possibility to forecast and to control the energetic expenditures at the executing of concrete special physical exercises, to increase the athletes' force potential and to improve the geometry and kinematics of their movements at the same time.

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