High jumper psychomotor skills: methods of improvement

Фотографии:

Dr.Hab., Professor **K.K. Markov**[1]
Associate Professor, PhD **O.O. Nikolaeva**[2]
[1]National Research Irkutsk State Technical University, Irkutsk
[2]Siberian Federal University, Krasnoyarsk

Keywords: *psychomotor skills, discrimination sensitivity, track and field high jump.*

Introduction. In sports involving motor actions of complex coordination nature the level of development of psychomotor skills based on athletes' abilities to accurately differentiate and reproduce temporal, spatial and strength parameters of working actions, especially at key points of the main competitive movement, is of particular importance. Motor activity of athletes in high jumps involves performance of extremely precise motor actions in space and time characterized by fine regulation, coordination and differentiation of movements.

Objective of the research was to test experimentally the effectiveness of a multistage sensory method of improvement of psychomotor skills of athletes.

Research methods and structure. In order to form psychomotor skills specific for a chosen sport a multistage sensory method was used [3] that had been successfully tested in a number of studies [4; 5] in sports where well developed sensorimotor skills are of high importance. The main focus and practical efforts in the research were directed at a consistent, stage improvement of discrimination sensitivity of the basic kinematic and dynamic characteristics that determine coordination and proportionality of the motor acts in terms of the accuracy of assessment, measuring, reproduction and differentiation of various motion parameters.

Subject to the experiment were 12 young athletes at the age of 16-20 of 1st sports category and Candidates for Master of Sport, who had 5-7 years of training and competitive experience at special preparatory and pre-season training stages. The nonparametric paired Wilcoxon T test that allows to evaluate the significance of the differences in the experimental data obtained under different conditions using the same sample of subjects was used to analyze the dynamics of the studied factors.

In track and field high jumps athlete's actions have the following features: rhythmic and pace structure of the running start; different length and flight time of the running steps; running along a circular arc precisely under the action of the centrifugal and other forces; angle and speed of foot-strike while running and pushing off; angular characteristics of body positions; timeliness and speed of trajectory change of the common center of mass of an athlete; timely and precise swing movements of the arms and movements precision in the flight phase [1; 6; 9].

Specificity of high jumps is reflected in the dynamics and rhythm of movements, both in individual parts and in a whole motor act. Achieving good sport performance in high jumps is associated with high speed running start that improves the power of the push-off and precision of hitting "oneself". Therefore, high speed, efficient rhythm and pace structure of the running start and spatial precision of motor actions underlie the overall successful performance of a jump. In fact, the conditions created from the first step of the running start largely determine the ensuing structure of the jumper's movement sequence. This is particularly evident

in the pre-push-off phase when one of the main objectives of effective jump performance is implemented. High speed, rhythm and pace structure of the running start, increasing pace and actions of external forces impose great demands on the sensory-perceptual culture of an athlete.

Thus, the nature of the jumper's activity considered in respect to the temporal and spatial characteristics demands much of his sensorimotor skills and the mental and intellectual activity indicators as well as precision of muscle motor sensations.

Formation of a high jumper's psychomotor movement mode is of great importance in terms of mastering and improving all the above listed qualities. The main ways of its formation and self-control are as follows: theoretic goal-setting, formation of the program and content of a motor task; targeted demonstration of the motor action highlighting the leading elements of the movement and the points of self-control; development of strong associations between the leading elements, control points and kinesthetic movement images and their names; use of simulation and technical training aids as well as performance of a motor action under simplified conditions.

It is also very important to activate visual, auditory and kinesthetic perceptions; ensure active observation and critical discussion of the ways how other people perform a motor action; perform motor actions while voicing the major elements being performed as well as points of self-control of movement and performance of movements by phase while voicing the elements; master the methods and techniques of ideomotor and psychomotor training while improving motor actions and psychomotor self-control under extreme conditions.

The main key points of motor actions of a high jumper

A scheme of structural management of high jumper's movements by the basic movement parameters and key points is presented in Table 1 [1; 9]:

Table 1. *High jumper's movements management structure*

Structural parts of jump	Major movement parameters		
	Time	Space	Effort
Running start Part I (first 4–5 steps of running start) Part II Part III (second accelerated phase)	Rhythm and pace structure of the running start: - gradual speed increase - running start speed is quite high - the pace of the last three-four steps increases, acceleration of the pace, flight time and its correlation with step length	Characteristics of running along a circular arc, number of running steps: - length of steps gradually increases, running raising knees high; - entering the arc, step length and foot-strike, asymmetrical movement of arms; - running start along the arc, torso and legs lean, foot-strike; - wide amplitude of motion; - c.g. is lowered during the last 2-3 steps (no "squatting"); - initial body position is good for a foot-strike of the take-off leg; - arms and shoulders movements; pelvic movements.	- athlete is relaxed (first steps of running start) - overall concentration and springy feet
Push-off	- rhythm, speed - coefficient of the running activity during the phase of preparation for a push-off - rate of flexion-extension of the takeoff leg - push-off speed - time of active push-off.	- step length and structure; - trunk position with regards to support, working with external and internal forces; - movement of the pelvis; - foot-strike; - movements of arms and shoulders; - c.g. trajectory; - angular characteristics of the lower leg, knee and hip joints; - push-off angle of the body; - swing movements of arms and legs; - torso, shoulders and head position.	- muscle strength (overall) - efforts during push-off - impulse of force during push-off (kgm/s) - value of vertical and horizontal efforts and control over them.

High jumps are distinguished by the dynamics and rhythm of movements, both in individual parts and in the whole motor act. Achieving good sport performance in high jumps is associated with a high speed of the running start that improves the power of the push-off, precision of hitting it and clearance. Therefore, high speed, efficient rhythm and pace structure of the running start and spatial precision of motor actions underlie the overall successful performance of a jump. Conditions created from the first step of the running start largely determine the ensuing nature of the structure of the jumper's movements. This is particularly evident in the phase before the push-off when one of the main objectives of an effective performance of a jump is implemented. High speed, rhythmic and pace structure of the running start, increasing pace and actions of external forces impose great demands on the sensory-perceptual culture of an athlete [2; 7; 10].

Research results and discussion. The following motor tests were used for the diagnostics and development of a number of psychomotor parameters of discrimination sensitivity of temporal, power and spatial characteristics of motor actions in high jumps under laboratory and field conditions:

Temporal parameter under laboratory conditions: to determine a time interval; a stopwatch with a closed face, to stop it after 30 seconds, 1 minute; a test on an increase/decrease of a time interval.

Temporal parameter under natural conditions: to determine for how long a piece of music played; a step forward after 1 minute; during 10 seconds, 30 seconds.

Spatial parameter under laboratory conditions (kinematometer): to determine by how many degrees an arm was pulled (passively); to measure the given angle and reproduce it; a test on minimal increase/decrease.

Spatial parameter under natural conditions: to determine the length of a drawn line; to draw a straight line of 10 cm long; a standing long jump aiming at maximum result, at 50% of the maximum; a jump of 180^0, 200^0; minimum increase.

Dynamic parameter under laboratory conditions (manual and torso dynamometer): to reproduce given force; minimum increase.

Dynamic parameter under natural conditions: a standing long jump and a standing high jump aiming at maximum result, at 50% of the maximum; minimum increase.

Table 2. *Results of the experimental study of efficiency of the athletes' discrimination sensitivity development method (high jumps)*

Type of test n=12	Period of time	Test results				
		X	□	V%	± m	Differences significance
Simple reaction time, s	before experiment	0.23	0.045	16.9	0.01	p<0.05
	after experiment	0.20	0.029	13.1	0.006	
	change	- 0.03	0.016	3.8	0.004	
Differentiation of microintervals of time, ms	before experiment	160	40	25.4	9.2	p<0.05
	after experiment	130	19	16.8	3.9	
	change	- 30	19	8.6	5.3	
Discrimination sensitivity of efforts, kg	before experiment	0.72	0.12	12.5	0.03	p<0.05
	after experiment	0.45	0.08	10.4	0.02	
	change	- 0.27	0.04	2.1	0.01	
Discrimination sensitivity of jump height, cm	before experiment	4.2	0.7	12.3	0.3	p<0.05
	after experiment	2.8	0.4	9.4	0.2	
	change	- 1.4	0.3	2.9	0.1	
Discrimination sensitivity of distance, m	before experiment	0.42	0.33	11.5	0.07	p<0.05
	after experiment	0.24	0.20	9.4	0.04	
	change	- 0.18	0.13	1.1	0.03	

Paired Wilcoxon t-test allowing to identify the direction of changes and their intensity was used to assess the differences in the experimental data obtained from the same sample of the subjects under two different sets of conditions. Since in this case the main, typical shift is negative, the additional, "atypical" shift will be positive, and at 95% of significance the rank sum of such shifts should not exceed 17 for this case. Analysis of the "significance axis" indicates that the value T_{emp}=10 obtained during the experiment is within the significance zone. Therefore, the changes recorded during the experiment are not random and are significant at the level of 95%, indicating a significantly positive effect of the experimental method of psychomotor skills development on the improvement of motor training of athletes.

Conclusions

The findings have confirmed the hypothesis that the multistage sensory methodology of development of psychomotor skills discrimination sensitivity of athletes in high jumps is significantly effective on the chosen contingent. It enables an athlete to develop abilities to differentiate and manage microintervals of time following instructions as well as randomly, differentiate and reproduce subtle gradations of muscular efforts under both laboratory and natural conditions, dynamically varying the scheme of efforts application during different phases of a jump.

Experimental confirmation of the possibility of using the sensory methodology to improve discrimination sensitivity of the height of jumps of an athlete, reproduction of the necessary parameters as well as his ability to assess and implement the smallest possible deviations from the task is of fundamental importance.

The conducted experiment also makes it possible to focus the direction of further research on the establishment of a reliable correlation between individual psychomotor skills and stable, reliable competitive efficiency of an athlete, high sport performance, thereby improving the pedagogically substantiated methodology of athletic training.

References

1. Diyachkov V.M. Pryzhok v vysotu (High Jump) / V.M. Diyachkov. – Moscow: Fizkul'tura i sport, 1970. – 96 p.
2. Ilyin E.P. Differentsial'naya psikhofiziologiya fizicheskoy trenirovki (Differential psychophysiology of physical training) / E.P. Ilyin. – St. Petersburg, Piter. – St. Petersburg, Питер, 1979. – 235 p.
3. Markov K.K. Formirovanie psihomotornykh kachestv v sovremennom sporte: teoreticheskie i metodologicheskie problemy (Formation of psychomotor qualities in modern sport: theoretical and methodological problems) / K.K. Markov, V.Yu. Lebedinskiy // Teoriya i praktika fiz. kultury, 2014. – № 6.– P. 52–54.
4. Markov K.K. Eksperimental'nye issledovaniya psikhomotornykh kachestv vysokokvalifitsirovannykh kikbokserov (Experimental studies of psychomotor qualities of elite kickboxers) / K.K. Markov, V.L. Sivokhov, I.S. Chechev // Vestnik IrGTU (Herald of IrSTU), Irkutsk, 2013, – № 5. – P. 269-274
5. Markov K.K. Eksperimental'nye issledovaniya sovershenstvovaniya psikhomotornyih kachestv igrokov v sovremennom voleybole (Experimental studies of improvement of psychomotor qualities of volleyball players today) / K.K. Markov, O.O. Nikolaeva // Sovremennye problemy na¬u¬ki i obrazovaniya– 2014. – № 4; URL: http://www.sci¬ence-education.ru/118-14476.
6. Markov K.K. Otsenka psikhomotornykh kharakteristik dvigatel'noy deyatel'nosti yunykh sportsmenov v pryzhkakh v vysotu i povyshenie effektivnosti ikh trenirovochnogo protsessa (Evaluation of psychomotor characteristics of motor activity of young athletes in high jumps and increase of training process efficiency) / K.K. Markov, O.O. Nikolaeva // Fundamental'nye issledovaniya. – 2015. – № 2 (11).
7. Ozerov V.P. Psikhomotornye sposobnosti cheloveka (Psychomotor abilities in man) / V.P. Ozerov. – Dubna: Feniks, 2005. – 320 p.
8. Platonov K.K. Problemy sposobnostey (Ability-related problems) / K.K. Platonov. – Moscow: Nauka, 1972. – 367 p.
9. Strizhak A.P. Pryzhok v vysotu (High Jump) / A.P. Strizhak. – Moscow: Fizkul'tura i sport, 1987. – 80 p.
10. Surkov E.N. Psikhomotorika sportsmena (Athlete's psychomotor activity) / E.N. Surkov. – Moscow: Fizkul'tura i sport, 1984. – 126 p.