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An interrelation of physical and technical readiness as a basis in sport result achievement of 400 m hurdlers

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Purpose: *to establish the relationship of physical and technical preparedness to achieve sports results of 400 m hurdlers at the stage of preliminary base preparation.*

Material & Methods: *study involved the first grade athletes in the amount of 18 people. Methods of research: pedagogical observation, pedagogical experiment, pedagogical testing of physical and technical readiness, telepodometry, methods of mathematical statistics.*

Results*: it found that the major indicators of special physical readiness in the step of preliminary base preparation are: run at 100 m. result which was 96.4% from the model; run at 200 m – 96,0% from the model; run at 400 m – 98,7% from the model; hopping run 100 m – 93,4% and jumps 20 m on one leg – 91,1% % from the model.*

Conclusion: *study of individual elements technique allows us to characterize not only the technique of movements, but also the level of physical qualities.*

Keywords: *training, physical readiness, technical readiness, model characteristics readiness of 400 m hurdlers.*

Introduction

The sports result, as is known, depends on physical, technical, tactical, psychological and integral preparedness. Conditional training division into separate relatively independent direction allows you to organize an idea of its structural content, as well as to systematize the methods, tools, and on this basis to create a system to monitor and control the process of sports training.

Achievement of sports results is possible only with a harmonious combination of all aspects of training [3; 5; 14].

But of fundamental importance in this case belongs to the technical preparedness, thanks to which the realization of all types of sports preparedness.

Analysis of scientific and methodological literature provides a basis for the conclusion that at present there is a lack of sufficient information about the technique of technical preparedness in combination with physical of 400 m hurdlers [4; 6; 18].

Some studies show the value of the optimum ratio of indicators of physical and technical preparation [1; 2].

At the same time, the question of their correlation at the stage of preliminary basic training has not yet been fully presented. The problem of developing dynamic models of physical and technical preparedness at the stage of preliminary basic training is an actual problem of the theory and methodology of athletics.

The relationship of research with scientific programs, plans, themes

The research was carried out in accordance with the theme of the plan for the research work of the department of athletics Dnepropetrovsk State Institute of Physical Culture and Sport for 2016–2020 pp. “Theoretical and methodological bases of perfection of training process and competitive activities at various stages of athletes preparation” (state registration number 011U000195).

The purpose of the research

To establish the relationship of physical and technical preparedness to achieve sports results of 400 m hurdlers at the stage of preliminary base preparation.

Objectives of the study:

1. On the basis of the analysis of scientific and methodological literature, to establish the dependence of the athletic performance of 400 m hurdlers on the combination of physical and technical readiness.

2. To develop a model of physical and technical preparedness for 400 m hurdlers at the initial stage of training.

Material and Methods of the research

The study involved athletes of the first rank in the number of 18 people. To achieve the objectives used such methods of research: pedagogical supervision, pedagogical experiment, pedagogical testing of physical and technical preparation, telepodometry, methods of mathematical statistics.

Results of the research and their discussion

It is proved that the results in the 400 m hurdles depend on many factors, and therefore the researchers paid special attention to the initial stage of training athletes [7; 8].

Specialized preparation stage of 400 m hurdlers begins with preliminary physical and barrier preparation. Therefore, the preliminary basic training phase is the immediate start of a specialized training period.

The complexity of 400 m hurdlers is due to the high level of physical and functional state, which allows, at a high level of technical preparedness, to realize speed-power capabilities in conditions of "severe" normobaric hypoxia.

The stage of preliminary basic training is characterized by a variety of physical activities with small amounts of special training. The main directions of training 400 m hurdlers have a wide development of physical qualities, an increase in coordination abilities, is the basis for the formation of barrier run techniques. A special place in the system of training takes the ability to display speed, speed-strength, speed endurance and flexibility.

Carrying out tests for general and special physical preparedness, model levels were developed that were based on the ratio of group indicators to the maximum. For model indicators, those that were obtained after a year of systematic training.

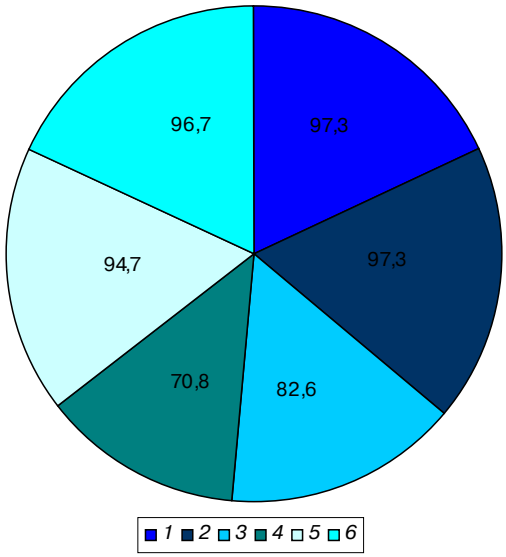

Fig. 1. Model characteristics of the general physical preparedness of 400 m hurdlers at the stage of preliminary basic training, %: *1 –standing long jump; 2 – fivefold jump; 3 – jumping up; 4 – explosive strength index; 5 – running at 30 m from the low start; 6 – running at 60 m from the low start.*

To characterize the state of general physical preparedness, six indicators were determined (fig. 1).
For testing special physical preparedness, exercises were used that contributed to the manifestation of the technical capabilities of athletes. The testing of special physical readiness determined five model characteristics (fig. 2).

Based on the studies carried out, a model for the technical specification of 400 m. hurdlers was developed, which included 14 indicators (table 1).

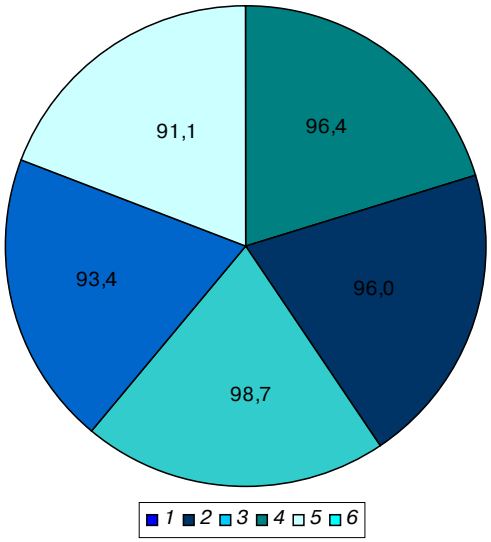

Fig. 2. Model characteristics of special physical preparedness of 400 m hurdlers at the stage of preliminary basic training, %: *1 – running at 100 m; 2 – running at 200 m; 3 – running at 400 m; 4 – jumping run; 5 – jump at 20 m on one leg.*

These results of the study are recommended in practical activities of trainers for the control of physical and technical preparedness of 400 m hurdlers.

One of the factors controlling the training process is the determination of the relationship between the level of physical and technical preparedness with the sports result [12; 21; 22]. The use of correlation analysis made it possible to establish a high level of connection between the result of 400 m hurdles and 22 indicators of physical and technical readiness.

A high level of communication was established between 400 m hurdles and physical fitness indicators:

– with the level of manifestation of speed – result of running at 30 m from the start (r=0,789) and running at 60 m. from the start (r=0,868);
– with the level of development of speed-strength qualities – result of standing long jump (r=0,773), triple jump(r=0,735), fivefold jump (r=0,793), jump at 20 m on one leg(r=0,813);
– with the level of development of speed and speed-strength endurance – result of running at 100 m (r=0,768), the result of jumping run at 100 m (r=0,889).

It is proved that the maximum manifestation of physical qualities depends on the level of technical preparedness, as a result of which a sport result is achieved [13; 19]. Correlation analysis identified a high level of connection between sports results and technical readiness indicators:

– start-up speed (r=0,898);
– distance repulsion to the barrier(r=0,728);
– resistance time for barrier attack (r=0,813);
– height of the common center of mass (CCM) above the barrier (r=0,788);
– landing angle (r=0,775);
– running steps speed (r=0,912);
– barrier step speed (r=0,827);
– running time of the first 200 m (r=0,927);

Table 1

Model characteristics of technical preparedness of 400 m. hurdlers at the stage of preliminary basic training

№	Indicators	Initial		Model	
		$\bar{X}$±m	V, %	$\bar{X}$±m	V, %
1.	Start-up speed, m·s^{-1}	5,78±0,06	7,5	6,12±0,06	7,4
2.	Distance repulsion to the barrier, sm	215,4±2,91	25,6	219,3±0,92	20,6
3.	Resistance time for barrier attack, ms	143,6±0,4	10,58	147,9±0,3	10,55
4.	Angle of attack of the barrier, deg.	62,5±0,3	8,52	63,3±0,3	6,35
5.	Height of the CCM, sm	120,5±1,3	17,5	116,5±1,2	12,7
6.	Angle of torso above barriers, deg.	38,8±0,2	5,6	33,2±0,2	65
7.	Distance from the barrier to the landing, sm	128,8±1,06	32,7	136,0±0,7	15,8
8.	Resistance time at landing, ms	117,6±0,7	16	114,5±0,4	9,8
9.	Angle of torso at landing, deg.	36,8±0,2	5,6	33,4±0,2	6,5
10.	Barrier step speed, ms	5,8±0,12	18,5	6,9±0,5	16,6
11.	Running speed, ms	7,8±1,9	7,9	8,5±0,3	7,8
12.	Running time of the first 200 m, s	25,39±0,7	12,5	24,3±0,2	7,8,5
13.	Running time of the second 200 m, s	30,8±0,8	15,7	29,7±0,7	6,7
14.	Coefficient of technical efficiency	41,7±0,1	6,5	4,56±0,6	6,1

– running time of the second 200 m (r=0,931);
– coefficient of technical efficiency (r=0,975);

The obtained results of the correlation analysis are confirmed by the literature data on the high level of the connection of the sports result with the indicators of the level of development of physical and technical readiness. Especially, in this case, it concerns speed-strength endurance [9; 10; 11].

Establishment of a significant level of correlation between individual indicators of physical fitness indicates the need for the development of certain physical qualities. Thus, the indicators at 30 m from the start and 60 m from the start have a high level of communication (r=0,787), as well as jumps by 30 m on one leg. There is a high level of connection between the indicators of standing long jump from the place and running at 30 m from the start (r=0,756).

For the first time, we used the time index of 100 m jumping run, which correlates with the 200 m run (r=0,830) and running at 400 m (r=0,813).

The conducted correlation analysis established the presence of a high level of connection between individual elements of the barrier run technique. Thus, the index of the speed of the foot steps has a high connection with the length of the running step (r=0,780), the duration of the reference reactions (r=0,815) and the step frequency (r=0,825).

The barrier step speed index has a high level of connection with the exponent of the repulsion distance during the barrier attack (r=0,789), with the resistance response during the barrier attack (r=0,795), with the distance of the landing after the barrier (r=0,812), with the indicator reaction of resistance at a landing (r=0,818) and an indicator of height of CCM above a barrier (r=0,797).

The running time of the first 200 m of the barrier distance depends on the speed of the starting acceleration (r=0,797), the speed of the running steps (r=0,818), the speed of the barrier step (r=0,825).

The running time of the second 200 m of the barrier distance has a high level of connection with the speed index of the running steps (r=0,785) and the speed of the barrier steps (r=0,857).

The existence of a high level of correlation between individual indicators of physical and technical readiness is recommended in practice as criteria for assessing the preparedness of 400 m hurdlers.

Sports result – is a rational manifestation of physical qualities on the basis of effective performance of the elements of exercise technique [15; 17].

Distribution of the training process on the physical and technical training – a conditional. The study of individual technique elements characterizes not only the level of technical preparedness, but also the level of development of physical qualities [16; 20]. Therefore, the improvement of the technique of sports exercises must be understood as the process of performing technique elements of sports exercises at a higher level of manifestation of physical qualities. Thus, the establishment of a high level of interrelation between the indicators of physical and technical preparedness of the barrier run provides an opportunity to choose more effective methods and measures to ensure the management of the training process.

The indicators of speed-strength readiness (jumps of 30 m on one foot, jumps in length from a place, fivefold jump, jumps up from Abolakov's position) have a level of interrelation (r=0,785–0,905) with parameters of starting acceleration, length of a barrier step, periods of resistance when attacking the barrier and when landing.

Speed indicators (running time at 30 m and 60 m) have a high level of interrelation with the speed indicators of the running steps and the barrier step (r=0,736–0,838).

Running time of the first and second 200 m of the barrier distance has a high level of interrelation (r=0,887) with the indices of speed-strength endurance (jumping run at 100 m).

Indicator of the coefficient of technical efficiency (CTE) has a direct time dependence on running smooth and barrier distance segments.

Thus, an arsenal of means was identified that provides an effective manifestation of the physical and technical capabilities of 400 m hurdlers.

Conclusions

1. These materials of a level correlation connection have allowed an opportunity to define quantitative characteristics of physical readiness defining a model level for a defining stage of preparation.

2. It is established that the main indicators of special physical preparedness at the stage of preliminary basic training are: 100 m run, the result of which was 96,4% of the model; running at 200 m – 96,0% of the model; running at 400 m – 98,7% of the model; jumping run at 100 m – 93,4% and jumps 20 m on one leg – 91,1% of the model.

3. The study of individual elements of technology makes it possible to characterize not only the technique of movements, but also the level of physical qualities.

4. Improved special movements techniques performing technical elements at a higher level of manifestation of physical qualities. Therefore, correlation analysis makes it possible to determine rational methods and measures to ensure correction of the training process.

Prospects for further research

Quantitative values of physical fitness determine the technical possibilities. Determination of the proportions of their ratio makes it possible to individually manage the training process.

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