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Instrumental method for monitoring speed-strength preparedness in sports

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Abstract

Purpose: The purpose of the work is to develop a measuring complex for monitoring of athletes' speed-strength preparedness.

Methods: The following research methods were used in this work: educational literature analysis, pedagogical testing, pedagogical observation, pedagogical experiment, methods of mathematical statistics.

Results: The necessity of taking into account the nature of the relationship between the level of physical, particular, speed-strength preparedness and dynamometric measuring device indicators. Summing up, we can state the followings: according to the testing and pedagogical observations' results, a correlation analysis was carried out; a quantitative assessment of the relationship between the level of physical preparedness and the parameters of the speed-strength indicators of the dynamometric device was obtained. A significant correlation was revealed between the level of physical, particular, speed-strength preparedness and indicators of the dynamometric device.

Conclusion: In this article has been presented the development of an instrumental method for monitoring athletes' speed-strength preparedness. A correlation analysis was made, as well as quantitative assessment of relationship between preparedness of speed-strength level and strength indicators parameters of dynamometric device was obtained in given work. Developed universal instrumental method for monitoring speed-strength preparedness, can help in control of athlete's state objectification during the training process is. A set of instrumental universal measuring device has been developed that can be applied in different kinds of sport.

Keywords: Sport, athletes, physical qualities, speed -strength preparedness, monitoring, instrumental method, measuring device.

Introduction

At the modern stage of physical culture and sports development, scientists are paying attention to creating a universal system for monitoring of population's physical health state of entire planet, as well as increasing the level of its physical preparedness. Monitoring at the modern stage of modern society development becomes a tool for organizing various procedures for education, observation, collection, processing, analysis, assessment, dynamics and forecast of both the state of physical development and physical preparedness of young rising generation (Goncharova, 2020; Kerimov et al., 2021; Goncharova et al., 2021). Currently, the sphere of physical culture and sport is in the stage of the most intensive development. Along with the two main components of sports training system - competitions and training – becoming the additional factors that increase effectiveness of great importance, including applying of instrumental methods and measuring devices. Preparing of a high-class athlete largely depends on effectiveness of the long-term training system, which could be defined as a rationally organized process of training and education of athletes (Platonov, 2004; Shustina, 2021). Today, the optimization of the modern training system and the strategy for innovative development processes of athletes' training - members of the national teams of our country and its nearest reserve is one of the most important tasks of our government. For the highest sportsmanship achievement and maintain it on the proper level, it is necessary to master quite significant amounts of training and competitive loads, which must be minimized through the targeted selection of means after the including of instrumental methods into the training process for conducting diagnostic measuring procedures for the development and improvement of physical skills (Shustina, 2021).

According to Yushkevich T.P., Vasyuk V.E., Bulanova V.A. opinions (Yushkevich et al.,1989) scientific and technological progress in sports is carried out in the following ways:

1. The usage of technological progress achievements in the practice of athletes' training accumulated in our country and abroad in different kinds of sport.
2. The usage of technological progress achievements in other areas of socio-economic life of our country.

3. Creation by specialists of physical culture and sports of new means of material and technical support for the system of athletes' training based on fundamentally new technical solutions.

Technical means in sports are - devices, systems, complexes and equipment using for training effects on different body organs and systems, for teaching and improving motor skills, as well as for getting information in the process of training sessions with the aim of efficiency improvement (Yushkevich et al.,1989).

Methods

The following research methods were used in this work: educational literature analysis, pedagogical testing, pedagogical observation, pedagogical experiment, methods of mathematical statistics.

In the training process, one of the most important task is the objectification of athlete's state control in the training process and competition. This requires the use of different measuring devices (MD) and preferably the most versatile ones that can be used in different kinds of sport. The development and implementation of devices and simulators for physical culture and sports are carried away and carried out by specialists from many foreign countries, like USA, England, France, Germany, Russia, etc.. Since today, this is a basic component of success on the world stage and the importance of this issue is undoubtable. Developed four universal measuring devices from our side (MD) to record and analyze information about a training athlete in the shortest possible interval times. For the developed and special tested measuring device which can determines the strength indicators of athletes' hip extensor muscles, was received a PATENT under the No. FAP 01687 by the Agency for Intellectual Property under the Ministry of Justice of the Republic of Uzbekistan.

Results and discussion

Developed MD allows monitoring and creating the necessary conditions for precise control and management of the most important parameters of the training load in the development of speed -strength qualities, which in turn creates the prerequisites for preventing errors and increases the possibilities of achieving higher performance compared to the usual conditions of training and competitive activities. The characteristics of an athlete, due to the sport specifics, the morphological abilities of muscles, joints, anthropometric data, significantly affect the individual curve when performing a particular exercise, the use of MD data will intensify training activity and eliminate unproductive work in time. Four measuring devices (MD) have been developed for various muscle groups (upper limbs, lower limbs, trunk muscles) for use in elite sports, which determine the parameters of the athlete's speed-strength qualities. The measuring complex is designed to test the strength qualities of highly qualified athletes (Figure 1), for example: absolute muscle strength; explosive strength, starting and accelerating strength of extensors and flexors of athletes main muscle groups. Studies are carried out in the following muscle groups:

⇒ Strength indicators of the foot (left, right);
⇒ Strength indicators of the leg extensors (left, right in the sitting position);
⇒ Strength indicators of back extensors;
⇒ Strength indicators of hands' biceps muscles;
⇒ Strength indicators of hands' triceps muscle;
⇒ Strength indicators of leg extensors in standing position.

Conducting the systematic qualitative monitoring and using the measuring complex which has been developed from our side in the training process to increase the level of strength and speed-strength training: contributes to the athletes' effective physical and technical training, both high-class and the nearest sports re-

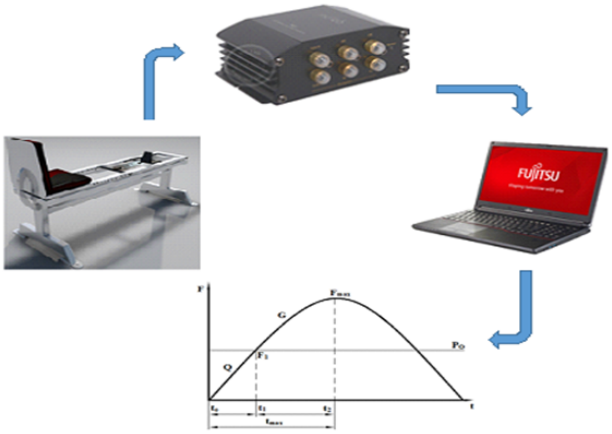


Figure 1. Instrumental method in the system of young generation's speed-strength training monitoring.

serve; purposeful management of the training process, taking into account all individual characteristics of athlete's speed-strength indicators, contributes to an effective increase in the level of athletes' preparedness and to an increase in the efficiency of the entire training system; contributes to the increase in athletes' performance due to the precise determination of development parameters of strength and speed-strength indicators in each training stage; aimed at increasing the efficiency of assessing the level of athlete's strength and speed-strength qualities development, which is extremely important in a long-term training process.

Development of the latest measuring devices, conducted by these devices, provides for determination of athlete's following speed-strength qualities: P_0 - the maximum value of isometric muscle tension; F_{max} – the maximum value of muscles' explosive strength in the explosive isometric mode; t_{max} – is the time to reach the maximum value of explosive strength in the isometric mode; speed-strength index – $J = F_{max} / t$ (kg/s); J - coefficient characterizing muscles' explosive strength in isometric mode;

$$V_{max} = \frac{S\,(F_{max})}{t_{max}}$$

V – is movement speed, S - is the path traveled from the starting point to the maximum value of muscles explosive strength (F_{max}); $N_{max} = F_{max} \times V_{max}$; N_{max} - work power; $Q = 0{,}5\ F_{max} / t_1$ (kg/s); Q – starting strength; $0{,}5\ F_{max}$ - half of the maximum strength explosive (kg); t_1 - time to reach the starting force (sec).

$$V_Q = \frac{S_{(Q)}}{t_1}$$

V_Q - movement speed in the starting mode; $S_{(Q)}$ – the path from the beginning of the movement to $0{,}5\ F_{max}$ half of the maximum value; $N_{(Q)} = 0{,}5\ F_{max} \times V_{(Q)}$; $N_{(Q)}$ – is the power of work in the starting effort; $G = 0{,}5\ F_{max} / t_2$; G – Accelerating force t_2 - time to reach the highest point of the accelerating force ($t_{Max} - t_1$);

$$V_G = \frac{S_{(G)}}{t_2}$$

V_G - movement speed in accelerating mode; $S_{(G)}$ – the path from $0{,}5\ F_{max}$ to F_{max}; $N_{(G)} = 0{,}5\ F_{Max} \times V_{(G)}$; $N_{(G)}$ – work power in accelerating force.

Applying of MD data in educational and training process contributes to the athletes' high-quality physical and technical training, both high-class and the nearest reserve. The management of the training process, taking into account all individual speed-strength characteristics obtained with the help of the athlete's MD, contributes to an effective increase in athletes' preparedness level and to an increase in the efficiency of long-term training system. Purposeful applying of MD in the training process will help to improve athletes' performance by accurately determining the parameters of development of speed-strength indicators at this stage and performing subsequent clear actions without unnecessary movements and exercises used to develop speed-strength qualities. Monitoring conducted with the help of MD data will increase the efficiency of assessing the level of athlete's speed-strength qualities development, which is extremely important by creating a long-term training process with a multifunctional system of training and competitive loads.

The progress of the training methodology is connected with an increasing of information value of the applying complex of control actions. A special role belongs to the systematized monitoring of athletes' strength and speed-strength training based on control using complex MD, taking into account the specifics of a particular sport and the individuality inherent in an athlete. Accurate registration of the combination of the finest biological and biomechanical processes, the use and processing of information contribute to providing the necessary conditions for the optimal development and management of developing sportsmanship process on an objective scientific basis.

The basics of the strength training methodology, which are part of the complex diagnostic equipment, will help coaches and athletes to creatively approach to the organization and management of the training process, taking into account the objective patterns that determine the improvement of the athlete's movements and the sportsmanship growth. Strength training, taking into account the determination of strength qualities parameters' development according to the complex of measuring devices, is one of the leading aspects of sports training process, taking into account the general laws of the process of sportsmanship formation and contributes to their implementation.

The ongoing monitoring with the use of complex measuring devices contributes to the

Table 1. Correlation relationship between the level of general physical preparedness and MD indicators.

№	Indicators	1	2	3	4	5	6	7	8	9	10	11	12	13
1	30 m running, sec.		0,534	0,529	-0,750	0,026	0,260	0,298	0,224	-0,152	0,364	-0,139	-0,255	-0,232
2	Shuttle run 3x10 m, s			0,524	0,053	0,464	0,540	0,468	0,216	0,046	0,232	0,373	0,209	0,127
3	6-min running, minutes				-0,099	0,420	0,454	0,500	-0,142	-0,115	-0,100	0,165	0,053	-0,030
4	Standing long jump, cm					-0,156	-0,414	-0,486	-0,096	0,187	-0,232	0,258	0,124	0,027
5	P_0						0,764	0,756	0,119	0,282	-0,031	0,181	0,095	0,012
6	F_{max}							0,983	-0,024	0,127	-0,108	0,170	-0,056	-0,057
7	0,5 F_{max}								0,014	0,129	-0,063	0,086	-0,123	-0,105
8	t									0,559	0,858	-0,214	-0,376	-0,437
9	t_1										0,054	-0,013	-0,307	-0,400
10	t_2											-0,250	-0,262	-0,278
11	J												0,757	0,740
12	Q													0,933
13	G													

high-quality physical and technical athletes' training, both high-class and the nearest reserve. Purposeful management of the training process, taking into account all individual athlete's characteristics, contributes to an effective increase in athletes' preparedness level and to an increase in the efficiency of the training system. The purposeful use of complex instrumental measuring devices in educational and training process will enhance formation process of athletes' sportsmanship by accurately determining the development parameters of strength indicators at this stage and performing subsequent clear actions without unnecessary movements and exercises used to develop strength qualities (Goncharova et al., 2021). Applying of systematized monitoring using complex measuring devices will increase the efficiency of assessing the level of athlete's strength and speed-strength qualities development, which is extremely important by creating a long-term training process with a multifunctional system of training and competitive loads (Goncharova, 2020; Kerimov et al., 2021).

Nowadays, technical means are not so widely used in the physical education of schoolchildren and students, particular in our country. The need to use technical means dictates the time itself, as it contributes to solve problems put forward by life itself, as it contributes to educational process improvement and extracurricular physical education classes in schools, colleges, lyceums and universities. Thanks to the use of instrumental measuring devices, the lesson organization will be improved, its density, quality and content will be increased, the motivation and emotionality of the students will be increased, and students will become involved in improving results. The technical measuring devices developed from our side help to improve the physical qualities' development, in particular speed-strength and make the right emphasis in teaching process on selection of appropriate training means.

By the aim of quantitative assessment of relationship correlation between the level of speed-strength preparedness and speed-strength indicators parameters of instrumental measuring device, based on the results of testing and pedagogical observations, a correlation analysis were made, the data of which are presented in the table.

Results: Thus, has been confirmed the necessity of taking into account the nature of

the relationship between the level of physical, particular, speed-strength preparedness and dynamometric measuring device indicators. Summing up, we can state the followings: according to the testing and pedagogical observations' results, a correlation analysis was carried out; a quantitative assessment of the relationship between the level of physical preparedness and the parameters of the speed-strength indicators of the dynamometric device was obtained. A significant correlation was revealed between the level of physical, particular, speed-strength preparedness and indicators of the dynamometric device.

Conclusion

According to the technical measuring devices developed from our side, it is possible to work more effectively on special motor qualities development of both beginner athletes and highly qualified athletes in different kinds of sport to improve: explosive strength, starting strength, accelerating strength and other indicators necessary to achieve success in different kinds of sport sports.

The monitoring conducted with the use of the MDs developed from our side in educational and training process will make it possible to bring the results of our athletes to the leading countries, which almost at the all Olympic Games in the top rank.

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