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The effectiveness of planning the training loads of discus throwers in the annual training process

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Abstract
Purpose: to develop a methodology aimed at improving the biomechanical mobility of discus throwers in special strength training and to determine the effectiveness in pedagogical practice.
Methods: The methods of analysis of scientific and methodological literature, pedagogical observation, anthropometric method, determination of the angle of flight of the disk, pedagogical experiment, pedagogical testing, mathematical statistics were used. (On FREMGE, G-VOLK equipment).
Results: The parameters of the movement of a student athlete in discus throwing were studied and methods of biomechanical analysis were developed.
Conclusion: In our study, it was found that the relative increase in the duration of the experiment for the three studied kinematic characteristics in CG averaged 7.32%, while in EG this indicator was 13.09%, which proves the effectiveness of the techniques used in the experimental group and aimed at improving biomechanical mobility for special strength training of discus throwers.

Keywords: Pedagogical experiment, statistical analysis, development methodology, training, optimization, flight angle, kinematic characteristics.

Introduction

The article presents the results on the development of a methodology for the development of special power training of discus throwers based on biomechanical movements using mathematical and statistical methods, as well as on optimizing the training process of athletes and determining its effectiveness by conducting pedagogical experiments at the Uzbekistan State University of Physical Education and Sports in the specialty “Athletics” in order to develop a methodology aimed at increasing biomechanical mobility with special power training of discus throwers, and to determine its effectiveness in pedagogical experiment, analyzes scientific and methodological literature, pedagogical observation, anthropometric method, determination of the angle of flight of the disk using the FREMGE apparatus, pedagogical experiment, pedagogical testing.

We know that planning with optimization of the annual training loads developed in the research work largely depends on the level of preparation for the comprehensive training of athletes. It remains to say that the annual training is connected with the development of technical training.

Therefore, the cooperation of coaches and athletes in the application of this developed methodology to training sessions allows us to achieve high sports results.

Based on the results obtained, we focused on developing an annual training program for discus throwers using a special set of exercises, in which, basically, annual loads were distributed as follows.

In order to implement the methodology of the training process, the tools of special training loads in various areas that are used in annual training will come.

Research work carried out not only in the direction of an approach to the introduction of “sports biomechanics” for use in teaching pedagogical science, but also creates an opportunity for an athlete to use it in the training process.

Methods

Statistical analysis of the results of pedagogical experiment in improving the special strength training of discus throwers using the developed methodology for the development of biomechanical mobility indicators allowed us to determine that the statistical characteristics of the results of athletes of the experimental group in which this method of development was used showed during the experiment kinematic characteristics of reliable changes that were greater than those of the control group.

Results and discussion

According to the materials of the scientific and methodological literature, when studying the discus throwing process, the following main

biomechanical phases of the discus throwing movement are distinguished.

A) the first phase of the movement begins with the athlete spreading his arms to perform a discus throw. This is done by the athlete holding the disc in his right hand in support of both legs, turning the shoulder line to the right to the optimal end point. The right and left hands should be in the projection of the shoulder line. In this case, the left hand crosses the projection of the shoulder line, continuing to move to the right.

B) The beginning of the rotation phase. The biomechanics of the second phase of movement is expressed in the "introduction". The introduction is performed by turning the inner part of the heel of the left foot to maximize the spread of the hips of the right and left legs, creating optimal conditions for performing a swing with the right foot. The left and right hands go beyond the shoulder line, which should be parallel to the plane of the circle.

C) The phase of rotation. The swing is performed with the hips of the right legs until the athlete can stand with his back to the field, achieving maximum heel rotation. The heel of the left foot actively depends on the circumference and is placed on the opposite part of the circle as short as possible.

D) The final phase of tension. When placing the left leg in a circle, the disc will be located below the height of the athlete's spine - from behind. From this situation, by turning the right side to the left, the projectile is directed towards the field through the left leg, which is actively and firmly located.

E) Braking phase. To stay in the circle after the throw, the athlete must either jump on the spot or change legs. Due to the active deposition of the heel of the left foot and the setting of the right foot in its place, the wing of the left arm is straightened into three parts from the shoulder line. This makes it possible not to release a projectile with a maximum amplitude from the left side. At the end of squats, the left leg cannot support the spread position of the hips. This reduces the "charge" of the abdominal muscles.

Due to the fact that all phases of the disc throw are performed in a certain logical sequence, this also serves to generate the maximum amplitude to accelerate the projectile, and it is necessary to ensure that the muscle group is as active as possible and the disc throw in the final phase of tension is performed quickly and evenly.

Thus, in general, the following factors affect the result of discus throwing.

1) Initial velocity of the discus (V_0);
2) Flight angle of the discus (α);
3) Influence of the atmospheric environment (air resistance, wind strength and direction);
4) Height from the ground while projectiles flight (h_0);
5) Aerodynamic properties of the discus;
6) Angle of attack of discus (β).

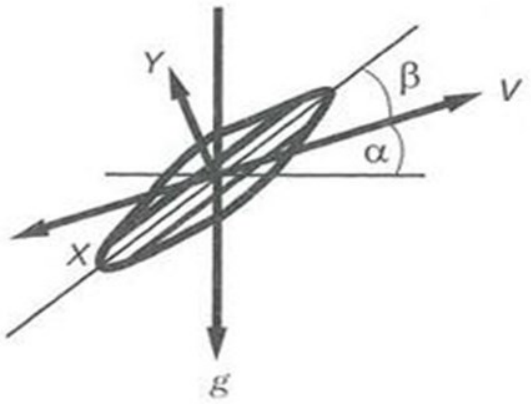


Figure 1. Forces acting on a flying discus in space. *Note: g- weight strength, X- the resistance force of the environment, Y- lifting force, α- flight angle of the discus, β- angle of attack, V- flight speed.*

Each of the factors mentioned above in each case determines the effectiveness of the throw and the degree to which the result is higher, but, nevertheless, the importance of each of these parameters is different. In practice, the most important of them are the initial speed, the angle of flight and the impact of the atmospheric environment.

Their analysis is necessary, first of all, in order to perfectly and correctly evaluate all the actions of the disk recorder. We know that planning with optimization of the annual training loads developed in the research work largely depends on the level of physical fitness of athletes and the level of training on the same day.

That is why he encourages coaches and athletes to work harmoniously when applying this developed methodology in their training processes.

It was also recommended to use the following training tools in various areas of training and when using a special set of exercises. We used the following special set of exercises

that were developed for the development and improvement of discus throwing techniques.

The experimental group used the following methods for the development of discus throwers based on biomechanical methods of special strength training.

In the experimental group of study participants, the average angle of flight of the discus during throwing was ± σ = 41,17±1,03o, whereas in the control group, the subjects performed this action at an angle ± σ = 41,29±1,16o .

The average speed of the disk in flight

Table 1. Methods of developing indicators of special power training of discus throwers.

Methods	Number of performances	Technological indicators
Maintaining balance when throwing a disc. In this exercise, tie one side of the rubber to the post, and squat on the other side with both arms bent forward.	4-6 times	The exercise is performed freely and without haste. This ensures that the balance will not be disturbed
Perform the exercise with a left and right turn with both hands, holding the rubber in the standing position.	6-8 times	This exercise is performed with left and right turns in a free position with rubber in a standing position.
Rotates at one point and reaches the specified center.	6-8 times	In this exercise, you will reach a certain central point by performing an exercise with rotation along one point while bending.
Perform turning exercises with a barbell for 40-100% of the athlete's weight, depending on the athlete's training.	4-6 times	Sitting on a chair with a barbell on your shoulder, lift your right leg forward when turning to the left and lift your left leg forward when turning to the right. When performing this exercise, it is important that the spine remains straight.
Athlete rotating his hands on a chair with a 10 kg barbell on his wrists	6-8 times	The exercise is performed by placing the athlete's hand on the barbell and turning the left hand back and the right hand forward on the seat. Then turn your left hand forward and your right hand back.
Bending with a 20 kg barbell	4-6 times	It is done by bending the barbell on the shoulder and sharply straightening the body.
Backsquat with a 40 kg barbell	6-8 times	Barbell squats with 40% of the athlete's weight on the shoulders
Deadlift	4-8 times	Lift the barbell from the ground to the waist without bending your arms.
Lift 40% of the barbell from the floor to the chest	6-8 times	When lifting the barbell, the athlete must lift the barbell from the ground without bending arms.
The use of a set of exercises performed on a special simulator.	6-8 times	While doing this exercise, do exercises such as bending your arms, standing on tiptoe.

At the beginning and at the end of the pedagogical experiment, the angle of the flying discus, speed and distance were determined.

When determining the significance of differences in the results of the control and experimental groups, the Student's criterion for uncorrelated selection was used. The differences were considered statistically significant when they were at a significance level that was found to be very reliable in pedagogical research.

Athletes of the control and experimental groups determined the angle of flight of the discus (degrees), the average speed of the discus (m/s), the distance of flight (m) at the beginning and at the end of the experiment.

(m / s) at the beginning of the experiment turned out to be ± σ =24,90±1,04 m/s. In the control group, the average result for the average speed of the disk was equal to the experimental group ± σ = 24,92±1,04 m/s.

At the end of the pedagogical experiment, the discus throwing distance was calculated, and the participants of the experimental group averaged ± σ = 41,56 ± 2,66 m. According to this indicator, while the results shown by the testers of the control group averaged ± σ = 41,61 ± 2,63 m. we see this

In addition, for the subjects of the experimental group, the average angle of flight recorded an average result of ± σ =39,17±1,11o,

Table 2. Statistical analysis of the dynamics of changes in the kinematic characteristics of discus throwers in the control and experimental groups during pedagogical experiments.

Indicators	Groups	At the beginning of the experiment		At the end of the experiment		t	P
		$\overline{X}$	σ	$\overline{X}$	σ		
Angle of flight of the discus (°)	CG	44.58	4.04	41.71	3.88	1.77	>0.05
	EG	44.76	3.92	39.14	3.48	3.71	<0.01
Average speed of the discus (m/s)	CG	23.39	2.16	25.27	2.19	2.12	<0.05
	EG	23.23	2.14	26.54	2.21	3.73	<0.01
The distance of flight m	CG	39.24	3.38	42.18	3.37	2.13	>0.05
	EG	39.08	3.16	43.95	3.24	3.73	<0.01

while the subjects of the control group could see the result of ± σ = 40,08±1,12o when performing this action.

The flight distance of the experimental group subjects averaged ± σ = 43,72 ± 3,02 m. The control group participants also averaged ± σ = 43,95±2.62 m in this test.

The average discus speed of the experimental group of subjects was the average result. ± σ =26,16 ± 1,09 m/s. In the control group , the average result of the average discus speed was ± σ = 25,84 ± 1,13 m/s (see table 2).

The dynamics of the relative increase in the percentage of kinematic characteristics of the discus throwers of the control and experimental groups during the pedagogical experiment is shown in Figure 2. The data presented in it show that the changes in the experimental group were much better than in the control group. The largest positive relative increase in CG occurred at the disk speed, which was 8.04%, the smallest increase was 6.44% at the angle of flight of the discus and 7.49% for the discus throwing range. The arithmetic mean relative increase in three indicators was 7.32%.

The greatest positive relative increase in EG occurred at the average speed of rotation of the discus, which was 14.25%, the smallest increase in flight range was 12.46%, and the angle of flight was 12.56%, the relative increase (1.79 times more than in CG) was 13.09%. This indicates the effectiveness of the methodology

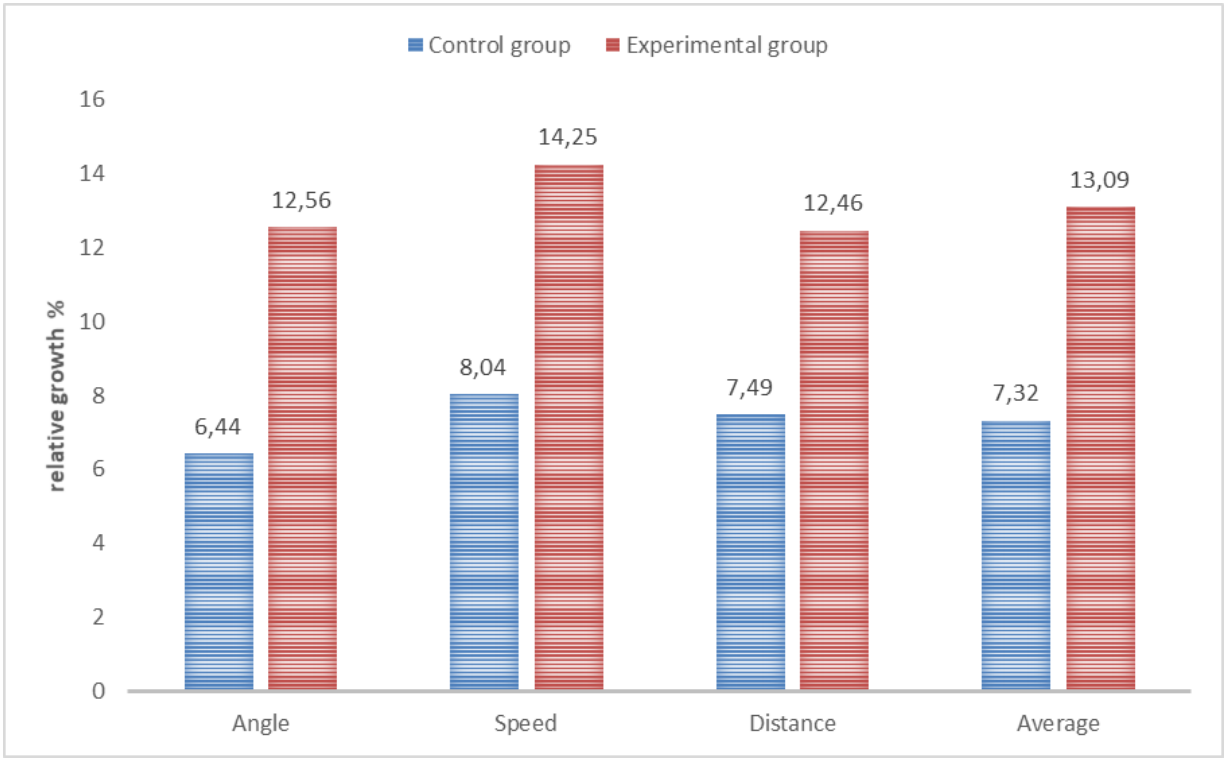


Figure 2. Relative growth dynamics during a pedagogical experiment to determine the kinematic characteristics of the control and experimental groups of discus throwers (%).

developed by the author for teaching the elements of discus throwing technique used in EG.

Conclusion

The statistical reliability indicators were evaluated based on the calculation of the Student's critical values of the changes in the arithmetic mean values of the three studied characteristics of the disk movement during the pedagogical experiment based on the calculation of the Student's variable of reliable ($p < 0.05$) critical values. In EG, however, all these indicators were reliable for changes in the course of statistical experiments. Of these, the flight angle and average speed are good ($p<0.01$), and the flight distance of the discus is satisfactory ($p< 0.05$). This indicator was 13.09%, which indicates the effectiveness of the technique used in the experimental group, and was developed by the author to improve the biomechanical mobility of students in discus throwing during special strength training.

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