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LEVEL OF STRENGTH DEVELOPMENT OF STUDENTS INVOLVED IN ROCK CLIMBING SPORTS SECTIONS USING EXERCISES ON DIFFERENT SIMULATORS

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Purpose: to determine the influence of rock climbing classes according to different programs on the level of strength development of students involved in rock climbing sports sections.

Material and methods: 45 student rock climbers (men) aged 18-23 participated in the study, who were engaged in rock climbing sections. The subjects were divided into three groups of 15 people each: the first - the control group (CG), included athletes who trained according to the standard method; the second - experimental group No. 1 (EG_1), included athletes who trained according to a standard program with the inclusion of specially designed exercises for the development of strength on the campus board; the third - experimental group No. 2 (EG_2), included athletes who went in for a standard program with the inclusion of

specially selected exercises on gymnastic rings. To assess the level of strength development and its dynamics, tests were used that illuminate as closely as possible the manifestations of strength in climbing, namely: hanging in the block, pulling up on the bar, pulling up to the chest, flexion of the extension of the arms in the lying position, wrist dynamometry, flexion of the hand with weights.

Results: in order to determine the influence of rock climbing lessons according to different programs on the level of strength development of students involved in rock climbing sports sections, an analysis of special indicators was carried out. So, it was revealed that the studied indicators in all groups during the experiment tended to improve.

Conclusions: it was found that exercises on a campus board and gymnastic rings have an unequal effect on the development of individual muscle groups, which allows us to conclude that it is necessary to combine these programs to ensure the diversified development of the strength of students involved in rock climbing sports sections.

Keywords: rock climbing, strength development, students, sports sections.

Introduction

Not a single sport can develop without the necessary theoretical support, in particular, in the form of developments in the theory and methodology of training and without solving the problems associated with the identification of physical fitness indicators, which largely determine the high result of competitive activity [1]. According to the results of recent years, it becomes obvious that the development of rock climbing has far outstripped its material and technical base (insufficient number of training stands, imperfection of their designs) and methodological approaches to training [9, 10].

The analysis of special literature shows that the modern scientific and methodological base in sports rock climbing is not sufficiently developed to ensure effective training of athletes. The publications on the topic of rock climbing are

mainly devoted to the development of coordination and general motor qualities [2, 5]. Foreign experts [6, 7, 8, 11, 12] have determined the determinants of physical readiness of climbers specializing in climbing on difficulty; by means of correlation analysis, the most significant physical qualities and mental processes influencing the sports and technical result for rock climbers of the 1st category in climbing on complexity. In the work of V.A. Galchinsky, L.A. Galchinsky, Yu.V. Kotchenko. [3] considered the factorial structure of physical fitness of female rock climbers, specializing in high-speed climbing in the framework of physical education at the university. The work of O. Shulga [5] is devoted to the study of the significance of the speed-strenght capabilities of the muscles of the girdle of the upper and lower extremities of climbers of 14-15 years old, specializing in speed climbing, the state of physical fitness of young climbers - Mulik K. V., Chichkunova A. Yu. [4].

Purpose of the work is to determine the influence of rock climbing on the level of strength development of students involved in sports rock climbing sections according to different programs.

Material and Methods of research

The study involved 45 male rock-climbing students aged 18-23, who were engaged in rock-climbing sections. The subjects were divided into three groups of 15 people each: the first - the control group (CG), included athletes who trained according to the standard method; the second - experimental group No. 1 (EG_1), included athletes who trained according to a standard program with the inclusion of specially designed exercises for the development of strength on the campus board; the third - experimental group No. 2 (EG_2), included athletes who went in for a standard program with the inclusion of specially selected exercises on gymnastic rings.

All groups studied three times a week with a duration of 3 hours per session. In the preparatory part of the lesson, generally accepted exercises were performed, and already at the beginning of the main part, exercises from a specially developed complex were included. At the beginning of the main part, students performed 4-5 exercises from the complex we proposed. This made it possible to perform the

exercises without errors due to the absence of fatigue. In the final part of the lesson, simple exercises were also given according to the complex we developed.

The study was conducted at the beginning of the school year and after 12 months of training. To assess the level of development of strength of students involved in sports sections of rock climbing, tests were used that as closely as possible illuminate the manifestations of strength in rock climbing:

– hanging in a block - the subject performs hanging on a crossbar on bent arms at the elbow joint, with the formation of an angle of 90 degrees. On the command "Ready" the athlete takes a given position, and the coach starts the stopwatch.;

– pull-up on the bar - the subject grabs the bar with an average grip, grabs the bar with a brush from above. The athlete must complete the maximum number of pull-ups. The number of correctly performed times is recorded;

– pulling up to the chest - the subject grabs the bar with an average grip and grabs the bar with a brush from above. The athlete must complete the maximum number of pull-ups. The number of correctly performed times is recorded;

– flexion and extension of the arms in the lying position - performed on a flat surface. The test subject assumes a supine position, arms straightened and spread apart shoulder-width apart, brushes forward, body and legs form a straight line. On command, the participant begins to bend and unbend his arms rhythmically with full amplitude. The number of unmistakable flexions and extensions of the arms is recorded in one attempt;

– hand dynamometry - measurements are made three times with the choice of the best result. The hand holding the dynamometer should be kept parallel to the floor;

– flexion of the hand with weights - the subject sits on the bench of the simulator, takes the pancake with both hands with a grip from below, then puts his hands on a horizontal support so that the hands are in an unsupported position. Having taken the desired position, the athlete begins to perform flexion of the hand with weights.

All data obtained in the course of the experimental study were subject to processing using the methods of mathematical statistics.

Results of the research

In order to determine the influence of rock-climbing lessons according to different programs on the level of strength development of students involved in rock-climbing sports sections, an analysis of special indicators was carried out. So, it was found that the indicators that were studied in all groups during the experiment tended to improve. At the beginning of the experiment, significant differences in the studied parameters between all groups were not determined ($p>0,05$). The testing carried out at the end of the year according to the "hanging in the block" test (Table 1) revealed a significantly better result ($p<0,05$) in the experimental groups as compared with the control. So, in EG_1 the result is higher by 3,5 s in relation to the CG ($t_{1,2}=2,91$; $p<0,05$), and in EG_2 – by 3,4 s ($t_{1,3}=2,71$; $p<0,05$).

Table 1

Indicators of hanging in the block of students engaged in sports climbing sections ($n_1=n_2=n_3=15$)

Indicators		CG	EG_1	EG_2	Reliability assessment
		$\overline{X}_1 \pm m_1$	$\overline{X}_2 \pm m_2$	$\overline{X}_3 \pm m_3$	
Test 1: hanging in the block, s	Start of the year	52,63±1,37	51,82±0,97	51,91±1,23	$t_{1,2}=0,42$; $p>0,05$ $t_{1,3}=0,38$; $p>0,05$ $t_{2,3}=0,06$; $p>0,05$
	End of the year	69,84±1,03	73,33±0,62	73,21±0,72	$t_{1,2}=2,91$; $p<0,05$ $t_{1,3}=2,71$; $p<0,05$ $t_{2,3}=0,11$; $p>0,05$

The indicators of pulling up students by the end of the year were also significantly higher in the experimental groups in relation to the control group by 1,6 ($t_{1,2}=2,88$; $p<0,05$) and 1,4 times ($t_{1,3}=2,22$; $p<0,05$), respectively (Table 2).

Table 2

Indicators of pull-ups of students engaged in sports climbing sections ($n_1=n_2=n_3=15$)

Indicators		CG	EG_1	EG_2	Reliability assessment
		$\overline{X}_1 \pm m_1$	$\overline{X}_2 \pm m_2$	$\overline{X}_3 \pm m_3$	
Test 2: pull-up, number of times	Start of the year	16,9±1,4	17,0±1,0	17,3±1,2	$t_{1,2}=0,13$; $p>0,05$ $t_{1,3}=0,50$; $p>0,05$ $t_{2,3}=0,39$; $p>0,05$
	End of the year	24,7±1,0	26,3±0,6	26,1±0,5	$t_{1,2}=2,88$; $p<0,05$ $t_{1,3}=2,22$; $p<0,05$ $t_{2,3}=0,35$; $p>0,05$

The test results for the first two tests indicate that the additional use of a campus board and gymnastic rings in the training process of climbers has the same effect on the development of special strength of the arm muscles. Classes on the campus board made it possible to double the number of pull-ups, however, they did not have a statistically significant difference in comparison with the control group, in which the increase for the year was also 2 times (Table 3). The results of exercises on gymnastic rings in EG_2 are statistically significantly higher not only in relation to the CG, but also in relation to EG_1. So, the difference with CG is 1,9 times ($t_{1,3}$=3,87; $p<0,01$), and with EG_1 – 1,4 times ($t_{2,3}$=3,11; $p<0,01$).

Table 3

Indicators of pull-ups to the chest of students engaged in sports climbing sections ($n_1=n_2=n_3=15$)

Indicators		CG	EG_1	EG_2	Reliability assessment
		$\overline{X}_1 \pm m_1$	$\overline{X}_2 \pm m_2$	$\overline{X}_3 \pm m_3$	
Test 3: pulling up to the chest, number of times	Start of the year	6,2±0,3	6,3±0,3	6,4±0,3	$t_{1,2}$=0,22; p>0,05 $t_{1,3}$=0,46; p>0,05 $t_{2,3}$=0,22; p>0,05
	End of the year	12,1±0,4	12,6±0,4	14,0±0,3	$t_{1,2}$=0,92; p>0,05 $t_{1,3}$=3,87; p<0,01 $t_{2,3}$=3,11; p<0,01

Similar results were obtained in terms of the test "Flexion and extension of the arms in support, lying on the floor" (Table 4). Indicators of EG_2 are higher in relation to the CG by 2,6 times ($t_{1,3}$=3,87; $p<0,01$) in relation to EG_1 – by 2,6 times ($t_{2,3}$=2,80; $p<0,05$).

Table 4

Indicators of flexion and extension of arms in support, lying on the floor of students engaged in sports climbing sections ($n_1=n_2=n_3=15$)

Indicators		CG	EG_1	EG_2	Reliability assessment
		$\overline{X}_1 \pm m_1$	$\overline{X}_2 \pm m_2$	$\overline{X}_3 \pm m_3$	
Test 4: flexion and extension of the arms in support, lying on the floor, number of times	Start of the year	32,8±0,6	32,6±0,5	32,9±0,4	$t_{1,2}$=0,24; p>0,05 $t_{1,3}$=0,18; p>0,05 $t_{2,3}$=0,51; p>0,05
	End of the year	44,7±0,5	45,6±0,5	47,3±0,4	$t_{1,2}$=1,26; p>0,05 $t_{1,3}$=3,87; p<0,05 $t_{2,3}$=2,80; p<0,05

These two tests indicate a greater effect of exercise on gymnastic rings on the muscles of the upper shoulder girdle and deltoid back muscles. The next two tests were designed to test specific hand strength and forearm muscle strength. Thus, the indices of hand dynamometry (Table 5) at the end of the year were significantly higher in EG_1 in relation to the CG by 2,6 kg ($t_{1,2}$=3,55; p<0.01) and by 2,2 kg ($t_{2,3}$=3,04; p<0,01) in relation to EG_2, and the indices of flexion of the hand with weights (Table 6) by 2,3 ($t_{1,2}$=3,65; p<0,01) and 1,8 ($t_{2,3}$=3,43; p<0.01) times, respectively.

Table 5

Indicators of hand dynamometry of students engaged in sports climbing sections ($n_1=n_2=n_3=15$)

Indicators		CG	EG_1	EG_2	Reliability assessment
		$\overline{X}_1 \pm m_1$	$\overline{X}_2 \pm m_2$	$\overline{X}_3 \pm m_3$	
Test 5: hand dynamo-metry, kg	Start of the year	55,5±0,7	55,3±0,6	55,7±0,6	$t_{1,2}$=0,23; p>0,05 $t_{1,3}$=0,22; p>0,05 $t_{2,3}$=0,50; p>0,05
	End of the year	63,7±0,6	66,3±0,4	64,1±0,6	$t_{1,2}$=3,55; p<0,01 $t_{1,3}$=0,48; p>0,05 $t_{2,3}$=3,04; p<0,01

Table 6

Indicators of flexion of the hand with weights of students engaged in sports climbing sections ($n_1=n_2=n_3=15$)

Indicators		CG	EG_1	EG_2	Reliability assessment
		$\overline{X}_1 \pm m_1$	$\overline{X}_2 \pm m_2$	$\overline{X}_3 \pm m_3$	
Test 6: flexion of th hand with weights, number of times	Start of the year	7,5±0,4	7,6±0,4	7,7±0,4	$t_{1,2}$=0,17; p>0,05 $t_{1,3}$=0,34; p>0,05 $t_{2,3}$=0,18; p>0,05
	End of the year	12,5±0,5	14,8±0,4	13,0±0,3	$t_{1,2}$=3,65; p<0,01 $t_{1,3}$=0,91; p>0,05 $t_{2,3}$=3,43; p<0,01

Thus, it was found that the use of experimental programs is more effective in increasing the level of strength abilities of athletes-climbers. However, at the same time, exercises on the camrusboard and gymnastic rings have an unequal effect on the development of individual muscle groups, which allows us to conclude that it is necessary to combine these programs to ensure the diversified development of the strength of students involved in sports climbing sections.

Conclusions / Discussion

The analysis of special literature shows that the modern scientific and methodological base in sports rock climbing is not sufficiently developed to ensure effective training of athletes. Therefore, there is an urgent need to determine the development of what physical qualities of climbers is decisive for achieving high sports results.

Exercises on a campus board and gymnastic rings have an unequal effect on the development of individual muscle groups, which allows us to conclude that it is necessary to combine these programs to ensure the diversified development of the strength of students involved in sports climbing sections.

The results of exercises on gymnastic rings made it possible in experimental group No. 2 to obtain a statistically significant difference not only in relation to the control group, but also in relation to the group that used exercises on the camrusboard in terms of pull-ups, flexion and extension of the arms in support, lying on the floor.

At the same time, campusboard exercise yielded a statistically significant difference with respect to the group exercising on gymnastic rings in terms of wrist dynamometry and in terms of weighted flexion of the hand.

Prospects for further research are in the study of the experience of the leading coaches of Ukraine in the development of strength abilities among qualified athletes-climbers.

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