Trakia Journal of Sciences, Vol. 21, Suppl. 1, pp 347-351, 2023

Available online at:
http://www.uni-sz.bg
ISSN 1313-3551 (online) **doi:10.15547/tjs.2023.s.01.056**

EXPERIMENTATION OF AN ORIGINAL FITNESS MODEL FOR MUSCLE STRENGTH DEVELOPMENT OF FEMALE STUDENTS

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ABSTRACT

The objective of this study is to determine the impact of an original fitness model, based on circuit training on the level of physical quality muscle strength of female students of Trakia University. The testing was conducted in the academic year 2016/2017. A contingent of the study were 69 female students of secondary age 20,04 years from the first and second year of three faculties of Trakia University - Economics, Agricultural, and Veterinary Medicine. They were divided into two groups. In an experimental group of 36 female students circuit training twice a week for 30 weeks had been conducted. A control group of 33 female students, were trained according to an approved curriculum for the discipline "Physical Sports and Education". To achieve the objective, we used the following methods: testing, pedagogical experiments, analysis of variance, comparative analysis, and graphical analysis. Their results and analysis showed that the experiment was successful and the developed fitness program is effective. The author's fitness model based on circuit workouts improved the muscular strength of female students.

Key words: circuit training, students, experiment, university

INTRODUCTION

The negative trend of decreasing the physical activity of mankind and youth, in particular, has become more and more noticeable in the last few decades. This is mainly due to the rapid development of technology. This affects the quality of human life. People tend to eat less and move less. Many scientific publications address the issue of reviewing and adjusting the magnitudes of physical exertion of adolescents and students, taking into account the results of recent scientific studies on their physical condition. The data are indisputable and point to a decrease in human physical activity.

The years spent at the university are an important stage in the formation of future specialists and citizens of our society. The student years are a period when the foundations of a person's creative longevity are being laid, but it is a period characterized by the immobilization of the organism and increased emotional and mental pressure (1). Diseases of various systems in the body, abnormalities, allergies, etc. are on the increase. The deterioration of the student youth's ability and vitality necessitates the mass implementation of physical education and sport in the daily educational process at universities and its optimization (2). The nature and content of physical education at the university are determined by the characteristics of this category of students, by the conditions of study, and by the nature of their future profession. The aim of physical education at the university is to contribute to the preparation of harmoniously developed and highly qualified specialists (3, 4).

Human physical capacity and the issues related to it have been exciting for generations. Strength as a physical quality of a person is the basis of motor activity. Thanks to the strength, of its

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development, we are able to perform both everyday work and to react in an extreme situation for the organism. A person's strength can be defined as his ability to overcome external resistance or to counteract it at the expense of muscular effort (5). The functional characteristics of strength capacities (of musculature) are reduced to the functional state of the neuromuscular apparatus of those engaged and the innervation of muscle contractions.

A number of studies have been carried out on undergraduate students on the influence of different motor activities on physical performance and in particular on muscular strength. Current research in the field of sports has shown that there are considerable reserves to improve muscle strength in terms of factors and mechanisms of energy metabolism and autonomic systems.

The aim of the present study was to determine the influence of an original fitness model based on circuit training on the level of the physical quality of muscle strength of female students of Trakia University.

METHODS

To realize the aim we set the following tasks:

1. To make a literature study of the problem.
2. To develop and approbate a specialized fitness model.
3. To develop a test battery.
4. To conduct a scientific experiment.
5. To process and analyze the data from the testing.

Research Methods:

1. Testing
2. Pedagogical experiment
3. Variance analysis
4. Comparative analysis
5. Graphical method

The testing was conducted during the academic year 2016/2017. The contingent of the study were 69 female students with an average age of 20,04 years from the first and second year of three faculties of Thracian University - Economics, Agricultural, and Veterinary Medicine. They were divided into two groups. An experimental group of 36 female students - they were given circuit training twice a week for 30 weeks. The control group of 33 female students was trained according to an approved curriculum for the discipline of Physical Education and Sport.

The test battery included the following tests:
Test 1 - Two-legged vertical push-off from the spot

Testing is conducted next to a wall or slat spaced every inch. The candidate shall stand facing the wall, without separating his/her heels from the floor, and extend his/her hand as far up the wall - the batten - as is comfortable. The height reached with the middle finger shall be recorded to the nearest 1 cm. The candidate then performs a maximal two-footed bounce from the spot. A preliminary swing and springing are allowed, but without separating the feet from the floor. At the highest point of the vertical rebound, the fingers of the hand touch the wall and the height H reached is measured to the nearest 1cm. Two consecutive trials are performed, with the better trial being recorded. Calculate X = H - h. Higher values of X lead to higher scores.

Test 2 - Stance force
Measure with a loom dynamometer. The test gives an insight into the development of the spinal-pelvic musculature and in particular the back extensor muscles. In a straddle stance (feet shoulder-width apart), the test subject steps on the special platform of the dynamometer. He then attaches the chain of the dynamometer so that the pulling arm is at knee height and the chain points to the center of gravity of the body. The test subject pulls the dynamometer with the strength of the spinal-pelvic musculature without flexing the upper and lower limbs at the elbow and knee joints and the measurement is recorded.

Test 3 - Throwing a medicine ball 3 kg forward
Starting position standing with legs slightly apart and ball grasped with both hands overhead. After a backward swing, the subject throws the ball forward and up. Three trials are performed and scored to the nearest 10 cm. The best result is recorded.

ANALYSIS OF RESULTS

The vertical rebound test scores of the two groups at the first examination varied between 10 and 40 cm, with the mean value of the EG being 25.78 cm. and the CG slightly higher at 26.06 cm. The

coefficients of variation were about 27%, indicating a satisfactory level of variability in the results. In the second study, the results of EG were concentrated around the mean value of 30.81 cm, and the variation of the values decreased (V=22%). The achievement of the KG subjects had approximately the same mean value of 26.30 cm and variability (V=20.06%) as in the initial testing. The calculated values of the coefficients of asymmetry (As e between 0.53 and 0.97) and excess (Ex between 0.04 and 0.91) are within the critical range, indicating that the distribution of results is normal.

Table 1. *Comparison of mean arithmetic values of the trait vertical rebound - before and after application of the specialized fitness model.*

Vertical rebound	**n**	**I study**		**II study**		**d**	**d%**	**Cohen's d**	**t**	**α**
		$\overline{X_1}$	**S₁**	$\overline{X_2}$	**S₂**					
Experimental	36	25,78	6,83	30,81	6,78	5,03	19,50	1,01	6,08	0,000
Control	33	26,06	5,87	26,30	5,28	0,24	0,93	0,05	0,30	0,765
d		-0,28		4,50		4,79				
Cohen's d		-0,045		0,696		0,90				
Eta²		0,022		-0,350		0,45				
t		0,18		3,06		4,13				
α		0,855		0,003		0,000				

The experimental results in the vertical rebound test are presented in **Table 1**. The EG students showed a mean of 25.78 cm in the incoming tests and a mean of 30.81 cm in the outgoing tests. The CG students showed the following results in the first test with a mean value of 26.06 cm and in the second test with a mean value of 26.30 cm. The increment of the experimental group was 5.03 cm (19.50%). It was statistically significant (t=6.08, α=0.000) and large in practical terms (Cohen's d=1.01). The control group realized a small (d= 0.24 cm, Cohen's d=0.05) and unreliable (t=0.30, α=0.77) improvement in practical terms.

The difference between the increments of the two groups was 4.79 cm, indicating a large (Cohen's d=0.90) and statistically significant (t=4.13, α=0.00) effect of the implemented fitness model. The Eta2 coefficient shows that 45% of the differences in the rates of increase in lower limb speed-strength capabilities in the experimental period were due to the specialized fitness model we applied. This further highlights its high effectiveness.

Table 2. *Comparison of arithmetic mean values of the trait stanova dynamometry - before and after application of the specialized fitness model*

Stanova dynamometry	**n**	**I study**		**II study**		**d**	**d%**	**Cohen's d**	**t**	**α**
		$\overline{X_1}$	**S₁**	$\overline{X_2}$	**S₂**					
Experimental	36	48,78	18,43	68,44	17,75	19,67	40,32	1,69	10,16	0,000
Control	33	46,12	18,15	47,21	15,98	1,09	2,37	0,16	0,94	0,352
d		2,66		21,23		18,58				
Cohen's d		0,146		1,066		1,39				
Eta²		-0,073		-0,537		0,70				
t		0,60		5,20		8,24				
α		0,549		0,000		0,000				

The results in the " stanova dynamometry" test of the two groups at the first examination varied between 15 and 80 kg, with the mean value of the EG being 48.78 kg and the mean value of the KG being slightly lower at 46.12 kg. The coefficients of variation were about 38%, indicating a high level of variability of the results. In the second study, the results of EG were concentrated around the mean value of 68.44 kg, and the variance of the values decreased (V=25.94%). The achievement of the KG subjects had approximately the same mean value of 47.21 kg and variability (V=33.84%), slightly lower than in the initial testing. The calculated values of the coefficients of asymmetry (As e between 0.53 and 0.97) and excess (Ex between 0.04 and 0.91) are within the critical range, indicating that the distribution of results is normal.

The results of the experiment in "stanova dynamometry" test are presented in **Table 2**. The EG students showed a mean of 48.78 kg in the incoming tests and a mean of 68.44 kg in the outgoing tests. The KG students showed the following results in the first test - mean value of 46.12 kg, in the second test 47.21 kg. The increment of the experimental group was 19.67 kg (40.32%). It was statistically significant (t=10.16, α=0.000) and large in practical terms (Cohen's d=1.69). The control group realized a small in practical terms (d=1.09 kg, Cohen's d=0.16) and unreliable (t=0.94, α=0.35) improvement in results.

The difference between the gains of the two groups was 18.58 kg, indicating a large (Cohen's d=1.39) and statistically significant (t=8.24, α=0.00) effect of the fitness model implemented. The Eta2 coefficient shows that 70% of the differences in the rates of increase in the strength capacity of the back muscles in the experimental period, were due to the training means and methods we applied. This highlights their high effectiveness.

Table 3. *Comparison of the arithmetic mean values of the throwing trait medicine ball forward - before and after application of the specialized fitness model.*

Throwing a medicine ball forward	**n**	**I study**		**II study**		**d**	**d%**	**Cohen's d**	**t**	**α**
		$\overline{X_1}$	**S₁**	$\overline{X_2}$	**S₂**					
Experimental	36	413,61	43,04	452,50	51,73	38,89	9,40	1,26	7,56	0,000
Control	33	423,33	40,98	424,55	40,78	1,21	0,29	0,04	0,23	0,818
d		-9,72		27,95		37,68				
Cohen's d		-0,231		0,576		1,06				
Eta²		0,116		-0,290		0,53				
t		0,96		2,48		5,13				
α		0,341		0,016		0,000				

The scores in the forward medicine ball throwing test of the two groups at the first examination ranged between 330 and 550 cm, with the mean value of the EG being 413.61 cm and the mean value of the CG being slightly higher at 423.33 cm. The coefficient of variation for the EG was 10.41% and that of the CG was 9.68%, indicating a low level of variability in the results. In the second study, the mean values of EG were 452.50 cm, and the coefficient of variation of the values increased slightly (V=11.43%). The achievement of the CG subjects had approximately the same mean value of 424.55 cm and variability (V=9.61%), lower than in the initial testing. The calculated values of the coefficients of asymmetry (As e between 0.53 and 0.97) and excess (Ex between 0.04 and 0.91) are within the critical range, indicating that the distribution of results is normal.

The experimental results in the forward medicine ball throwing test are presented in **Table 3**. The EG students showed a mean of 413.61 cm in the incoming tests and a mean of 452.50 cm in the outgoing tests. The CG students showed the

following results in the first test with a mean value of 423.33 cm and in the second test with a mean value of 424.55 cm. The increment of the experimental group was 38.89 cm (9.40%). It was statistically significant (t=7.56, α=0.000) and large in practical terms (Cohen's d=1.26). The control group realized a little from a practical point of view (d=1.21 cm, Cohen's d=0.04) and unreliable (t=0.23, α=0.82) improvement in the results.

The difference between the increments of the two groups was 37.68 cm, indicating a large (Cohen's d=1.06) and statistically significant (t=5.13, α=0.00) effect of the conducted fitness model. The Eta2 coefficient shows that 53% of the differences in the rates of increase in the speed-strength capabilities of the arm muscles in the experimental period were due to the training means and methods we applied. This highlights their high effectiveness.

The following conclusions can be drawn from the scientific study conducted:

1. The author's fitness model based on circuit training improved the muscular strength of female students.

RECOMMENDATIONS

- Application of circuit training to develop physical quality muscle strength.
- Conduct educational work to convince female students that the level of physical fitness is directly related to health and level of performance.
- Activate female students to develop quality muscular strength in Physical Education and Sports classes.

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