

the strength training for the university students, thus constituting a basis for new training programs able to limit or eliminate the issues detected and to optimise the level of physical fitness.

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COMPARATIVE ANALYSIS OF THE CORRELATION BETWEEN THE MUSCLE STRENGTH ASSESSMENT TESTS FOR THE FEMALE STUDENTS IN THE FACULTY OF SPORTS AND PHYSICAL EDUCATION (FSPE) AND THE FACULTY OF AUTOMATICS, COMPUTER SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING (FACSEEE)

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Abstract:

Strength as a motor skill has a decisive role in expressing the movement ability of any individual, as all voluntary motion involves in variable degrees the contraction of one or several muscle bundles. By the multitude of existing manifestation forms and the diversity of combinations with the other motor skills, it is a fundamental element of the motor skill, also defined as fitness in specialised literature. General strength is part of the physical fitness, in addition to local muscular endurance,

cardio-vascular endurance, flexibility and corporal composition. Certain strength combinations are also included in motor fitness, such as agility and speed-strength/power, together with the sense of balance, response time, speed, segmental coordination. The present paper aims at the comparative analysis of the connections/ associations between the strength manifestation forms and the strength combinations with other motor skills, by calculating the correlation coefficients in all the tests included in the battery of tests, distinguished for the two lots of female students enrolled in FSPE and FACSEEE. The results obtained allow for the scientific guidance of the training process and the reasonable association of the exercises used to develop muscle strength in a differentiated manner, according to the peculiarities of each lot subjected to tests.

Keywords: *muscle strength, combined motor skills, power, positive and negative associations, fitness.*

INTRODUCTION: The young generation's relation with the natural and social environment involves the continuous optimisation of movement ability, reflected in a variable level of general and specific motor possibilities. The elements of motor ability are conditioned by the consistency and perseverance in making physical effort, the quality of the food consumed, the lifestyle, the ability to avoid or tolerate stress factors, heredity, the quality of the social environment, etc. [Badiu T./2002/p.67].

The young generation's participation and interest in movement is synthesised in their categorisation in 4 distinct groups, differentiated by the value and importance degree given to physical effort [Bota A./2007/p.319], according to the following schema:

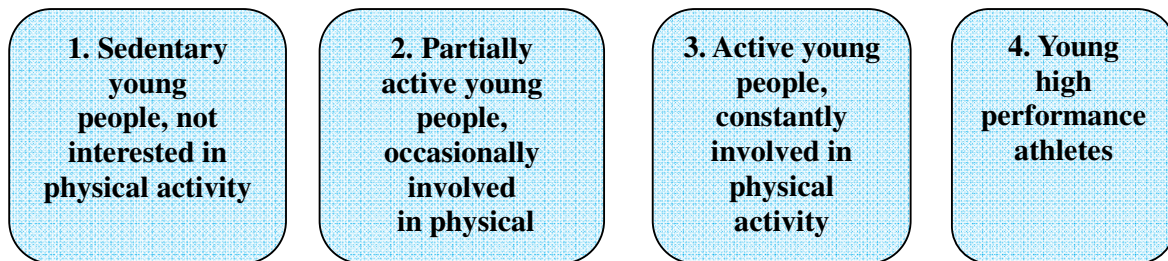


Figure 1: Classification of young people depending on the importance given to physical effort

As a result of the observations and questionnaires addressed to the two lots of female students, it may be said that most girls in the FSPE lot fall into categories 3 and 4, while the FACSEEE girls show the features of categories 1 and 2, with just a few exceptions belonging to the other two categories. Covering the practical disciplines in FSPE imposes a good development and favourable influence on the forms of manifestation of muscle strength, depending on each sport discipline and test approached, according to the curriculum. These strength gains are supplemented with the adaptive transformations generated by sport training, in case of the girls involved in high-performance sport activity. The FACSEEE lot has an assumed starting drawback in point of strength development, the direct result of insufficient training in previous school stages and the present lack of consistent interest in this respect.

The types of strength are called upon in performing various motor actions and condition the quality of the effected skills, and especially the value of performance in various sport disciplines. Specialised sources [1,3,5,10,13,14,15,16,17,18,19] contain several variants/criteria of strength classification, leading to an extremely varied typology and the need for separate testing of these variants. Figure 2 shows all these types of classification and the corresponding forms of manifestation, starting from the criteria of muscle group participation, the typology of muscular contractions, effort capacity, and ending with the main variants resulting from associating strength with the other skills, where power/ explosive strength is the most often approached and detailed by specialists.

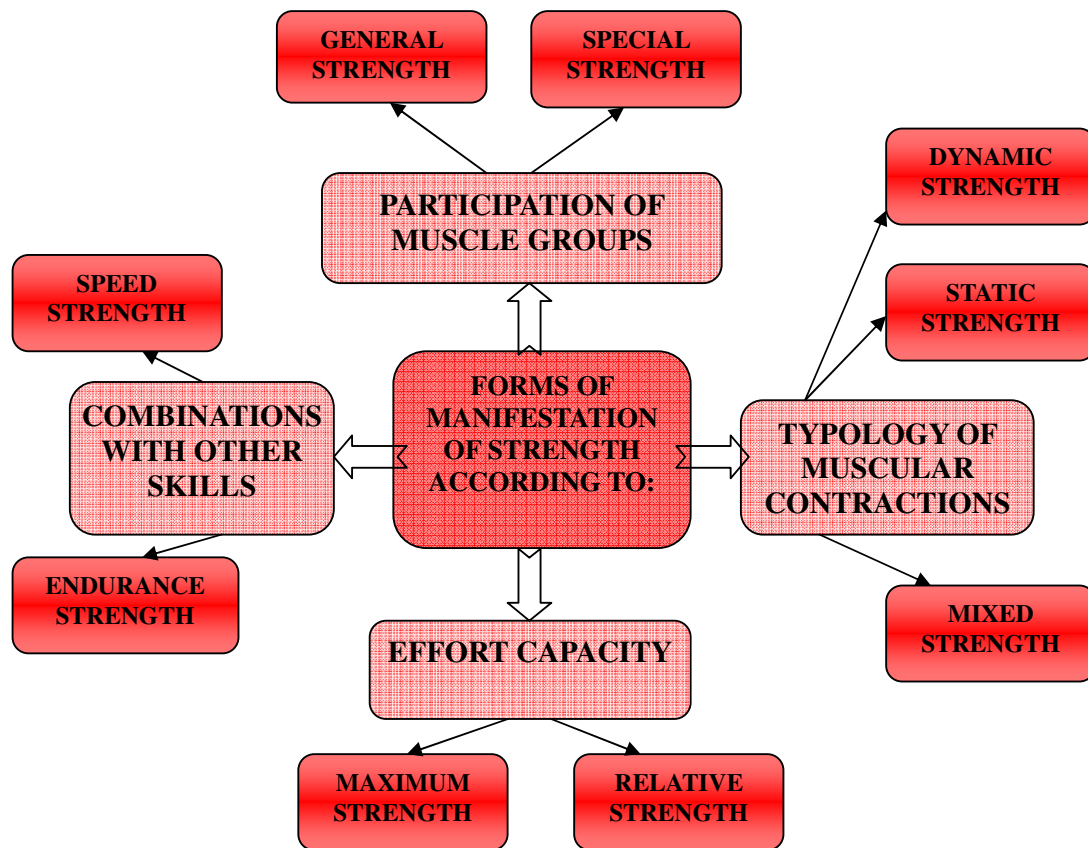


Fig. 2 Main forms of strength manifestation

The physical tests assessing strength that the students from both lots had to take approach all these forms of manifestation—which may also overlap—thus exploring the level of manifestation for almost the entire variety of combinations as seen above.

Problem statement: Insufficient investigation of the manifestation forms of muscular strength and their neglect in the process of physical training led to performance decrease in physical activities and the limitation of general and specific effort potential in students. Besides, one should also consider the real difficulty in making the effort characteristic to strength development, which are usually too demanding, and the organisation of this process by means which are usually quite unattractive and uninteresting, thus not contributing to a suitable involvement of students in motor activities.

Purpose of study: The present study aims at the comparative analysis of the development level of the manifestation forms of muscle strength for the two lots of female students –FSPE and FACSEEE – evincing the links and correlations existing among the tests used, separately for each lot. The results obtained and their statistical processing will indicate the favourable transfer or the interferences that may occur among the types of strength tested, allowing for a scientific programming of future efforts in order to limit the flaws found or to increase the strong points in the training of the two lots of female students.

Working hypothesis: It was our assumption that there are strong positive and negative associations/connections among the strength tests that the two lots took, expressed in the value of the correlation coefficients. The value of these coefficients is not identical for the two lots, the variations being determined by the specific features of the activity and the different degree of training.

Organisation and content of research: The present scientific research was performed by using the following methods according to specialised literature [6,7,8,9,11,12,20,21,22]: the analysis of the scientific and methodological specialised literature, the enquiry based on questionnaire and interview, the pedagogical observation, the method of measurements and tests, statistical-mathematical methods of result representation and interpretation.

The two lots of female students (27 girls for FSPE and 50 girls for FACSEEE) were subjected to a battery of 10 tests, examining the development level of the various manifestation forms of muscle strength. The study took place during the 2012/2013 academic year, resorting to the devices in the FSPE and the logistics of “Dunărea de Jos” University of Galati. These tests are the following:

1. *Trunk lift-ups from a back-down position 30 secs*: the initial position is back-down, palms at the back of the neck, bent knees and soles fixed by a partner or on the fixed ladder; the trunk is lifted and the elbows touch the knees, then back to the initial position. The exercise tests the dynamic abdominal strength. The number of accurate repetitions is recorded. – SNSE test.
2. *Leg lift-ups from a back-down position 30 secs*: the initial position is back-down, palms at the back of the neck; when the signal goes off the student lifts the extended legs vertically and then comes back to the original position, without touching the ground. The exercise tests dynamic abdominal strength. The number of accurate repetitions is recorded. – SNSE test.
3. *Trunk extensions from a face-down position 30 secs* : from a face-down position, palms at the back of the neck, ankles held by a partner, trunk extensions are performed, lifting the head above the height of the gym bench, then back to the initial position. The exercise tests the dynamic strength of the back muscles. The number of accurate repetitions is recorded. – SNSE test.
4. *Simultaneous lift-ups of the arms and legs from a face-down position 30 secs*: from a face-down position, strong extensions of the trunk, with the simultaneous lift-up of the extended arms and legs, above the level of the gym bench. The executions lacking the required amplitude or the accurate coordination of arms and legs are not counted. The exercise tests the dynamic strength of the back muscles, the flexibility of the muscle chains under strain and the quality of intersegment coordination.
5. *Dynamometry left/right*: it measures the maximum strength of the palm flexors. The subject holds the dynamometer in her palm with the forearm extended, flexing the palm with the most strength she can muster, without swinging the body or the arm tested. It is recommended to adjust the dynamometer according to the palm size of each subject taking the test. Two attempts are allowed and the best result is recorded for each palm.
6. *Throwing the rounders ball with wind-up*: The throw is performed on a marked spot, single-handedly, by throwing the ball over the shoulder. The exercise measures the explosive strength of the able arm. The length of the throw in metres is recorded.
7. *Long jump without take-off*: the tips of the feet are aligned behind a line, the soles placed at shoulder width, arm swing, doubled by the bending and extension of the legs, energetic impulse, take-off, long jump, concluded by a two-feet landing. The distance in centimetres from the starting line to the heel placed closest to it is measured and recorded. The test determines explosive strength/ lower limb impulse.
8. *Maintaining the hanging position*: hanging from the fixed bar irrespective of the grip – from above or from below-, a chin-up is performed, until the chin goes above the bar level, and the duration when this position is timed in seconds, until the chin goes under the level of the bar. The exercise determines the static strength in endurance regimen, especially at arm level. Eurofit and SNSE test.
9. *Push-ups*: From a face-down position, supported by the palms and toes, stretched out body, eyes forward; the arms are bent until the chest gets close to the ground and then the initial position is resumed. The number of successive executions is recorded, without time limit. The motion should be continuous, without interruptions, which would allow the muscles involved in the effort to recover. The test determines the dynamic strength in endurance regimen for the upper limbs muscles. SNSE test.
10. *Sit-ups*: From a sitting position, the subject has to perform 10 successive sit-ups, coming back to the original sitting position, without using the upper limbs—the arms are crossed over the chest. The sit-up technique is freely chosen by the subject. The duration necessary for the 10 sit-ups is recorded, lower times representing superior performance; the exercise tests the muscle strength of the lower limbs, the results being also influenced by the mobility of the joints involved in the effort, and also by adopting an efficient technique.

Findings and results, conclusions and recommendations: The results obtained after the process of testing and measuring were registered and processed by means of the statistical calculus programme SPSS [*Statistical Package for the Social Sciences*]. Some of the girls in the FACSEEE lot could not go through with the final three tests, which is why the number of cases for these tests registers lower values as compared to the original number of girls involved in the study. In this respect, only 31 girls in the FACSEEE lot completed all the tests.

The Shapiro-Wilk test was used to find the distribution normality values, which allows for the detection of the type of correlation among tests: Pearson correlations for the normal distribution tests and Spearman correlations for the tests where data distribution is not normal. The results are shown in Table 1, where it should be noted that reaching the significance thresholds means that the result distribution is not normal.

Table 1 - Tests of Normality

Tests of Normality- Shapiro-Wilk						
	Girls FACSEEE			Girls FSPE		
	Statistic	df	Sig.	Statistic	df	Sig.
Trunk lift-ups from a back down position	.964	31	.381	.942	27	.136
Leg lift-ups from a back down position	.964	31	.370	.942	27	.133
Trunk lift-ups from a face-down position	.919	31	.022	.711	27	.000
Arm and leg lift-ups from a face-down position	.981	31	.849	.898	27	.012
Dynamometry left	.930	31	.045	.954	27	.266
Dynamometry right	.894	31	.005	.964	27	.445
Rounders ball throw	.909	31	.012	.960	27	.379
Long jump without take-off	.969	31	.495	.955	27	.285
Maintained hanging position	.821	31	.000	.882	27	.005
Push-ups	.872	31	.002	.814	27	.000
Sit-ups	.977	31	.738	.685	27	.000

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Table 2: Value of the correlation coefficients, significance threshold and number of cases for the strength tests / FACSEEE lot

	Trunk lift-ups from a back down position	Leg lift-ups from a back down position	Trunk lift-ups from a face-down position	Arm and leg push-ups from a face-down position	Dynamometry left	Dynamometry right	Rounders ball throw	Long jump without take-off	Maintained hanging position	Push-ups	Sit-ups
Trunk lift-ups from a back down position	-	Prs .509** Sig. .000 N=50	Sprm .489** Sig. .000 N=50	Sprm .293* Sig. .039 N=50	Sprm .182* Sig. .205 N=50	Sprm .301* Sig. .034 N=50	Sprm .150* Sig. .298 N=50	Prs .391** Sig. .005 N=50	Sprm .265* Sig. .094 N=41	Sprm .499** Sig. .001 N=41	Prs -.086 Sig. .606 N=38
Leg lift-ups from a back down position		-	Sprm .333* Sig. .018 N=50	Prs .285* Sig. .045 N=50	Sprm .038 Sig. .791 N=50	Sprm .049 Sig. .734 N=50	Sprm .031 Sig. .833 N=50	Prs .345* Sig. .014 N=50	Sprm .111 Sig. .491 N=41	Sprm .493** Sig. .001 N=41	Prs -.038 Sig. .822 N=38
Trunk lift-ups from a face-down position			-	Sprm .570** Sig. .000 N=50	Sprm .247 Sig. .084 N=50	Sprm .358* Sig. .011 N=50	Sprm .105 Sig. .469 N=50	Sprm .183 Sig. .204 N=50	Sprm .193 Sig. .228 N=41	Sprm .320* Sig. .041 N=41	Sprm .043 Sig. .798 N=38
Arm and leg lift-ups from a face-down position				-	Sprm .278 Sig. .051 N=50	Sprm .237 Sig. .098 N=50	Sprm .119 Sig. .412 N=50	Prs -.026 Sig. .856 N=50	Sprm .293 Sig. .063 N=41	Sprm .232 Sig. .145 N=41	Prs .061 Sig. .715 N=38
Dynamometry left					-	Sprm .751** Sig. .000 N=50	Sprm .416** Sig. .003 N=50	Sprm .315* Sig. .026 N=50	Sprm .134 Sig. .405 N=41	Sprm .191 Sig. .231 N=41	Sprm -.092 Sig. .581 N=38
Dynamometry right						-	Sprm .449** Sig. .001 N=50	Sprm .361** Sig. .010 N=50	Sprm .012 Sig. .941 N=41	Sprm .240 Sig. .131 N=41	Sprm .085 Sig. .613 N=38
Rounders ball throw							-	Sprm .355* Sig. .012 N=50	Sprm -.110 Sig. .495 N=41	Sprm .139 Sig. .386 N=41	Sprm .079 Sig. .638 N=38
Long jump without take-off								-	Sprm .000 Sig. .998 N=41	Sprm .164 Sig. .306 N=41	Prs -.198 Sig. .234 N=38
Maintained hanging position									-	Sprm .281 Sig. .088 N=38	Sprm -.367* Sig. .036 N=33
Push-ups										-	Sprm .015 Sig. .934 N=32
Sit-ups											-

Note: * Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Sprm – Spearman Correlation Coefficient

Prs – Pearson Correlation Coefficient

Table 3: Value of the correlation coefficients, significance threshold and number of cases for the strength tests / FSPE lot

Note: * Correlation is significant at the 0.05 level (2-tailed).

	Trunk lift-ups from a back down position	Leg lift-ups from a back down position	Trunk lift-ups from a face-down position	Arm and leg push-ups from a face-down position	Dynamometry left	Dynamometry right	Rounders ball throw	Long jump without take-off	Maintaining hanging position	Push-ups	Sit-ups
Trunk lift-ups from a back down position	-	Prs .227 Sig. .255 N=27	Sprm .467* Sig. .014 N=27	Sprm .287 Sig. .147 N=27	Prs .278 Sig. .160 N=27	Prs .283 Sig. .152 N=27	Prs .017 Sig. .932 N=27	Prs .416* Sig. .031 N=27	Sprm .644** Sig. .000 N=27	Sprm .245 Sig. .218 N=27	Sprm -.525** Sig. .005 N=27
Leg lift-ups from a back down position		-	Sprm .217 Sig. .277 N=27	Prs .207 Sig. .299 N=27	Prs -.150 Sig. .455 N=27	Prs -.019 Sig. .926 N=27	Prs -.353 Sig. .071 N=27	Prs .000 Sig. 1.000 N=27	Sprm .010 Sig. .959 N=27	Sprm .189 Sig. .346 N=27	Sprm -.149 Sig. .459 N=27
Trunk lift-ups from a face-down position			-	Sprm .724** Sig. .000 N=27	Sprm -.268 Sig. .176 N=27	Sprm .189 Sig. .344 N=27	Sprm .105 Sig. .469 N=27	Sprm .246 Sig. .216 N=27	Sprm .487* Sig. .010 N=27	Sprm .220 Sig. .270 N=27	Sprm -.085 Sig. .673 N=27
Arm and leg push-ups from a face-down position				-	Sprm -.323 Sig. 1.000 N=27	Sprm .078 Sig. .700 N=27	Sprm .024 Sig. .906 N=27	Sprm .128 Sig. .525 N=27	Sprm .356 Sig. .068 N=27	Sprm .205 Sig. .304 N=27	Sprm -.134 Sig. .505 N=27
Dynamometry left					-	Prs .784** Sig. .000 N=27	Prs .129 Sig. .523 N=27	Prs -.016 Sig. .936 N=27	Sprm .266 Sig. .179 N=27	Sprm .251 Sig. .208 N=27	Sprm -.120 Sig. .551 N=27
Dynamometry right						-	Prs .320 Sig. .103 N=27	Prs .020 Sig. .921 N=27	Sprm .213 Sig. .286 N=27	Sprm .151 Sig. .451 N=27	Sprm -.068 Sig. .737 N=27
Rounders ball throw							-	Prs .253 Sig. .203 N=27	Sprm .136 Sig. .497 N=27	Sprm -.225 Sig. .260 N=27	Sprm .202 Sig. .312 N=27
Long jump without take-off								-	Sprm .258 Sig. .194 N=27	Sprm -.291 Sig. .141 N=27	Sprm -.481* Sig. .011 N=27
Maintaining the hanging position									-	Sprm .399* Sig. .039 N=27	Sprm -.508** Sig. .007 N=27
Push-ups										-	Sprm -.008 Sig. .969 N=27
Sit-ups											-

** Correlation is significant at the 0.01 level (2-tailed).

Sprm – Spearman Correlation Coefficient

Prs – Pearson Correlation Coefficient

The calculus of the correlation coefficients allowed for assessing the influence/ connection between the various forms of manifestation and combinations of strength, tested by the battery used. The results vary dramatically between the two lots, thus proving that the training level and sport speciality have a strong influence, either positive or negative, on the various forms of strength manifestation. Tables 2 and 3 show that the number of significant correlations registered among tests in the FACSEEE lot –with a weaker training- is 20, double than the 10 cases of significant correlations in the FSPE lot – better trained-. This supports the theory that the higher level of training and sport speciality limit the positive transfer actions and increases the cases of interference at the level of motor skills, while the weaker level of training often favours a positive transfer among most of the skills developed and tested. Thus, in the case of beginners or individuals with a weaker level of physical training, the actions of explosive strength development -for example- may also have favourable effects on the maximum strength or the endurance strength, even if the type of strain is different. These aspects are confirmed by the high number of positive correlations, which are in fact dominant in Table 2, the only test with frequent negative correlations being *sit-ups*, due to its nature: it is the only atypical test, i.e. higher performance presuppose obtaining low times/ results, while for the other tests the value of performance increases with the value of the results obtained.

In the FACSEEE lot one may see that strong and significant positive correlations are obtained for a threshold < 0.01 for the following test combinations:

- trunk lift-ups from a back-down position, and trunk lift-ups from a face-down position –both involve abdominal muscles, but with a different execution technique.
- trunk lift-ups from a back-down position, and trunk lift-ups from a face-down position – evince the interdependence between abdominal and back muscles in performing movement.
- trunk lift-ups from a back-down position and leg lift-ups from a back-down position, and the long jump without take-off and push-ups– proving the role of abdominal muscles as movement stabiliser for the actions of explosive strength or endurance strength of upper or lower limbs.
- trunk lift-ups from a face-down position, and arm and leg lift-ups from a face-down position –both involve back muscles strength and mobility.
- dynamometry left and dynamometry right – evincing the strong correlation between the strength of the palm flexors for both hands, dynamometry left and dynamometry right, and the rounders ball throw– both involve strains at the level of the upper limbs and arm extension at the time of effort, even if the types of strength tested are different.

Surprising significant correlations are found in the combinations between the long jump without take-off and the dynamometry tests, and the rounders ball throw respectively, with significance thresholds < 0.01 or < 0.05 . Even if the muscle groups tested are totally different, a possible explanation of these favourable results is that the strength tested is the dynamic strength, all tests involving a high concentration capacity, and the long jump without take-off and the rounders ball throw involve muscle power/ explosive strength.

The FSPE lot obtains significant correlations for fewer test combinations, and in many cases these are different from those seen in the FACSEEE lot, the significant correlations between certain tests in the FACSEEE lot being irrelevant –see Table 3. These results prove that effort specificity in the various sports practised, the strong development of those muscle chains and energy systems supporting specific effort, training mainly those manifestation forms and combinations of strength that are necessary for muscle strength development, reaching a high level of specific physical fitness are factors limiting the favourable transfer from or to those motor skills not involved in competition effort. It is to be noted that there are several negative correlations among tests, even if they are not significant in most cases, which prove the cases of negative interference or association.

Besides, there are significant positive correlations for a threshold < 0.01 or < 0.05 between the maintaining the hanging position test –determining the static strength in an endurance regimen – and the tests determining the dynamic strength in an endurance regimen: trunk lift-ups from a back-down position, trunk lift-ups from a face-down position, and push-ups, all the muscular groups isotonically involved in these 3 tests being isometrically contracted to stabilise and maintain the hanging position in the case of the initial test.

The results obtained upon testing the two lots underline the fact that the forms of strength manifestation and strength combinations should be developed in a system, and also the fact that the connection between them is dependent and varies greatly depending on the peculiarities, potential and training level of each lot tested. The favourable influences between tests are the more obvious as the training level and sport speciality become higher, thus confirming the working hypothesis. The negative associations mainly seen in the tables for the FSPE lot are to be avoided in the training process, in order to prevent the phenomenon of interference.

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STUDY ON THE PHYSICAL TRAINING OF THE JUNIOR GYMNASTS III

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Abstract

The physical preparation in the women's artistic gymnastics is set towards the development of the main combined physical qualities and of the specific stamina as well. Thus, the sports practice in gymnastics is permanently concerned with the periodic change of the physical and technical preparation content in order for the training and performance goals to be achieved.

Through the themes we chose, this paper sets as a main objective to determine the level of physical preparation that the junior gymnasts III from School Sports Club (CSS) around the country have.

Methods – *in order to find out the level of physical preparation of the junior gymnasts III a number of 13 general and specific physical tests were applied. Microsoft Excel was used to process the statistics.*

The results *restored after the tests showed a major deficit in the physical preparation to the junior gymnasts III that were included in this experiment. This fact explains the poor performance in competitions.*

Keywords: *women's artistic gymnastics, physical preparation, tests, physical trials*

INTRODUCTION

The sports training technology translates into a group of methods, means, education, guiding and body recovering technique that are used depending on the set objectives (Bompă O.T., 2002).