



CORRELATION DEPENDENCES OF SOME PHYSICAL DEVELOPMENT AND CAPACITY INDICATIVE TESTS OF STUDENTS AT TRAKIA UNIVERSITY

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ABSTRACT

The study of the various components of physical training and its structure is the focus of attention when working with qualified athletes. At the same time, these issues are poorly developed in relation to groups with poor physical training and those not involved in sports. The aim of the study is to study the level of physical ability and the relationship between the physical qualities of female students from Thrace University. Research methodology – to conduct a literature review of the problem, to develop a test battery for the study, to organize experimental coverage of the test battery, to process and analyze the data from the conducted testing. Research methods – testing, pedagogical observation, variation analysis, correlation analysis, graphic method. The study contingent is 300 first and second year female students from the Faculty of Pedagogy, Faculty of Economics, Faculty of Veterinary Medicine and Faculty of Agriculture. The students do not engage in sports. The data from 12 tests were downloaded from the female students, which were conducted under standardization of the conditions of all groups.

Keywords: endurance, strength, speed

Physical education as part of the general educational system at universities, together with other subjects, is called upon to solve issues related to training highly qualified staff in various professional fields. Physical education tools are used to solve a wide range of health-improving, educational and upbringing tasks, contributing to development of qualified specialists (1-3).

The choice of effective tools in Physical education is largely determined by the structure of students' physical training, which is understood as relation of basic motor qualities. The study on various components of physical development, physical training and its structure is the focus in workout with qualified athletes. The dependence between physical development of athletes at universities and their physical abilities lies in the focus of sports educators (4-7).

poor physical training and not involved in sports. That is why it is necessary to examine and clarify the structure of qualities needed for a specialist to effectively conduct pedagogical process. Some authors believe (3) that when creating the model of educators, the issue of physical training and ability of future teachers is not paid needed attention to. It is logical to think that in order to educate strong, agile and resilient boys and girls, the educator himself/herself should possess these qualities. It is known that nowadays the majority of educators are women and most of them do not pay much attention to their physical training.

The aim of this study is to examine the level of physical abilities and the relationship of physical qualities of female students at Trakia University.

METHODOLOGY

To achieve the aim, we set the following tasks:

1. To do a reference study on the problem.
2. To develop a test battery for the study.
3. To organize experimental coverage of the test battery.

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However, these issues have not been well-developed in the groups of undergraduates with

4. To process and analyse the data collected from the conducted tests.

Research methods:

1. Testing
2. Pedagogical observation
3. Variation analysis
4. Correlation analysis
5. Graphical method

At the beginning of the 2024/2025 academic year, 300 first- and second-year female students at the Faculty of Pedagogy, Faculty of Economics, Faculty of Veterinary Medicine and Faculty of Agriculture were subjected to a study on their physical abilities. It should be mentioned that none of them had been engaged in sports. The average age of students involved in this study was 20.48 years.

The data on female students were taken by 12 tests conducted under standardised conditions in all groups. The test battery included the following indicators of physical development and physical capacity:

1. Height (cm),
2. Weight (kg).
3. Forward lean (cm),
4. Flying 30-meter sprint (sec),
5. Low start for a 60-meter sprint (sec),
6. Standing long jump (cm),
7. Standing vertical jump (cm),
8. Standing strength (kg),
9. Push-ups to failure (number),
10. Arm curls at lying height on a low bar (number),
11. Sit-ups to failure (number),
12. 300-meter smooth sprint (sec).

The results of the study were statistically processed.

ANALYSIS OF RESULTS

The representative sample of this study fully characterized the people engaged in the same age-and-sex group. As final results of data processing, we obtained the following results of variation features (**Table 1**) – the minimum and maximum values of each test, arithmetic mean ($\bar{X}$), standard deviation (α), coefficient of variation (V) and swinging of arms (R).

Table 1. Values of variation features

Indicators	$X_{\min}$	$X_{\max}$	$\bar{X}$	α	V	R
Height (cm)	148	172	162,04	3,86	2,38	24
Weight (kg)	42	107	68,56	11,88	18,20	68
Standing strength (kg)	45	115	66,13	13,07	19,70	70
Push-ups to failure (number)	0	12	3,64	0,83	3,10	12
Arm curls at lying height on a low bar (number)	4	47	20,38	9,27	45,50	43
Sit-ups to failure (number)	10	113	37,64	16,04	42,60	103
Standing long jump (cm)	102	190	149,14	17,04	11,40	78
Standing vertical jump (cm)	20	38	29,58	2,76	9,53	18
Forward lean (cm)	11	28	13	6,16	47,40	39
Low start for 60-meter sprint (sec)	10,2	14	11,91	1,12	9,39	3,8
Flying 30-meter sprint (sec)	4,8	7	5,47	1,02	8,50	2,2
300-meter smooth sprint (sec)	75	122	103,2	11,53	9,90	47

The obtained average values and standard deviation for each indicator estimate the general parameters of population. Due to the fact that standard deviations are expressed in different measurement units, in order to be able to compare the individual deviations from each other, we calculated the coefficient of variation. That makes possible to compare the degree of dispersion of all indicators studied, expressed in percentages. The highest percentage of variation was obtained in the tests of forward

lean (47.40), arm curls at lying height on a low bar (45.50), sit-ups to failure (42.60), and the lowest coefficient was obtained in the tests at 60-meter slow start (9.39), push-ups to failure (3.10), height (2.38).

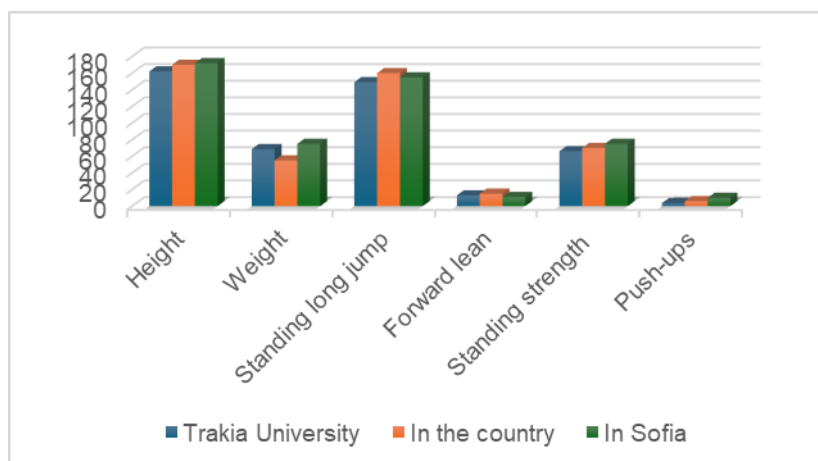
Based on the obtained average values of individual tests and their standard deviations, using the sigma deviation method, we have compiled a table for individual assessment of physical performance (**Table 2**).

Table 2. Individual assessment of physical performance

Indicators	-2α	-1α	$\bar{X}$	$+1\alpha$	$+2\alpha$
	Lagging	Below average	Average	Above average	Very good
Standing strength (kg)	40	53,06	66,13	79,50	92,27
Push-ups to failure (number)	0	1	2,64	4	5
Arm curls from lying height on a low bar (number)	2	11	20,38	30	39
Sit-ups to failure (number)	6	22	37,64	54	70
Standing long jump (cm)	115,06	132,10	149,14	166,18	183,22
High jump with two legs from a place (cm)	24,06	26,82	29,58	22,34	35,10
Forward lean (cm)	0,62	6,84	13	19,16	25,32
Low start for a 60-meter sprint (sec)	14,15	13,03	11,91	10,79	9,67
Flying 30-meter sprint (sec)	7,51	6,49	5,47	4,45	3,43
300-meter smooth sprint (sec)	144	133	122	111	100

Figure 1 presents the comparative data on physical development and some of the physical

ability tests of individuals examined from the country and the city of Sofia.

**Figure 1.** Comparison of data on physical development and physical ability tests

Considering that the selection of participants in this study had been made on the basis of representativeness, we set the task of determining interrelation of the individual tests. Using the method of correlation analysis, we calculated 66 correlation coefficients of different tests as well as the limits of real coefficients at a significant level of 99.73%. When interpreting the individual correlation coefficients, the following significant interdependences can be indicated (**Table 3**).

The table shows that the value of interdependence of tests is different both in magnitude and direction. The correlation between height and weight is moderately positive ($r=0.457$) at $Sy=3.43$. There is negative significant and moderate correlation between height and the achievement of 60-meter sprint

($r= -0.700$) and 300- meter smooth sprint ($r= -0.518$).

The negative correlation coefficients indicate that the achievements in specified runs improve with increasing height of female students. Height has negative correlation, significant and moderate, with the indicators of arm curls at lying height on a low bar ($r= -0.624$), sit-ups to failure ($r= -0.567$) and push-ups to failure ($r= -0.382$). We obtained a significant correlation between weight and the achievements of flying 30-meters sprint ($r= 0.532$) and a moderate correlation with the achievements of 60-meters low start sprint. We assume that the difference in dependence degree is due to the factor of low start execution technique with the 60-meter sprint test.

Table 3. Correlation coefficients of individual tests

Indicators	12	11	10	9	8	7	6	5	4	3	2	1
300-meter smooth sprint	-0,518	0,236	-0,277	-0,173	-0,247	-0,161	-0,681	-0,202	-0,331	0,703	0,346	X
Flying 30-meter sprint	-0,402	0,532	-0,402	-0,282	-0,212	-0,195	-0,328	-0,848	-0,358	0,774	X	
Low start for 60-meter sprint	-0,700	0,359	-0,800	-0,565	-0,755	-0,705	0,468	-0,640	-0,529	X		
Standing long jump	0,679	0,260	0,700	0,134	0,270	0,428	0,125	0,616	X			
Standing vertical jump	0,707	0,619	0,635	0,714	-0,593	0,446	-0,579	X				
Forward lean	0,378	-0,420	0,190	-0,384	0,394	0,681	X					
Sit-ups to failure	-0,567	-0,170	0,184	0,272	0,119	X						
Arm curls at lying height on a low bar	-0,624	-0,420	0,264	0,223	X							
Push-ups to failure	-0,382	0,453	0,447	X								
Standing strength	0,594	0,458	X									
Weight	0,457	X										
Height	X											

The different indicators of physical ability correlate each other as follows: the dependence between standing strength and the achievement of 60-meter low start ($r = -0.800$) is high it is significant while correlating the achievements in standing long jump tests ($r = 0.700$) and standing vertical jump ($r = 0.635$). The achievements in standing vertical jump tests and standing long jump tests correlate significantly each other ($r = 0.616$), which means that the achievement in one of these tests can be used to draw conclusions about the other one. The standing vertical jump and the push-ups to failure tests significantly correlate ($r = 0.714$). The coefficient obtained confirmed the conclusion of V. P. Filin that the height standing vertical jump with swinging of arms depends on the degree of development of arm muscle strength.

Rebound tests highly correlate with speed tests (30-meter fly sprint and 60-meter slow start) as well as other speed tests. In our opinion, the high correlation between the achievement of 60-meter slow start and the tests of strong endurance of abdominal muscles is due to the fact that while one is running, the abdominal muscles are actively involved in hip lifting.

The obtained small correlation coefficients in dependence between the flexibility test (forward lean) and the tests characterising strength and strength endurance, gave us grounds to conclude that the work on flexibility

as physical quality did not lead to an increase in strength and strength endurance.

It should be emphasized that the obtained correlation coefficients relate to and characterize only the examined students and the total population whom the representative sample was taken from.

CONCLUSIONS

1. The obtained objective data on the average physical development and average level of physical ability is sufficient to fully characterize the students engaged in groups for general physical training.
2. The relatively large coefficients of variation indicate a high variability of the examined features of female students.
3. The indicators of physical ability, such as speed, standing strength and rebound, are in a high correlation with all other tests.

The results of the conducted research will contribute to clarifying the structure of qualities necessary for specialists to maintain their physical capacity. That especially refers to students at the Faculty of Pedagogy because to train strong and resilient adolescents, future teachers, mostly female, should keep a good level of physical fitness.

REFERENCES

1. Angelova P.. Overview of the research activity of the Department of physical education and sport at Trakia University, *Trakia Journal of Sciences*, Vol. 21, Suppl. 1, 420-424, ISSN 1313-3551, 2023
2. Angelova, P., Belomazheva-Dimitrova, S., Study on sports injuries among students volleyball athletes, *Trakia Journal of Sciences*, Vol. 21, Suppl. 1, 425-430, ISSN 1313-3551, 2023
3. Ignatova, D., Angelova, P., Biomechanical sustainable trends in the dynamics of speed endurance indicators, November, *Journal edited by Bulgarian Academy Of Science, Series on Biomechanics*, Vol. 38(Suppl. 3):48-54, DOI: 10.7546/SB.06.03.2024, 2024
4. Arsova, R., Assessment of training programmes for development of speed – force qualities with volleyball players. *International Journal Knowledge*, Skopje, Scientific papers, Vol. 38. 6., pp. 1531 - 1535, ISSN 2545-4439, 2020
5. Arsova, R., “Correlation interrelation between the indications of speed-strength preparation of 17-19-years old female volleyball players”, *RESEARCH IN KINESIOLOGY*, Vol. 6 - 2/2016, pp. 183-187, ISSN 1857-7687, Skopje, 2016
6. Peeva, D., Manual of Physical Education at Todor Kableshkov University of Transport, Sofia. ISBN 978-954-718-317-9, 2011
7. Tzankova, J., Study of the physical development, physical and technical-tactical preparedness of women basketball players *Trakia Journal of Sciences* Trakia University, Vol. 19, Suppl. 1, 696-702, ISBN 1313-3551, 2021