

**NATIONAL SPORTS ACADEMY**

**“VASIL LEVSKI”**

**Department “Football and Tennis”**



**VIKTORIA EMILOVA OCHEVA**

**Technology of Conditioning in the Learning Process of Physical  
Education through Tennis Classes in Higher Schools**

**ABSTRACT**

**Sofia, 2024**

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**ABSTRACT**

**TECHNOLOGY OF CONDITIONING IN THE LEARNING  
PROCESS OF PHYSICAL EDUCATION THROUGH TENNIS  
CLASSES IN HIGHER SCHOOLS**

for awarding the educational and scientific degree “Ph. Doctor”,  
higher education area 7. Healthcare and sport, professional field 7.6. Sport,  
doctoral program “Theory and methodology of sport science”

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**Sofia, 2024**

The dissertation work has been discussed and scheduled for public defense by the Department of “Football and Tennis” of the National Sports Academy “Vasil Levski”.

The dissertation work contains 168 printed pages. It is illustrated with 42 tables and 26 figures. The bibliography includes 154 literary sources, 136 of them in the Cyrillic and 18 in the Latin alphabet.

The public defense of the dissertation work will take place on 12.02.2025 at 14.00 in hall “Beckenbauer”, bl.70 of NSA “Vasil Levski”, “Studentski Grad”, Sofia -1700.

The materials for the defense are available in the library of NSA “Vasil Levski”, Sofia.

## INTRODUCTION

Tennis is one of the most popular sports in our country and abroad. It becomes more and more dynamic in recent years and is in the group of the most complex games using a playing court, a net, a racket, a ball and an opponent. Tennis popularity is also increasing among university students lately. Through tennis practice, students have the opportunity to develop their physical qualities, to expand their social contacts, to acquire new knowledge and skills and to improve their motor and functional abilities. Students' willingness to practice tennis is an expression of their inherent desire to seek and gain new knowledge, to improve their coordination, physical and functional capabilities.

University education is a stage in students' personal and intellectual growth. The development of higher education institutions in modern conditions is accompanied by greater intensifications of students' work, an increase in the diverse flow of information, a wide access of information and computer technologies in education and free time activities (Узунов, М., 2021).

The constant increase of scientific and practical information limits the time for its acquisition and assimilation, which leads to overloading and disharmony in the development of a student's personality. The process of education is often accompanied by stress situations. In general, that leads to a decrease in motor activity, it also leads to a decrease in work capacity, health deterioration and is a prerequisite for a number of diseases (Люзанов, В., 2019).

Physical education and sports are a major component of personal development and an important part of the general culture and professional preparation of students. Sports games increase the emotional impact, improve motor capabilities and form skills for social interaction and socialization of the personality. The characteristics and content of physical education at higher schools is determined by the peculiarities of that group of learners, by the conditions in which their learning activities take place, and by the characteristics of their future profession.

Physical education, as the only subject in the university curriculum, which has the direct task of strengthening the health of students and increasing their professional

and general work capacity, is obliged to respond in time to modern changes in the process of education at higher schools (Атанасова, К., 2013). The education process in tennis is conducted in several forms – optional sport, sports performance, elective form, and training sessions for students with health problems (Цолова, В., 2017).

The learning process is conducted with the application of physical exercises, and the physical capabilities of students are objectively registered. In connection with this, appropriate parameters in terms of the number and quality of activities are accepted and improved, on the basis of which, indicative information about the physical condition and the development of the physical abilities can be obtained. Regardless of the form of education – compulsory, elective or independent, the place and importance of physical education in higher education is indisputable. The high level of physical capacity, of developed motor skills and habits of the students is a guarantee for better acquisition of theoretical knowledge and longer professional life of the future specialists.

Promoting the development of physical education and sport is not the concern of specialized higher schools alone. It is an important task for all higher education institutions to create the necessary prerequisites for students to actually carry out purposeful physical activity (Николова, Е. и кол., 2005).

The technologies of physical education form a branch of pedagogical technologies, involving ordered sets of procedures, techniques, means and methods, algorithms, and their interaction in order to obtain the planned result.

The technologies of physical education can be divided into technologies of learning motor activities and technologies of developing motor skills.

One of the main tasks of physical education at universities is the development of physical qualities. According to Рысев, Р. (2000) in resolving that task, a high level of physical performance and harmonious body structure are achieved, which are important components of the ideal of physical education – the perfect physique of man. Motor qualities are at the basis of all human activity. Efforts are aimed specifically at developing and maintaining the necessary motor qualities of students during their university education and obtaining knowledge about organized or independent sports

activities to help their future professional realization after the completion of their university studies. Students' good physical condition has a positive impact on their better professional realization. In contemporary sport, physical preparation is increasingly replaced by "conditioning" (Гъдев, М., 2015). These two terms overlap, but tracing their development reveals differences in their content as part of the structure of sport training. In sport practice, the term conditioning came to mean preparedness, physical fitness, building and maintaining the basic physical qualities – speed, strength, endurance. Physical preparation aims at all-round physical development, increasing the functional capabilities of the human organism and strengthening the athlete's health. When sport preparation is defined as "physical", the differentiated qualities and their development as such come to the fore. And when it is defined as "conditioning", we associate it with creating conditions for building the necessary specific psycho-physiological motor state. It involves the preparation leading to that state, while at the same time the aim and direction are very precisely and clearly formulated. The term "conditioning" is related to specific modelling of various complexes of exercises (models) for the respective sport, in order to form and develop motor skills and capabilities. These complexes and models of exercises need to reflect the essence and the peculiarities of motor capabilities, characteristic of the respective sport (tennis in particular) (Димов, Ив., 2018).

Conditioning in higher schools through tennis training sessions, implies the use of a large range of means used to train the students. Systematizing the basic and additional means with a view to their purposeful application is an important task of the specialized program (Стоянова, С., 2016).

### **Working hypothesis**

The hypothesis of the present study was built on the assumption that one of the possible ways to improve fitness qualities in the learning process of physical education through tennis classes in higher schools is by the introduction of a specially developed (original) program with modern methods and technical means for its implementation.

**Our working hypothesis is based on our assumption, that the development and testing of a conditioning technology through the sport of tennis will increase the interest and improve the quality and effectiveness of the learning process in higher schools.**

Of course, such a hypothesis and the research related to it do not reject the established approaches and programs in tennis practice, but they only complement them in favor of the learning process in physical education and sports at the higher schools.

## **AIM, TASKS, METHODOLOGY AND ORGANIZATION OF THE RESEARCH**

### **Aim and tasks of the research**

**The aim of the present research** is the development of the motor condition of students in the physical education and sports sessions of the groups in “Optional Sport - Tennis” at nonspecialized higher schools through the application of a special learning program.

For the achievement of the aim of the research we had the **following tasks**:

1. Review and analysis of the literature on the problems of conditioning, physical performance of students and impact technologies.
2. Study of students’ attitude to tennis lessons in the learning process of physical education and sport in higher schools.
3. Establishing the mean value and variability of the studied indicators of motor conditioning and some mental characteristics of students involved in tennis classes.
4. Establishing and specifying the nature of correlation dependencies in the complex correlation - structural model between the studied indicators.
5. Establishing the effectiveness of the developed original program to improve the motor condition of the students from the “Optional Sport - Tennis” groups.

**6.** Development of a normative system for control of the physical development and physical capacity of students from tennis groups at higher schools.

### **Object, subject and contingent of the research**

**The object** of the research are the indicators of physical development and physical capacity, as well as some mental characteristics of students from higher schools in the groups of “Optional Sport-Tennis” .

**The subject** of the research is the training of students in the “Optional Sport-Tennis” groups of the higher schools.

**The contingent** of the research are 93 students from the University of National and World Economy, the Technical University and Sofia University “St. Kliment Ohridski”, participating in the “Optional Sport-Tennis” classes, divided into two groups (experimental and control).

### **Methodology of the research**

The following methods were applied for the realization of the set aim and tasks of the research:

- 1. A review and theoretical analysis of specialized literature** – to establish the state of the problem according to literary sources. 154 sources were studied, 136 in Cyrillic and 18 in Latin alphabet.
- 2. A survey** – to establish the interest of students from the University of National and World Economy, the Technical University- Sofia and Sofia University “St. Kliment Ohridski” to the sport of tennis in the physical education and sport classes.
- 3. Anthropometry** – to reveal the state of the basic morpho-functional characteristics of students by collecting information on anthropometric indicators.



- 4. Pedagogical observation** – to collect information about the motor skills of students from the University of National and World Economy, the Technical University-Sofia and Sofia University “St. Kliment Ohridski” during the training activities.
- 5. Pedagogical experiment** – the participants in the research are first year students, studying the discipline “Physical Education and Sport” at the University of National and World Economy, the Technical University - Sofia and Sofia University “St. Kliment Ohridski”. A total of 93 students are involved in the study - an experimental group of 40 students – 24 men and 16 women, and a control group of 53 students – 30 men and 23 women, aged between 19 and 22. The experiment was conducted in the course of one academic year in two semesters with a total of 30 seminars. The experimental group applied the prepared specialized program for improving students’ motor condition through the sport of tennis, and the control group used the accepted and approved education programs in physical education and sport at the higher school.

The prepared specialized program was included only in the education content of the students from the experimental groups (men and women - students) of the University of National and World Economy and the Technical University - Sofia. The exercises included in it were performed during the preparatory part, the main part and the final part of the tennis lessons. The sport seminars with the experimental group were structured, as follows:

1. Preparatory part with duration ~ 10 – 15 minutes.
2. Main part with duration ~ 60 – 70 minutes.
3. Final part with duration ~ 10 – 15 minutes.

The preliminary part had to prepare functionally the students’ organisms for the greater loading in the main part. Various types of exercises were performed to prepare the musculoskeletal system, such as:

- ✓ running of various durations;
- ✓ different types of special running exercise;
- ✓ agility ladder drills;

- ✓ running different lengths and from different starting positions;
- ✓ flexibility exercises – dynamic stretching.

The main part was divided in two sections – it includes specialized exercises for technical skills and conditioning exercises:

- ✓ exercises to develop lower limb strength;
- ✓ exercises to develop upper limb and body strength;
- ✓ exercises to develop explosive power;
- ✓ exercises to develop endurance;
- ✓ exercises to develop speed;
- ✓ exercises to develop agility.

The final part aimed to normalize the vital functions of the organism by decreasing physical tension. Attention was also paid on developing flexibility (stretching) and on recreation work using light recovery jogging.

**Sport pedagogical testing** – to establish the level of physical condition indicators of the subjects of the research and some mental characteristics. The applied test battery included 12 sport pedagogical tests /indicators/ (**Table 1**).

## **6. Mathematical-statistical methods** for processing research results.

The study was carried out in four main stages.

## **RESULTS AND ANALYSIS**

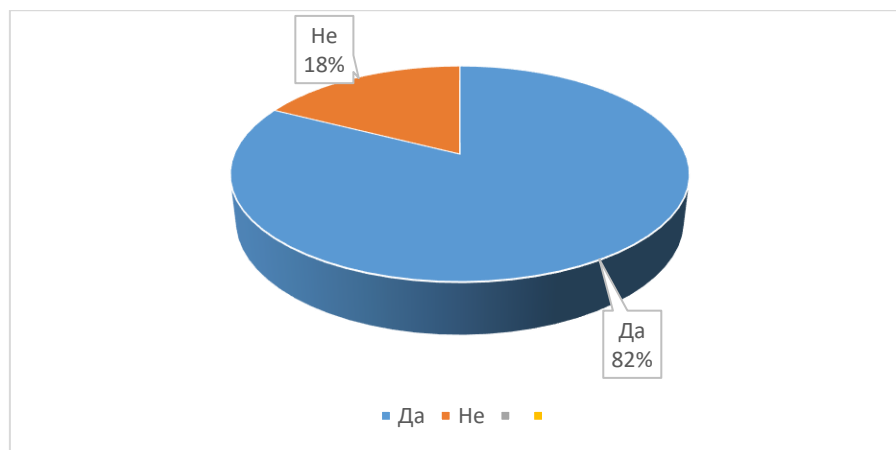
In order to resolve the aim and tasks of our research, the interests and attitude to activities were studied in the profiled tennis groups for the discipline “Physical Education and Sport” in nonspecialized higher schools in Bulgaria.

The number of students participating in the survey was quite big – 93 in total, 53 men and 40 women – full time first year students from the University of National and World Economy, the Technical University - Sofia and Sofia University “St. Kliment Ohridski”. We believe that this is a guarantee of high representativeness of the sample and allows important conclusions to be drawn on the research problem. Each of the questions posed was analyzed independently.

**Table 1.** *List of indicators*

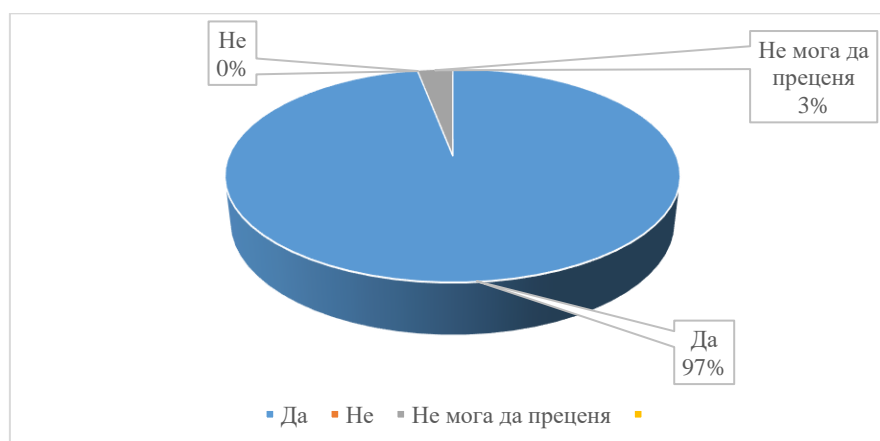
<b>№</b>	<b>Indicators</b>	<b>Conditioning qualities</b>	<b>Measurement units</b>	<b>Accuracy</b>	<b>Direction of increase</b>
1	Height		cm	1,0	+
2	Weight		kg	0,1	
3	Body mass index	General endurance	%	0,01	-
4	Sprint – 20 m	Speed	sec.	0,01	-
5	Long jump	Explosive power	cm	1,0	+
6	Incline depth	Flexibility	cm	1,0	+
7	Sit-ups	Strength and endurance of the lower part of the body	no./ 20 sec.	1,0	+
8	Push-ups	Strength and endurance of the upper part of the body	no./ 20 sec.	1,0	+
9	Beep test	Endurance	Index		+
10	Fan test	Speed endurance	sec.	0.01	-
11	Balance compass test	Agility/Coordination/	no./ 20 sec.	1,0	+
12	Munsterberg test	Selectivity of attention and resistance to interference	Index		

Regarding the interest of the students enrolled to practice the sport of tennis, from the conducted research we noticed that their interest in this sport was demonstrated not only during the physical education and sport classes, but also outside of them. It was established that 82,5% would like to practice tennis outside of the compulsory discipline. Only 17,5% had no desire to play tennis more actively (**Fig. 5**).



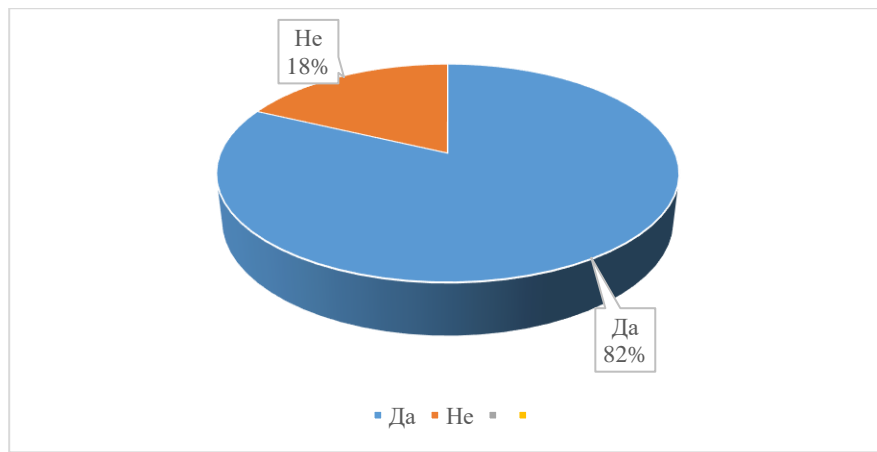
**Fig. 5** Question: *Would you practice tennis outside of the tennis lessons in the physical education and sport class?*

The processed results to question № 10: “Do you think that playing tennis would lead to a positive effect on your health and physical status?” presented in Figure 10 give us information that 97% are convinced in the positive effect, 3% cannot decide, no student has given a negative answer (**Fig. 10**).



**Fig. 10** Question: *Do you think that playing tennis would lead to a positive effect on your health and physical status?*

From the last question of the survey it becomes clear that a large part of the students participating in the research (82%) would choose the sport of tennis in the next academic year as well (**Fig. 12**).

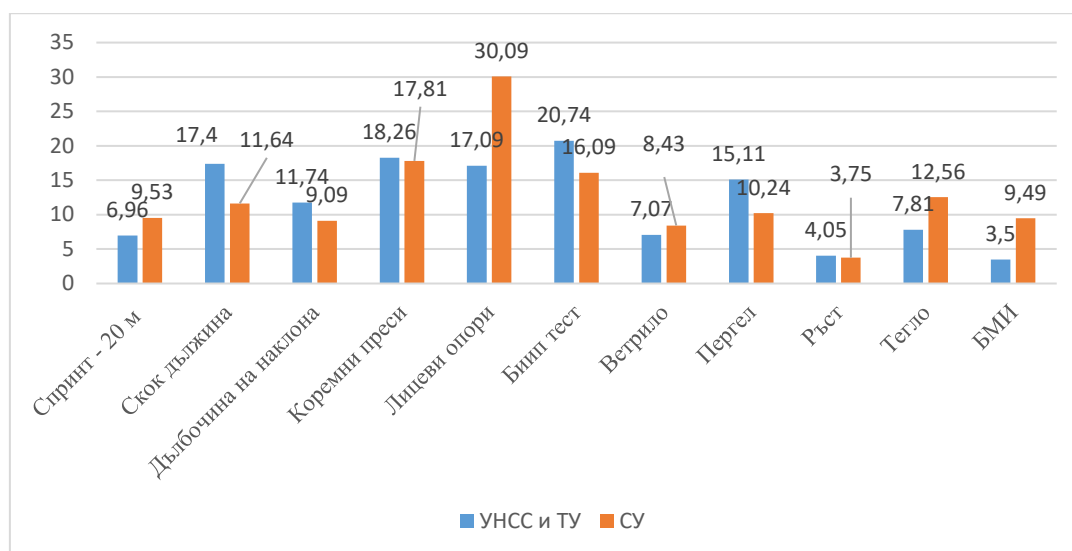


**Fig. 12** *Question: Would you choose the sport of tennis in the next academic year as well?*

The second aspect of the analysis was aimed at revealing the mean values and variability of the studied characteristics of the students at the end of the pedagogical experiment.

The analysis (**fig. 15**) of the women in the experimental group shows that for test 1 the achievements are between 3,71s and 4,8 s, and the arithmetic mean result is 4,23 s. We believe that this shows a good level of improvement for the skill of speed in comparison to the first study.

We find that the sample of the test on *running speed* is homogeneous, the coefficient of variation is 6,96% for the experimental group of women. The different level of the conditioning quality of speed is as a result of the applied program in the experimental group.



**Fig. 15** Variation analysis of the physical development and work capacity with women students from the University of National and World Economy, the Technical University and Sofia University "St. Kl. Ohridski" (at the end of the experiment)

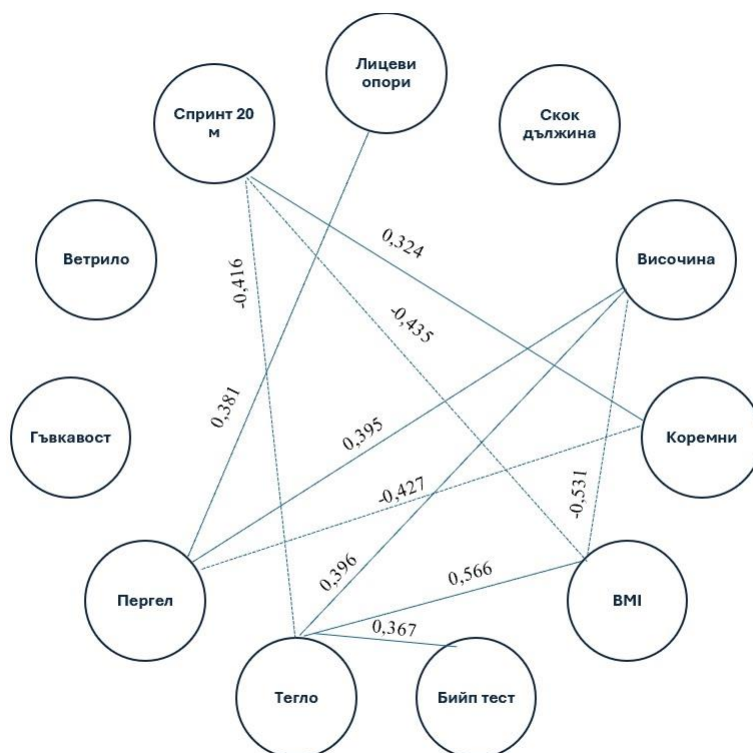
With *explosive power of lower limbs* (test 2) in the experimental group for men it is  $V=8,6\%$  and for women  $V=17,4\%$  – an improvement of homogeneity is observed in comparison with the first study. The test measuring *flexibility* (test 3) of students from the experimental group - men and women, shows greater dispersion in the results. With both contingents, flexibility is positive. The mean value is 76,38 cm for women and 75,04 cm for men. It is a fact that women have greater flexibility compared to men, which is evident from the improved results of the minimum and maximum values for the experimental group. In the *long jump*, the mean value for the experimental group of women is 166,13 cm. In comparison with the results from the first study - 161,19 cm, there is an improvement. Regarding the *strength of lower limbs* in the control group – women, there is no great difference between the obtained maximum and minimum results. In the same test for men, the experimental group values are improved, the dispersion of this indicator is small, i.e. the sample is uniform (8,6%). The better results in the push-ups are impressive with reference to the minimum results – 14 pieces per second for women, in comparison to the entrance level – 3 pieces per second, and 15 pieces per second for men from the experimental group. This shows the positive effect of the applied program.

To establish the level of some mental indicators, a Munsterberg test was used, which evaluates the selectivity of attention and the resistance to disturbance. The results from the test of attention and resistance to disturbance clearly show that students from both studied groups increased their results (**table 12**). In the control group, the mean value increased from  $X \text{ mean} = 14,02$  for  $(S=3,42)$  to  $X \text{ mean} = 15,15$  for  $(S=2,98)$ . The improvement of the results for attention and resistance to disturbances is more significant with the students in the experimental group from the University of National and World Economy and the Technical University – Sofia, with a change in the mean value from  $X \text{ mean} = 15$  for  $(S=3,25)$  to  $X \text{ mean} = 20$  for  $(S=2,87)$ . It has to be noted, that the differences in the test results between the control and the experimental group at the exit stage in the end of the academic year is statistically significant, according to Student's t-test for independent samples ( $P_t > 95\%$ ). The presented data clearly show that the applied specialized program in tennis training for students from the University of National and World Economy and the Technical University – Sofia, had a positive effect on attention and resistance to disturbance. We believe that this mental indicator is of great importance when using the conditioning technology for students practicing tennis in their physical education classes.

**Table 12.** *Comparative analysis of mental indicators between the experimental and the control group of men and women students from the University of National and World Economy, the Technical University and Sofia University (in the conducted experiment)*

Indicator	n	I study		II study		Increase			Statistical significance	
		X <sub>1</sub>	S <sub>1</sub>	X <sub>2</sub>	S <sub>2</sub>	d	d%	Cohen's d	t <sub>emp</sub>	P (t)
<b>Experimental group</b>	40	15	3,25	20	2,87	4,95	33,62	2,16	13,69	100
<b>Control group</b>	53	14,02	3,42	15,15	2,98	1,13	8,08	0,42	3,06	99,65
<b>Difference</b>	<b>d</b>	0,706		4,52		3,82				
	<b>Cohen's d</b>	0,211		1,227		1,211				
<b>Statistical significance</b>	<b>t</b>	1,01		7,36		7,21				
	<b>P(t)</b>	68,36		100		100				

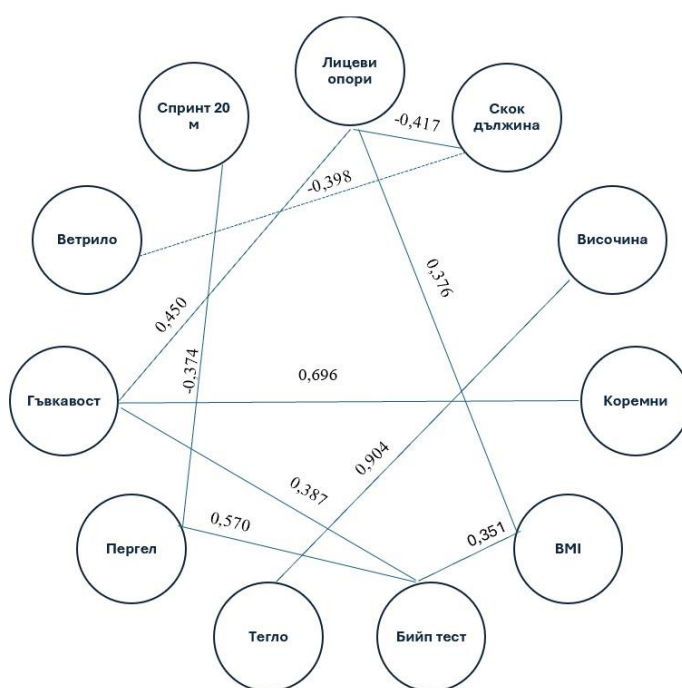
The third aspect of analysis is related to revealing the correlation structure of the studied indicators at the end of the sport pedagogical experiment.



**Figure 20** *Correlation matrix (men – students) – University of National and World Economy and Technical University – Sofia.*



and 5 – sit-ups and push-ups) for the experimental group of men ( $r=-0,427$ ), which means that the decrease of one of them will lead to an increase in the other ( $r=0,381$ ). For the experimental group of women, a moderate correlation was observed between the conditioning quality of speed and body weight ( $r=0,307$ ) and a slight correlation with height ( $r=0,280$ ). As expected, the correlation between body weight and height is the strongest ( $r=0,904$ ), while the relationship with the other indicators is weak. We can make a conclusion that body weight could be the reason for greater or smaller efficiency of the pointed indicators, connected with it. A moderate correlation was observed between upper body strength and endurance tests and cardiorespiratory endurance for the experimental group of women ( $r=0,328$ ), ( $r=0,376$ ). There is also moderate correlation between speed endurance (Fan test) and lower limbs strength (long jump test) ( $r=-0,398$ ). The most dependencies in indicators between physical development and physical capacity as a whole were observed in the experimental group of women (**fig. 21**).

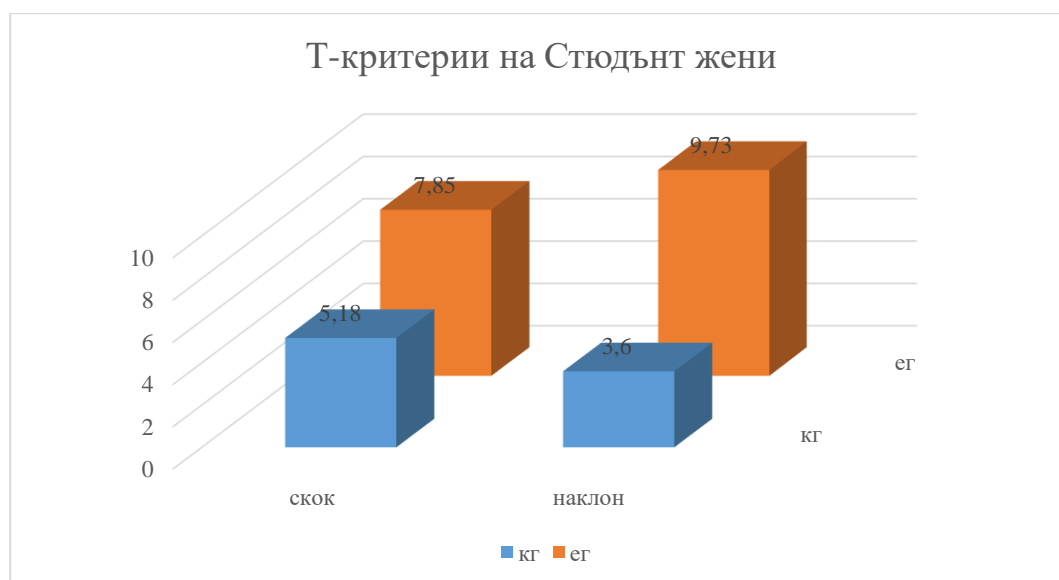


**Fig. 21** Correlation matrix (women – students) – University of National and world Economy and Technical University-Sofia

Establishing the effectiveness of the developed original program for improving students' motor condition was one of the main tasks of the dissertation work.

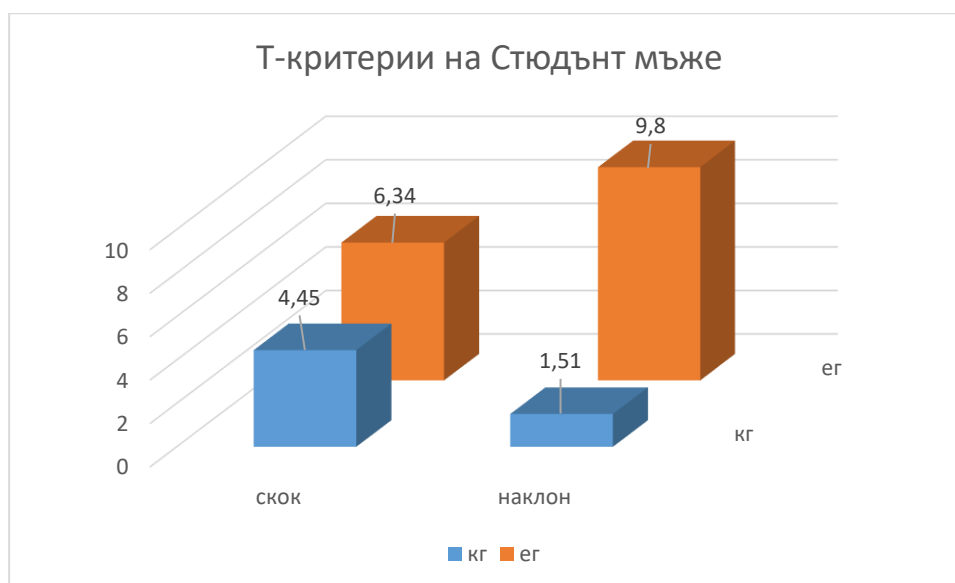
At the sports pedagogical experiment, in the test of *speed* of the participating groups of *women students*, the mean value of the experimental group in the first study is  $X \text{ mean}=4,59 \text{ sec.}$  ( $S=0,38$ ), decreasing in the second study to  $X \text{ mean}=4,07 \text{ sec.}$  ( $S=0,19$ ). The control group reports the following values – first study  $X \text{ mean}=4,97 \text{ sec}$  ( $S=0,84$ ), decreasing a little in the second study –  $X \text{ mean}=4,58 \text{ sec.}$  ( $S=0,44$ ). A difference is also observed in the relative growth rate, in the experimental group it is ( $d\%=-11,3$ ), and for the control group it is ( $d\%=-7,73$ ). In this case, the difference is statistically significant at a guarantee probability  $P>95\%$ . In the Fan test, providing information about the motor quality *speed endurance*, the result in the experimental group is improved from  $X \text{ mean}=20,24 \text{ sec.}$  in the first study, to  $X \text{ mean}=19,77 \text{ sec.}$  in the second study.

In the test - depth of incline, giving information about the motor quality of *flexibility*, in the experimental group of women there is again an increase of the mean value. In the first study  $X \text{ mean}=75,38$  ( $S=8,79$ ), and in the second, it has increased to  $X \text{ mean}=78,81$  ( $S=8,98$ ),  $\text{temp}=9,73$ . The higher relative growth rate in the experimental students' group of women is significant ( $d\%=4,56$ , for the control group  $d\%=0,96$ ). The difference between the first and second study is statistically significant  $P(t)=100\%$  for the experimental group. Regarding the results in the long jump test for the quality *explosive power of the lower limbs*, statistically significant increase was observed between the first and the second study of the experimental group ( $d=4,94$ ,  $\text{temp}=7,85$ ), the relative growth rate is higher in comparison with the control group ( $d\%=3,06$ , with  $d\%=1,08$ ). In both groups a statistically significant difference was observed between the two studies at the end of the applied program  $P(t)=100\%$  (**fig.22**).



**Figure 22.** *Comparative analysis between the experimental and control group of students-women after the conducted pedagogical experiment for indicators depth of incline and long jump*

The results from the test in the long jump, providing information about the motor quality *explosive power of the lower limbs*, show statistically significant improvement in the experimental students' group of men, according to Student's t-test ( $P > 95\%$ ). The mean value of the experimental group increases from  $X \text{ mean} = 207,42 \text{ cm}$  to  $X \text{ mean} = 213,54 \text{ cm}$ . The relative growth rate of the experimental group is higher in comparison to that of the control group ( $d\% = 2,95$ , at ( $d\% = 2,51$ ),  $t_{\text{temp}} = 6,34$ ). In the first study of the experimental group, the mean value for depth of incline was  $X \text{ mean} = 71,38$  ( $S = 3,43$ ), in the second study it was  $X \text{ mean} = 75,04$ , at  $P(t) = 100\%$ ,  $t_{\text{temp}} = 9,8$ . No statistical significance was observed in the results for the control group  $P(t) = 85,84\%$ . (Fig.24).

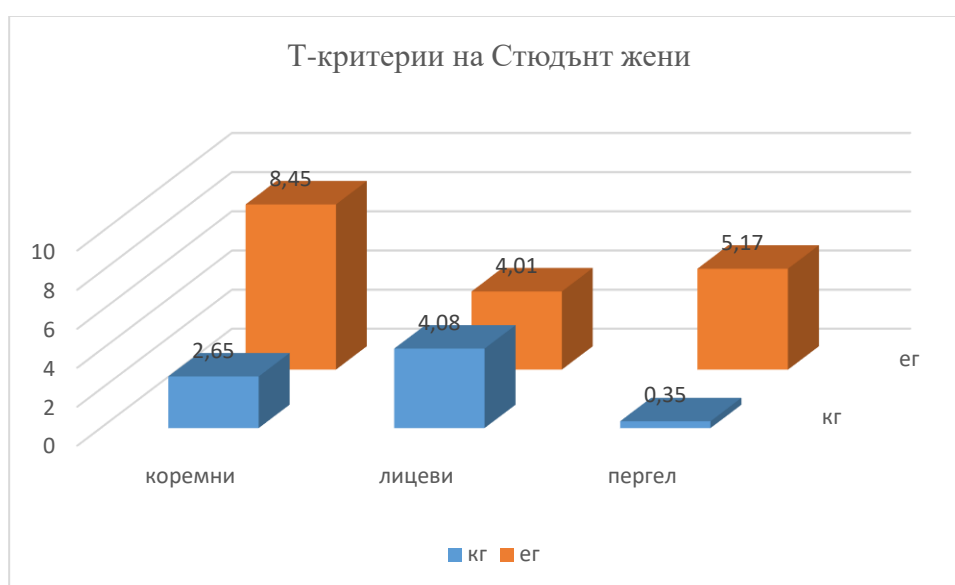


**Figure 24.** *Comparative analysis between the experimental and control group of students-men after the conducted pedagogical experiment for indicators depth of incline and long jump*

After looking at the gained values separately for the experimental and control group of students–men, from the first and second study, we can analyze and summarize the results in the following way: there is a greater increase in the results for the experimental group, where the mean value for sit-ups increases from  $X \text{ mean} = 20$  no. ( $S=3,43$ ) to  $X \text{ mean} = 27,63$  no. ( $S=3,1$ ). Regarding the size of the differences (Cohen's  $d$ ) between the experimental and the control group, we notice greater increase in the experimental group, a significant difference in this indicator ( $d=7,09$ , Cohen's  $d=1,695$ ). The results in both studied groups are statistically significant.

In the test on *strength and endurance of the upper body*, the following differences were established for the experimental group - women:  $X \text{ mean} = 15,13$  ( $S=4,44$ ) and for the control group:  $X \text{ mean} = 14,74$  ( $S=5,7$ ) – in the first study. In the second study – the results of the experimental group were  $X \text{ mean} = 18,06$  ( $S=3,09$ ),  $t_{\text{emp}}=4,01$  and for the control group -  $X \text{ mean} = 16$  ( $S=4,81$ ),  $t_{\text{emp}}=4,08$ . In terms of actual differences (Cohen's  $d$ ) between the groups, we noticed an increase for the experimental group with a significant difference in the test of *push-ups* ( $d=1,68$ , Cohen's  $d = 0,724$ ). For the motor quality of *speed endurance* (Fan test), the results of the experimental group were improved from 22,11 sec. in the first study, to 20,41 sec. in the second study.

The *balance compass* test shows good results for the experimental group - women. The mean value at the first study is  $X \text{ mean} = 37,94$  no. ( $S=8,83$ ), and it increases at the second study to  $X \text{ mean} = 42,88$  no. ( $S=6,48$ ),  $t_{\text{emp}}=5,17$  with statistical significance  $P(t)=99,99$ . The control group has the following values – at the first study  $X \text{ mean} = 44,22$  no., with a slight increase to  $X \text{ mean} = 44,43$  no., with no statistical significance. It was observed that the relative growth rate is much higher for the experimental group ( $d\%=13,01$ ), and for the control group it is ( $d\%=0,49$ ),  $t_{\text{emp}}=0,35$  (fig.25).



**Figure 25.** Comparative analysis between the experimental and control group of students-women after the conducted pedagogical experiment for indicators push-ups, sit-ups and balance compass

In the test giving us information about the strength of the upper body, the following results are available – in the first study for the experimental group –  $X \text{ mean} = 26,25$  ( $S=10,6$ ), and in the second study -  $X \text{ mean} = 29,67$  ( $S=9,92$ ), relative growth rate ( $d\%=13,02$ ),  $t_{\text{emp}}=4.01$ , statistical significance  $P(t) = 100\%$  (fig.25).

The last aspect of analysis is related to the development of a normative basis for control and optimization of the physical development and motor condition of the students from the tennis groups (tables 43 and 44).

The application of the sigma method allows a normative table to be developed, which can be used for assessment of each studied indicator easily and quickly. The 50-point scoring system used takes into account even the smallest changes occurring in the level of development of the studied indicators, which is not possible with the 6-point, 10-point or 20-point scoring systems.

It is necessary to note here that in the development of the normative table, due to the opposite direction of increase of achievements, the evaluation scales of some indicators are reversed. These are usually indicators in which the achievements are measured in seconds. It is also important to note, that due to the specifics in the evaluation of indicator 3 (body mass index – BMI) it is impossible to develop norms for it using the applied technology.

### **Methodological guidelines for the application of the normative basis**

In order to carry out effective control on the physical development and motor condition of the students from higher schools, practicing tennis as an optional sport, it is necessary to perform a number of activities arranged in a strict logical sequence, observing the following conditions:

1. To conduct sports-pedagogical tests on the entire set of indicators, as follows:
  - ✓ in the first two seminars of the academic year;
  - ✓ in the end of the first semester;
  - ✓ in the last two seminars of the academic year.

**Table 43.** Normative table for evaluation of the physical development and motor condition of *women students from the tennis groups*

Evaluation T (points)	Evaluation P (%)	Height	Weight	BMI		Sprint 20 m	Long jump
		1.	2.	3.		4.	5.
50	99,38	183,76	70,51	197,89		3,62	162,19
49	99,18	183,12	69,91	197,21		3,65	161,69
48	98,93	182,47	69,30	196,54		3,68	161,19
47	98,61	181,82	68,70	195,86		3,71	160,69
46	98,22	181,17	68,09	195,18		3,74	160,19
45	97,73	180,52	67,49	194,51		3,77	159,69
44	97,13	179,88	66,89	193,83		3,80	159,19
43	96,41	179,23	66,28	193,16		3,83	158,69
42	95,55	178,58	65,68	192,48		3,86	158,19
41	94,52	177,93	65,07	191,80		3,89	157,69
40	93,32	177,28	64,47	191,13		3,92	157,19
39	91,93	176,64	63,87	190,45		3,95	156,69
38	90,32	175,99	63,26	189,78		3,98	156,19
37	88,50	175,34	62,66	189,10		4,01	155,69
36	86,44	174,69	62,05	188,42		4,04	155,19
35	84,14	174,04	61,45	187,75		4,07	154,69
34	81,60	173,40	60,85	187,07		4,10	154,19
33	78,82	172,75	60,24	186,40		4,13	153,69
32	75,81	172,10	59,64	185,72		4,16	153,19
31	72,58	171,45	59,03	185,04		4,19	152,69
30	69,15	170,80	58,43	184,37		4,22	152,19
29	65,54	170,16	57,83	183,69		4,25	151,69
28	61,79	169,51	57,22	183,02		4,28	151,19
27	57,93	168,86	56,62	182,34		4,31	150,69
26	53,99	168,21	56,01	181,66		4,34	150,19
25	50,00	167,56	55,41	180,99		4,37	149,69
24	46,01	166,92	54,81	180,01		4,42	148,99
23	42,07	166,27	54,20	179,04		4,46	148,29
22	38,21	165,62	53,60	178,06		4,50	147,59
21	34,46	164,97	52,99	177,08		4,55	146,89
20	30,85	164,32	52,39	176,11		4,59	146,19
19	27,42	163,68	51,79	175,13		4,64	145,49
18	24,19	163,03	51,18	174,16		4,68	144,79
17	21,18	162,38	50,58	173,18		4,72	144,09
16	18,40	161,73	49,97	172,20		4,77	143,39
15	15,86	161,08	49,37	171,23		4,81	142,69

<b>14</b>	<b>13,56</b>	160,44	48,77	170,25		4,86	141,99
<b>13</b>	<b>11,50</b>	159,79	48,16	169,28		4,90	141,29
<b>12</b>	<b>9,68</b>	159,14	47,56	168,30		4,94	140,59
<b>11</b>	<b>8,07</b>	158,49	46,95	167,32		4,99	139,89
<b>10</b>	<b>6,68</b>	157,84	46,35	166,35		5,03	139,19
<b>9</b>	<b>5,48</b>	157,20	45,75	165,37		5,08	138,49
<b>8</b>	<b>4,45</b>	156,55	45,14	164,40		5,12	137,79
<b>7</b>	<b>3,59</b>	155,90	44,54	163,42		5,16	137,09
<b>6</b>	<b>2,87</b>	155,25	43,93	162,44		5,21	136,39
<b>5</b>	<b>2,27</b>	154,60	43,33	161,47		5,25	135,69
<b>4</b>	<b>1,78</b>	153,96	42,73	160,49		5,30	134,99
<b>3</b>	<b>1,39</b>	153,31	42,12	159,52		5,34	134,29
<b>2</b>	<b>1,07</b>	152,66	41,52	158,54		5,38	133,59
<b>1</b>	<b>0,82</b>	152,01	40,91	157,56		5,43	132,89

**Table 43 (continued).** *Normative table for evaluation of the physical development and motor condition of women students from the tennis groups*

Evaluation T (points)	Evaluation P (%)	Depth of incline test	Raising the body from supine position	Flexing and extending from support position	Beep test	Fan test	Balance compass test
		6.	7.	8.	9.	10.	11.
<b>50</b>	<b>99,38</b>	30,83	30,83	27,52	6,14	17,03	52,29
<b>49</b>	<b>99,18</b>	30,39	30,39	27,09	6,05	17,17	51,95
<b>48</b>	<b>98,93</b>	29,96	29,96	26,67	5,96	17,31	51,61
<b>47</b>	<b>98,61</b>	29,53	29,53	26,24	5,87	17,45	51,27
<b>46</b>	<b>98,22</b>	29,09	29,09	25,81	5,78	17,59	50,93
<b>45</b>	<b>97,73</b>	28,66	28,66	25,39	5,70	17,73	50,59
<b>44</b>	<b>97,13</b>	28,23	28,23	24,96	5,61	17,87	50,25
<b>43</b>	<b>96,41</b>	27,79	27,79	24,53	5,52	18,01	49,91
<b>42</b>	<b>95,55</b>	27,36	27,36	24,11	5,43	18,15	49,57
<b>41</b>	<b>94,52</b>	26,93	26,93	23,68	5,34	18,29	49,23
<b>40</b>	<b>93,32</b>	26,50	26,50	23,25	5,26	18,43	48,89
<b>39</b>	<b>91,93</b>	26,06	26,06	22,82	5,17	18,57	48,55
<b>38</b>	<b>90,32</b>	25,63	25,63	22,40	5,08	18,71	48,21
<b>37</b>	<b>88,50</b>	25,20	25,20	21,97	4,99	18,85	47,87
<b>36</b>	<b>86,44</b>	24,76	24,76	21,54	4,90	18,99	47,53
<b>35</b>	<b>84,14</b>	24,33	24,33	21,12	4,82	19,13	47,19
<b>34</b>	<b>81,60</b>	23,90	23,90	20,69	4,73	19,27	46,85
<b>33</b>	<b>78,82</b>	23,46	23,46	20,26	4,64	19,41	46,51
<b>32</b>	<b>75,81</b>	23,03	23,03	19,84	4,55	19,55	46,17
<b>31</b>	<b>72,58</b>	22,60	22,60	19,41	4,46	19,69	45,83
<b>30</b>	<b>69,15</b>	22,17	22,17	18,98	4,38	19,83	45,49



29	65,54	21,73	21,73	18,55	4,29	19,97	45,15
28	61,79	21,30	21,30	18,13	4,20	20,11	44,81
27	57,93	20,87	20,87	17,70	4,11	20,25	44,47
26	53,99	20,43	20,43	17,27	4,02	20,39	44,13
25	50,00	20,00	20,00	16,85	3,94	20,53	43,79
24	46,01	19,57	19,57	16,42	3,87	20,69	43,25
23	42,07	19,13	19,13	15,99	3,80	20,85	42,71
22	38,21	18,70	18,70	15,57	3,73	21,01	42,17
21	34,46	18,27	18,27	15,14	3,66	21,17	41,63
20	30,85	17,84	17,84	14,71	3,59	21,33	41,09
19	27,42	17,40	17,40	14,28	3,52	21,49	40,55
18	24,19	16,97	16,97	13,86	3,45	21,65	40,01
17	21,18	16,54	16,54	13,43	3,38	21,81	39,47
16	18,40	16,10	16,10	13,00	3,31	21,98	38,93
15	15,86	15,67	15,67	12,58	3,24	22,14	38,39
14	13,56	15,24	15,24	12,15	3,17	22,30	37,85
13	11,50	14,80	14,80	11,72	3,10	22,46	37,31
12	9,68	14,37	14,37	11,30	3,03	22,62	36,77
11	8,07	13,94	13,94	10,87	2,96	22,78	36,23
10	6,68	13,51	13,51	10,44	2,89	22,94	35,69
9	5,48	13,07	13,07	10,01	2,82	23,10	35,15
8	4,45	12,64	12,64	9,59	2,75	23,26	34,61
7	3,59	12,21	12,21	9,16	2,68	23,42	34,07
6	2,87	11,77	11,77	8,73	2,61	23,59	33,53
5	2,27	11,34	11,34	8,31	2,54	23,75	32,99
4	1,78	10,91	10,91	7,88	2,47	23,91	32,45
3	1,39	10,47	10,47	7,45	2,40	24,07	31,91
2	1,07	10,04	10,04	7,03	2,33	24,23	31,37
1	0,82	9,61	9,61	6,60	2,26	24,39	30,83

**Table 44.** Normative table for evaluation of the physical development and motor condition of *men students* from the tennis groups

Evaluation T (points)	Evaluation P (%)	Height	Weight	BMI		Sprint 20 m	Long jump
		1.	2.	3.		4.	5.
50	99,38	196,54	89,47	22,5		3,37	257,40
49	99,18	195,85	88,84	22,25	22,75	3,40	254,96
48	98,93	195,17	88,22	22	23	3,42	252,51
47	98,61	194,49	87,59	21,75	23,25	3,45	250,07
46	98,22	193,81	86,96	21,5	23,5	3,48	247,62
45	97,73	193,12	86,34	21,25	23,75	3,51	245,18
44	97,13	192,44	85,71	21	24	3,54	242,73

43	96,41	191,76	85,08	20,75	24,25	3,56	240,29
42	95,55	191,07	84,46	20,5	24,5	3,59	237,84
41	94,52	190,39	83,83	20,25	24,75	3,62	235,40
40	93,32	189,71	83,20	20	25	3,65	232,95
39	91,93	189,02	82,57	19,75	25,25	3,68	230,51
38	90,32	188,34	81,95	19,5	25,5	3,70	228,06
37	88,50	187,66	81,32	19,25	25,75	3,73	225,62
36	86,44	186,98	80,69	19	26	3,76	223,17
35	84,14	186,29	80,07	18,75	26,25	3,79	220,73
34	81,60	185,61	79,44	18,5	26,5	3,82	218,28
33	78,82	184,93	78,81	18,25	26,75	3,84	215,84
32	75,81	184,24	78,19	18	27	3,87	213,39
31	72,58	183,56	77,56	17,75	27,25	3,90	210,95
30	69,15	182,88	76,93	17,5	27,5	3,93	208,50
29	65,54	182,19	76,30	17,25	27,75	3,96	206,06
28	61,79	181,51	75,68	17	28	3,98	203,61
27	57,93	180,83	75,05	16,75	28,25	4,01	201,17
26	53,99	180,15	74,42	16,5	28,5	4,04	198,72
25	50,00	179,46	73,80	16,25	28,75	4,07	196,28
24	46,01	178,78	73,07	16	29	4,10	194,03
23	42,07	178,10	72,44	15,75	29,25	4,14	191,78
22	38,21	177,41	71,82	15,5	29,5	4,17	189,53
21	34,46	176,73	71,19	15,25	29,75	4,21	187,28
20	30,85	176,05	70,56	15	30	4,24	185,03
19	27,42	175,36	69,93	14,75	30,25	4,28	182,78
18	24,19	174,68	69,31	14,5	30,5	4,31	180,53
17	21,18	174,00	68,68	14,25	30,75	4,35	178,28
16	18,40	173,32	68,05	14	31	4,38	176,03
15	15,86	172,63	67,43	13,75	31,25	4,42	173,78
14	13,56	171,95	66,80	13,5	31,5	4,45	171,53
13	11,50	171,27	66,17	13,25	31,75	4,49	169,28
12	9,68	170,58	65,55	13	32	4,52	167,03
11	8,07	169,90	64,92	12,75	32,25	4,56	164,78
10	6,68	169,22	64,29	12,5	32,5	4,59	162,53
9	5,48	168,53	63,66	12,25	32,75	4,63	160,28
8	4,45	167,85	63,04	12	33	4,66	158,03
7	3,59	167,17	62,41	11,75	33,25	4,70	155,78
6	2,87	166,49	61,78	11,5	33,5	4,73	153,53
5	2,27	165,80	61,16	11,25	33,75	4,77	151,28
4	1,78	165,12	60,53	11	34	4,80	149,03
3	1,39	164,44	59,90	10,75	34,25	4,84	146,78
2	1,07	163,75	59,28	10,5	34,5	4,87	144,53

<b>1</b>	<b>0,82</b>	163,07	58,65	10,25	34,75	4,91	142,28
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**Table 44 (continued).** Normative table for evaluation of the physical development and motor condition of *men students* from the tennis groups

Evaluation T (points)	Evaluation P (%)	Depth of incline test	Raising the body from supine position	Flexing and extending from support position	Beep test	Fan test	Balance compass test
		<b>6.</b>	<b>7.</b>	<b>8.</b>	<b>9.</b>	<b>10.</b>	<b>11.</b>
<b>50</b>	<b>99,38</b>	88,50	34,94	50,96	9,65	16,57	65,59
<b>49</b>	<b>99,18</b>	87,83	34,51	50,16	9,51	16,70	64,79
<b>48</b>	<b>98,93</b>	87,15	34,09	49,36	9,37	16,83	63,99
<b>47</b>	<b>98,61</b>	86,48	33,66	48,57	9,23	16,96	63,19
<b>46</b>	<b>98,22</b>	85,80	33,24	47,77	9,09	17,09	62,39
<b>45</b>	<b>97,73</b>	85,13	32,81	46,98	8,96	17,21	61,59
<b>44</b>	<b>97,13</b>	84,45	32,39	46,18	8,82	17,34	60,79
<b>43</b>	<b>96,41</b>	83,78	31,96	45,38	8,68	17,47	59,99
<b>42</b>	<b>95,55</b>	83,10	31,54	44,59	8,54	17,60	59,19
<b>41</b>	<b>94,52</b>	82,43	31,11	43,79	8,40	17,73	58,39
<b>40</b>	<b>93,32</b>	81,75	30,69	43,00	8,26	17,85	57,59
<b>39</b>	<b>91,93</b>	81,08	30,26	42,20	8,12	17,98	56,79
<b>38</b>	<b>90,32</b>	80,40	29,84	41,40	7,98	18,11	55,99
<b>37</b>	<b>88,50</b>	79,73	29,41	40,61	7,84	18,24	55,19
<b>36</b>	<b>86,44</b>	79,05	28,99	39,81	7,70	18,37	54,39
<b>35</b>	<b>84,14</b>	78,38	28,56	39,02	7,57	18,49	53,59
<b>34</b>	<b>81,60</b>	77,70	28,14	38,22	7,43	18,62	52,79
<b>33</b>	<b>78,82</b>	77,03	27,71	37,42	7,29	18,75	51,99
<b>32</b>	<b>75,81</b>	76,35	27,29	36,63	7,15	18,88	51,19
<b>31</b>	<b>72,58</b>	75,68	26,86	35,83	7,01	19,01	50,39
<b>30</b>	<b>69,15</b>	75,00	26,44	35,04	6,87	19,13	49,59
<b>29</b>	<b>65,54</b>	74,33	26,01	34,24	6,73	19,26	48,79
<b>28</b>	<b>61,79</b>	73,65	25,59	33,44	6,59	19,39	47,99
<b>27</b>	<b>57,93</b>	72,98	25,16	32,65	6,45	19,52	47,19
<b>26</b>	<b>53,99</b>	72,30	24,74	31,85	6,31	19,65	46,39
<b>25</b>	<b>50,00</b>	<b>71,63</b>	<b>24,31</b>	<b>31,06</b>	<b>6,18</b>	<b>19,77</b>	<b>45,59</b>
<b>24</b>	<b>46,01</b>	70,95	23,91	30,26	6,04	19,90	44,76
<b>23</b>	<b>42,07</b>	70,28	23,51	29,46	5,90	20,03	43,92
<b>22</b>	<b>38,21</b>	69,60	23,11	28,67	5,76	20,16	43,08
<b>21</b>	<b>34,46</b>	68,93	22,71	27,87	5,62	20,29	42,24
<b>20</b>	<b>30,85</b>	68,25	22,31	27,08	5,48	20,41	41,41
<b>19</b>	<b>27,42</b>	67,58	21,91	26,28	5,34	20,54	40,57
<b>18</b>	<b>24,19</b>	66,90	21,51	25,48	5,20	20,67	39,73
<b>17</b>	<b>21,18</b>	66,23	21,11	24,69	5,06	20,80	38,90

<b>16</b>	<b>18,40</b>	65,55	20,71	23,89	4,92	20,93	38,06
<b>15</b>	<b>15,86</b>	64,88	20,31	23,10	4,79	21,05	37,22
<b>14</b>	<b>13,56</b>	64,20	19,91	22,30	4,65	21,18	36,39
<b>13</b>	<b>11,50</b>	63,53	19,51	21,50	4,51	21,31	35,55
<b>12</b>	<b>9,68</b>	62,85	19,11	20,71	4,37	21,44	34,71
<b>11</b>	<b>8,07</b>	62,18	18,71	19,91	4,23	21,57	33,87
<b>10</b>	<b>6,68</b>	61,50	18,31	19,12	4,09	21,69	33,04
<b>9</b>	<b>5,48</b>	60,83	17,91	18,32	3,95	21,82	32,20
<b>8</b>	<b>4,45</b>	60,15	17,51	17,52	3,81	21,95	31,36
<b>7</b>	<b>3,59</b>	59,48	17,11	16,73	3,67	22,08	30,53
<b>6</b>	<b>2,87</b>	58,80	16,71	15,93	3,53	22,21	29,69
<b>5</b>	<b>2,27</b>	58,13	16,31	15,14	3,40	22,33	28,85
<b>4</b>	<b>1,78</b>	57,45	15,91	14,34	3,26	22,46	28,02
<b>3</b>	<b>1,39</b>	56,78	15,51	13,54	3,12	22,59	27,18
<b>2</b>	<b>1,07</b>	56,10	15,11	12,75	2,98	22,72	26,34
<b>1</b>	<b>0,82</b>	55,43	14,71	11,95	2,84	22,85	25,50

## **CONCLUSIONS, RECOMMENDATIONS AND SCIENTIFIC-APPLIED CONTRIBUTIONS**

### **1. Conclusions**

On the basis of the analysis of the results and the establishment of the effectiveness of the specialized program in physical education and sport with tennis, for improving the physical condition of students from the University of National and World Economy and from the Technical University-Sofia, the following more important conclusions and recommendations can be made:

1. It was found that a significant percent of higher education students are willing to play tennis, which is a confirmation of its popularity among young people. The students would like to practice tennis more than once a week with different motivations – the emotions it offers, the beauty of the sport, its dynamics, the pleasure of practicing it, for good health and functional balance.
2. Similar variability results were established with both sexes for the qualities of speed endurance and flexibility. The indicators providing information about

speed, explosive power of lower limbs and speed endurance are also stable. Strength and endurance of the upper body are characterized with highest heterogeneity -  $V=33,42\%$  for the experimental group - men, and with approximate uniformity in general endurance for the experimental group - women –  $V=20,74\%$ .

3. The greatest number of dependencies between indicators of motor condition were observed with the experimental group of women – 36, 20 of which positive.
4. The effectiveness of the specialized program through the sport of tennis, applied with students from the University of National and World Economy and the Technical University – Sofia for improving their motor condition was proved.
5. It has been established that the application of the created program for development and improvement of the motor condition of students from the groups of “Optional Sport -Tennis” has a significant impact on the quality speed with the experimental students’ group of women, in comparison to those from the control group. It has to be noted, that for the motor quality of agility in men, the results are very good and the relative growth rate is much higher for the experimental group ( $d\%=13,33$ ), and for the control group it is lower ( $d\%=0,53$ ). In terms of the magnitude of differences (Cohen’s  $d$ ) between groups we noticed greater growth rate for the experimental group, with a significant difference in the test ( $d=4,36$ , Cohen’s  $d=1,613$ ).
6. The comparative analysis of mean values and variability showed differences in terms of homogeneity with students from the experimental and the control group in explosive power of lower limbs, endurance and strength of the upper body.
7. The exercises included in the specialized program with tennis lead to positive changes in selectivity and persistence of attention.
8. It was found that the created technology for improving students’ conditioning qualities in the physical education and sports seminars with tennis increases students’ interest and the quality and effectiveness of the learning process in physical education and sports at higher schools.

9. The developed normative basis for assessment and control of students' physical development and motor condition is a reliable tool for improving the process of learning and training at higher education institutions.

## **2. Recommendations**

1. We propose that tennis, as an optional sport, should take a more important place in the learning programs of physical education and sports at higher schools, which is a prerequisite for improvement of the facilities and conditions for practicing it (tennis courts, halls, equipment, education programs) and for increasing the qualification of coaches involved in the learning process.
2. The developed and experimented specialized tennis program, which showed high efficiency in improving the conditioning and mental qualities of students from the experimental groups allows us to recommend its application in the learning process in physical education and sports at higher schools.
3. The created normative basis for control and assessment of physical development and motor condition of the students from higher schools, participating in physical education and sports seminars with tennis should be introduced into practice as an objective tool for the optimization of the education process.

## **3. Scientific and Applied Contributions**

1. The applied nature of the conclusions and contributions is related to establishing the effect of the created and approved specialized program for physical conditioning of students from higher education institutions.
2. The pedagogical experiment confirmed the statistical effectiveness of the developed specialized program for improvement of the conditioning qualities of students in the learning process of physical education and sports through the sport of tennis at higher schools.

3. Test batteries with proven effectiveness were developed and approved for control and evaluation of the physical conditioning and mental preparation of students participating in the learning process of physical education and sports.

## SCIENTIFIC PUBLICATIONS IN CONNECTION WITH THE DISSERTATION

1. **Очева, В.**, (2022). Проучване отношението на студентите към заниманията по тенис в учебния процес по физическо възпитание и спорт във висшето училище, стр.48-57, V-та Научна конференция с международно участие на тема: „Съвременни тенденции, проблеми и иновации във физическото възпитание и спорта във висшите училища“ – 25.11.2022 г., Издателски комплекс – УНСС, София, 2023 г.

2. **Ocheva,V.** (2023). Department Football and tennis, National Sports Academy “Vasil Levski”, Sofia, Bulgaria – STUDY ON THE CONDITION OF STUDENTS’ PHYSICAL DEVELOPMENT AND PHYSICAL ABILITY, Research in Kinesiology 2023, Vol. 51, No. 2 pp. 22 – 29 DOI: <https://www.doi.org/10.46705/RIK23512022o>