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**A MODEL FOR INCREASING THE PHYSICAL FITNESS OF
UNIVERSITY STUDENTS WITH THE MEANS OF
CIRCULAR TRAINING**

ABSTRACT

**of the dissertation for awarding educational and scientific degree "Doctor"
in professional field – 1.3. Pedagogy of training in ... (Methodology of
training in physical education and sports – fitness disciplines)**

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The dissertation work contains 202 pages. It includes 50 tables, 35 shapes, 16 pictures and 9 applications. The bibliography covers 160 sources, of which 41 in Cyrillic and 108 in Latin and 11 websites.

The PhD student was assigned to a Doctorate of Self-Study at the Department of Individual Sports and Recreation, Sofia University "St. Kliment Ohridski" and with a right of protection.

The dissertation work was discussed on internal protection from the expanded composition of the Department of Individual Sports and Recreation, on December 9, 2021 and proposed for public protection.

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The public protection of the dissertation work will take place on 08/03/2022 from 11.00 am on the online platform: <https://meet.google.com/rzp-mfzk-pbn?pli=1>, at a meeting of a SCIENTIFIC JURY appointed by order of the Rector of University "St. Kliment Ohridski".

ABBREVIATIONS USED

ACSM	American College of Sports Medicine
% BF	Body Fat Percentage
BMI	Body Mass Index
FM	Fat Mass
HIIT	High Intensity Interval Training
HRmax	Maximal Heart Rate
LBM	Lean Body Mass
WHO	World Health Organization

INTRODUCTION

Sport for health worldwide is gaining more and more importance. The need for it is perceived and realized as one of the main factors that affect people's physical fitness, as a result of which a number of health problems related to stagnant lifestyles are solved.

The need for physical activity is mainly nurtured in the family, in schools and logically continues in universities, where already fully conscious students, along with the curriculum, attend sports activities under a certain plan and program. Modern higher education is associated with constantly increasing tension and intensity of curricula, which implies the preservation and maintenance of high working capacity. Physical education and sports are an important part of the development of the person and the general culture of the student. Care for their health and physical fitness must be paramount for university lecturers in the field of sport.

In recent years, there has been a tendency for more and more students to exhibit desires for new and interesting activities, choosing sports that are aimed at fitness disciplines. This motivates sports professionals in higher education institutions to constantly improve their preparation, which today makes it a very serious training process. For the changes in the educational process in physical education and sports in the Bulgarian schools in their study J. Ivanov and B. Tsolov confirm the need in two guidelines: "*Increasing the horarium of compulsory sports hours in the curriculum; Raising the educational level of the subject, increasing the interest and activity of the learners to it by giving theoretical knowledge about the purposeful use of lifelong physical exercises as a means of health, capacity and beauty, to counteract negative phenomena and to active socialization in society*" (Ivanov, Tsolov, 2009). The need to provide opportunities for additional motor activity and maintain good health in order to actively combat immobilization creates prerequisites for the promotion and introduction of new fitness disciplines. Which in turn helps to maintain the motivation of the students and their interest.

Many literary sources address the problems of improving the physical education and sport system of higher education and sports students and effective programs have been developed to improve their physical fitness. It is this area that we have directed our research.

CHAPTER ONE

LITERARY OVERVIEW

I.1. EMERGENCE AND DEVELOPMENT OF FITNESS DISCIPLINES

The roots for the emergence and development of the fitness and fitness industry can be sought at the dawn of humanity, when people apply systematic and purposeful physical exercises, realizing the benefit of motor activities in connection with maintaining and developing the skills necessary for survival in harsh living conditions.

Fitness (English: "fitness", derived from "fit" – "in shape") means good sports form. The content of the word "fitness" also includes a workout to maintain and improve health, active form, style and lifestyle, combined with physical exercises and proper nutrition (Colfer, 2004; Nied, Franklin, 2002).

The founder of mass fitness culture is considered Hyeonimus (Geronimo) Mercururylis – the father of sports medicine. In 1569 he published the book "The Art of Gymnastics", which justifiedly describes all kinds of training and diet, as the main focus of the work on sports and its role in health protection. Mercururylis is also the inventor of the medical ball – the fruit of the scientist's research on ancient sports games with a ball of sand. At that time, the sport was more accepted as a way of entertainment, but with its ideas and inventions, Geronimo laid the foundations (Petrova, 1985).

In the 1960s, spurred by Morris's research, more and more people began taking part in organized sporting events to improve physical training.

In 1968, Kenneth Cooper published the book "Aerobics", which provoked even more interest and desire for regular workouts among most people. Then gradually different diets and training regimes are created en masse, which creates a whole new trend – fitness.

Physical education in an organized form of training is not able to independently counteract the physical activity and health-prophylactic needs of modern man. The need to provide opportunities for additional motor activity and maintain good health in order to actively combat immobilization creates the necessary prerequisites for the emergence and development of the fitness industry.

I.2. FITNESS DISCIPLINES AS PART OF PHYSICAL EDUCATION AND SPORT IN THE HIGHER EDUCATION SYSTEM

Physical culture is important for the upbringing of a healthy, strong and physically developed young generation. Its task is to minimize the harmful effects of stagnant lifestyle and to be a major factor in the harmonious development of the individual. To optimize the physical activity of students, it is necessary to properly organize and use the individual forms, methods and means of physical exertion and increase physical fitness. In the physical education and sport system, student sport is seen as its subsystem. Sport in universities is advocated in the training of students worldwide (Mineva, 2011). Its social function, as well as solving various health and prophylactic problems of students makes it mandatory and therefore included in some curricula. However, the successful management of university sport requires the relevant legal basis for (The Higher Education and Sport Act, 1995).

In Bulgaria, sports activity in higher education institutions is organized on the basis of: The Higher Education and Sport Act (The Higher Education and Sport Act), Regulations for the application of the law on physical education and sport (Regulations for the application of the law on physical education and sport, 2003), National Strategy for the Development of Physical Education and Sport in the Republic of Bulgaria 2012 - 2022 (National Strategy for the Development of Physical Education and Sport, 2011).

According to the Law on Higher Education, the higher school can develop scientific and production, artistic-creative, sports and health activities in accordance with its specifics (Art. 6. (2)), as students and PhD students have the right to choose subjects under the conditions laid down in the curriculum (Art. 70. (1)). In Art. 35. (1) of the Regulations for implementation of the law on physical education and sports states that "organized sports activity in higher schools outside the horarium for compulsory activities is carried out by the student sports clubs", and in respect of mandatory activities – "the allocation of classes for the activities under para. 1 is carried out by school years and seed. The curricula in physical education and sport for the different specialties are developed after consultation with the proposals of the student council and are approved by the academic council of the higher school" (Art. 36. (2)).

In the national strategy for the development of physical education and sports in the Republic of Bulgaria 2012 – 2022 in I.3.2. Organized sport for all concludes that "the organized sport of the learner youth does not meet the growing needs of social practice", which also applies to university sports, where there are also problems with sports facilities. A major strategic objective is set: "... promoting physical education, sport and social tourism as a means of improving the health and physical fitness of the population, maximising the share of sports covered in organised sport to all from diverse social groups, as well as raising the nation's sporting prestige to global level." The main strategic objective has two sub-objectives: Modernization of sports infrastructure and improvement of the National System for Physical Education and Sport in accordance with the leading European practices with a view to promoting the physical education of citizens (National System for Physical Education and Sport 1995).

Targeted sports activities have proven beneficial on faster personal and professional adaptation to constantly changing conditions, which in turn contributes to greater efficiency in all areas of the activity carried out. Their systematic practice leads to improved health, working capacity and functionalities of those engaged, to the formation of a harmonious and athletic physique, to better

self-esteem, muddling of the will, increasing the body's resistance to stressful situations and various diseases. Many authors explore the problems of university sports and come to different conclusions. (Baycheva, 2005; Ivanova, 2004; Alexandrova, 2003, 2004; Simeonova, 2007, etc.)

In conclusion, we can say that all authors agree on the effect of practicing different sports disciplines - the influence of sport in terms of student health is undeniable. Authors such as L. Baycheva (2005), B. Valkova (2003), A. Ivanova (2010), M. Turnichkova (2006), T. Stoyanova (2014) and P. Hristova (2017) in their research confirm the effect of various aerobic fitness activities. Much of the motivation of the students and their interest in sports is related to the improvement and development of curricula with modern models and new fitness activities.

From all of the above, we believe that there is an opportunity to create a model that improves the learning process and increase the physical activity of students. This provokes us to look for new approaches through which to increase the interest and activity of students for sports activities in particular fitness activities on the principle of circular training. This will increase the motivation of students (Ivanova, 2004), will educate the need for a need for motor activity (Ilieva, 2012) and last but not least increase their working capacity in all aspects of the modern way of life.

I.3. CLASSIFICATION OF FITNESS DISCIPLINES

Physical exercises requiring strength and endurance have existed since ancient times. But then they were not taken as a way of training, but as a way of life. That's where the phrase "Run for your life" comes from. In order to survive, people had to not only be able to run, but also jump, climb, lift hard, throw and catch objects, etc.

From the theory of sports training, it is known that each training load has 3 main characteristics (Jeliazkov; Dsheva, 2017):

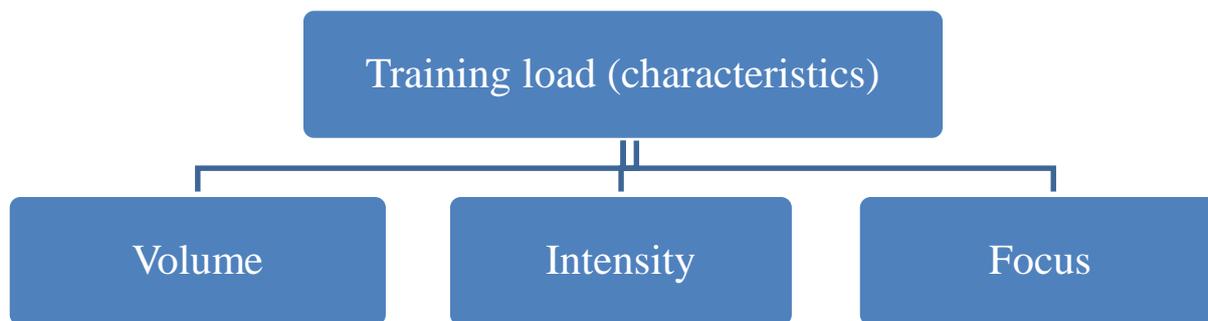


Figure 1. Training load

Fitness gymnastics (Figure 2) are divided into two main structural groups (Sergiev, 2018), and what distinguishes them is the focus as the main characteristic of the training load (Peeva, 2004; Valkova, 2003):

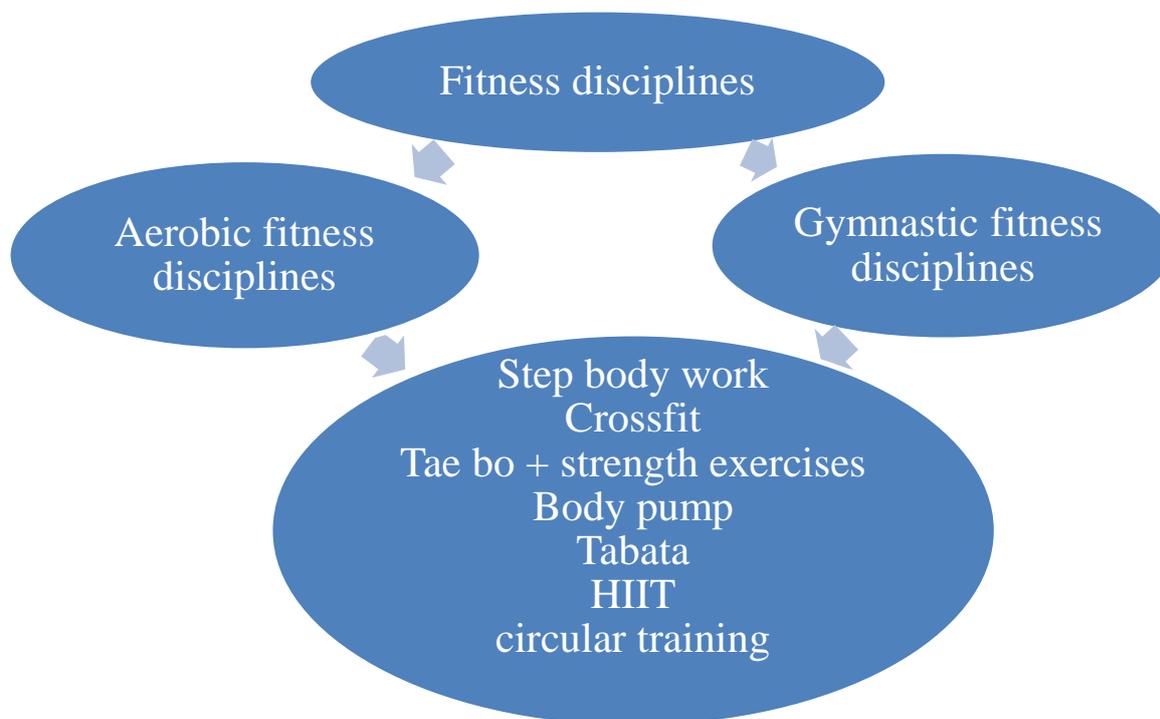


Figure 2. G. Sergiev Fitness Classes (2018)

In the first group – Aerobic fitness disciplines, (Figure 2) the focus of the training load is pre-emulsive to the development of aerobic endurance. Or to put it another way, general endurance develops by improving the work of the cardio-

respiratory system, with the training taking place mainly in aerobic enegros mode (Karabiberov, 2009).

In the second group – Gymnastic fitness disciplines, the focus of the training load is on developing and improving the musculoskeletal system by increasing the level of physical training (motor qualities). Gymnastic exercises and physical training exercises are the main means. Such disciplines are: body stump (Mills, 2016), stretching (Aladzhov, 2001) and others.

Increased interest in activities of this kind on the one hand and market principles on the other required the mixing of different types of fitness disciplines. Thus, disciplines with a complex focus on loads were formed (Sergiev, 2018).

I.4. PHYSICAL FITNESS AND PHYSICAL QUALITIES

Systematic activities with physical exercise and sports lead to changes in the functional capacity of those involved. So far, no other form of organization of sports activity is known, which will have such a strong influence on the development of the body's functionalities as sports training.

The problems of physical fitness (capacity) are a wide subject of research, presenting the current state of the capacity and lead to the disclosure of the internal connections and regularities of physical qualities and building models for their development and improvement. Determining the physical capacity of children, adolescents and adults is an important component of their physical improvement process (Bube; Feck; Stubler; Trogsh, 1972).

Physical ability is associated with the physical development, health and working capacity of the individual. Physical ability is stimulated by proper nutrition (Tremblay et al, 2010); load intensity consistent with the current functional state of the body (de Groot, Fagerström, 2011) and faster and more effective course of recovery processes (Malina, 2010).

Physical ability is a complex indicator of a person's general functional state and motor abilities. An important structural component in the construction of

personality is related to the degree of development of the main motor qualities and the level of built motor habits.

According to T. Ignatova, S. Baselkov, J. Ionov (2011), influence on the physical fitness of students, have numerous social factors:

- The period of study in higher education is associated with a gradually increasing intensity of the learning process.
- Their professional training and creative realization reveals wide opportunities for expression and satisfaction of their interests and needs, which in turn predetermines high requirements for their health, mental and physical abilities.

Among the means of successful educational and professional activity are the various sports activities. Physical education and sports in the higher school support adaptation and reduce negative mental and physical processes through systematic and active motor activity. Students with good physical training adapt faster to changes related to emotional stress from the new environment, socio-household conditions and the environment. This requires the implementation of targeted physical training to improve and improve motor abilities in order to adapt more quickly. The more developed they are, the greater the body's working capacity. According to T. Ignatova (2018), against the background of increased general physical fitness, the physical qualities and motor habits necessary in the future professional activity are positively affected. Physical qualities are understood as the functionalities of the organism that determine a person's motor abilities.

As we said above, fitness disciplines, depending on the focus of the load, affect differently the body of those involved. This allows, on the basis of logical selection, both the types of fitness activities and the basis of their content to work as a priority for different qualities in specific activities. This makes these disciplines an ideal means of maintaining high levels of motor ability of those involved.

In conclusion, we will express our opinion that fitness disciplines are the most commonly used ones in terms of development of motor qualities. This is due to their specificity based on the basic gymnastics, which is characterized by a variety of different positions and movements, the use of which without additional appliances, appliances and appliances allows for selectivity of the object of impact (muscle groups). Also, with the selection of the appropriate methods and means, it is possible to develop all motor qualities. This makes fitness disciplines an indispensable factor in terms of physical education and sports in universities to increase students' motor qualities, as well as in the prevention of their health.

Summarizing the results of the literary review, we concluded that the topicality of the problems is related to the physical development and the place of the variety of fitness disciplines. In our opinion, there is a significant interest in the realization of motor activity precisely through this type of activity. The reasons lie in the benefit of their practice on the one hand and on the other the emotional effect that they cause in the dealings. This is also the result of the work of a number of authors who have created different fitness disciplines and methodologies.

All these positives led us to the idea of offering the circular workout as an object of the physical education program at the university. By introducing it, we want to attract more and more students to actively engage in physical activity and improve their performance.

I.5. WORKING HYPOTHESIS

The experimental methodology developed by us, including a complex of exercises with methods and means of circular training, applied over a period of three months, would develop the physical fitness of the students from Sofia University “St.Kliment Ohridski”.

CHAPTER TWO

PURPOSE, TASKS, ORGANISATION AND METHODOLOGY OF THE STUDY

II.1. PURPOSE OF THE STUDY

THE AIM of the study is to develop a model for increasing fitness and examining the effect of its impact in students from Sofia University „ St. Kliment Ohridski “.

II.2. TASKS OF THE STUDY

To analyze and identify the need to develop a model for improving the physical fitness of students through the study of literary and other information sources.

1. To offer a test battery to assess the physical fitness of sofia university students before and after the application of the developed Model.
2. Development of a model for developing physical qualities by means of circular training.
3. Implementation of the developed model by conducting sport-profiled circular training activities with students from the University of „St. Kliment Ohridski “.
4. Assessment of the physical fitness of the participants in the sports-pedagogical experiment after the application of the developed Model.
5. Assess the degree of applicability of the developed model based on the results of the proposed test battery.

THE SUBJECT of the study is the circular training activities of students who participated in the sports-profiled activities held at Sofia University „ St. Kliment Ohridski “ in the 2018-2019 school year.

OBJECT of research is the effect of applying the developed model to physical fitness of the students involved in the pedagogical experiment during the research period.

THE RESEARCH CONTINGENT is 150 students of University “St. Kliment Ohridski”, from I to IV course, aged 18-22, participated in sports-profiled circular training activities during the 2018-2019 school year. Due to the technical inability to study all students of the course, a representative sample of 44 women was formed, using the method of simple random selection.

II.3. ORGANISATION OF THE SURVEY

The organisation of the work took place in three main stages:

First stage – July – October 2018

During this stage, the information and experience gained in the field of fitness disciplines was summarized. A comprehensive analysis of the scientific literature, documentary and electronic sources related to this topic has been carried out. During this period, the hypothesis, purpose, tasks of the study are specified. A model with training content in fitness gymnastics has been developed and the test battery is specified.

Second stage – October 2018 – June 2019

Formation of an experimental group – application of the methodology of the program of training in fitness disciplines in the conditions of a pedagogical experiment. Conducting the test measurements to diagnose the state of physical fitness and capture the anthropometric indicators of the persons examined. The pedagogical experiment is implemented within the framework of the 2018/2019 school year and covers students from the 1th – 4th course.

Third stage – June 2019 – March 2020

In this period, time is provided for mathematical and statistical processing, analysis, summary of the results obtained, illustration and actual shaping of the dissertation work. Conducting a survey with students who have signed up for sports – profiled circular training activities.

II.4. METHODOLOGY OF THE STUDY

A toolkit of the following research methods will be used to carry out the tasks assigned:

1. Research and analysis of literary and other information sources;
2. Online survey with students of University “St. Kliment Ohridski”, from I to IV course, aged 18-22, participated in sports-profiled circular training activities;
3. Sports-pedagogical testing before and after application of the developed model;
4. Conducting a pedagogical experiment with students who participated in sports-profiled circular training activities;
5. Application of mathematical and statistical methods and means of analysis of the results obtained from testing;

Sport-pedagogical testing

Tests to measure physical abilities

Traditional pedagogical models, which cover from preschool to higher education, apply different programs and methodologies related to physical education and sports, taking into account the results through tests with experimental groups at the beginning and end of the programs. Thus, physical abilities and its dynamics are established. Normative facilities for assessing achievements are developed and standards are prepared for motor tests, tracking changes in physical condition over time. Typically, standard bases rely on basic characteristics such as gender, age and anthropometric indicators of height and weight, while measuring the factors of physical fitness: strength, speed, endurance and flexibility. In recent years, different systems for assessing and controlling physical fitness have changed in the Bulgarian education system, with most higher education institutions currently using the Eurofit test system as a basis.

In order to assess and track the state of the students' motor fitness, it is necessary to study the physical qualities – strength, endurance and flexibility. In

this regard, a brief overview of the structure and content of the Eurofit system has been carried out in order to compile and implement the test battery (Table 1).

Table 1. *Eurofit Physical Fitness Measurement Tests (Eurofit, 1993)*

Test	Factor being tested	Fitness dimension
Endurance shuttle run	Cardiorespiratory endurance	Cardiorespiratory endurance
Hand grip	Static strength	Strength
Standing broad jump	Explosive power	Strength
Bent arm hang	Functional strength	Muscular endurance
Sit-ups	Trunk strength	Muscular endurance
Shuttle run (10 x 5 meters)	Running speed; agility	Speed
Plate tapping	Speed of limb movement	Speed
Sit and reach	Flexibility	Flexibility
Flamingo balance	Total body balance	Balance

The Eurofit test battery consists of nine physical tests covering flexibility, speed, durability, strength and equilibrium resistance.

Standardised and established by the Council of Europe for school-age children has been used in many European schools since 1988. The test series shall be designed so that they can be carried out within 35 to 40 minutes using minimal equipment.

PEDAGOGICAL EXPERIMENT

After reviewing the Eurofit test battery, in order to achieve the tasks assigned, we compiled a test battery according to the same methodology. Through it we will establish the anthropometric data, the level of physical qualities and functional indicators of the students involved in the experiment. 10 indicators divided into 3 groups (Figure 3) and presented in three tables (Tables 2, 3, 4) will be examined.

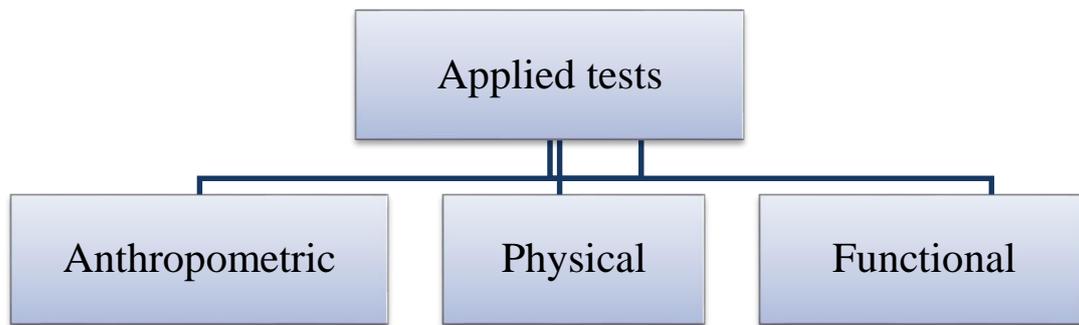


Figure 3. *Types of tests*

In order to objectify the effect of the training work carried out, initial, intermediate and final measurements will be carried out.

Table 2. *Anthropometric indicators (Nos 1 to 4)*

№	Indicators	unit of measure	Accuracy of measurement	Direction of growth
1.	Heigh	sm	1	+
2.	Weight	kg	0,1	+/-
3.	BMI	index	0,01	+/-
4.	Skin folds	mm	0,5	+/-

Table 3. *Physical fitness indicators (Nos 5 to 9)*

№	Indicators	unit of measure	Accuracy of measurement	Direction of growth	Indicators
5.	Jump in length from place	explosive force	sm	1	+/-
6.	Push-ups	strength endurance	pcs/30 sec	1	+/-
7.	Sit-ups	strength endurance	pcs/30 sec	1	+/-
8.	Slope of standing	Flexibility	sm	0,5	+/-
9.	Flamingo	equilibrium	sec	0,1	+/-

Table 4. *Functional ities (No10)*

№	Indicators	unit of measure	Accuracy of measurement	Direction of growth	Indicators
10.	Beep test	endurance	pcs	1	+/-

II.6. MATHEMATICAL AND STATISTICAL METHODS

- The results were measured on strong scales, which warrants the analysis of the data to use the following statistical methods:
 - Multi-metered frequency analysis;
 - Variation analysis;
 - Students T Test for dependent samples;
 - Wilcoxon Non-Parametric Sampling Test (Wilcoxon Signed Rank Test);
 - Tests of Kolmogorov-Smirnov and Shapiro-Wilk to check the normality of data distribution;
 - Inequality of Shevishev;
 - Sigman method.

The results were processed with the SPSS v.25 and EXCEL 2016 software pact.

II.7. MODEL FOR INCREASING PHYSICAL FITNESS WITH THE MEANS OF CIRCULAR WORKOUT

In terms of developing motor qualities, it is of interest to us the serial method of teaching. In our opinion, the circular workout and its variant – interval training in the work for qualities – are of great importance in the work for individual muscle groups. It makes it possible to increase the density of activities, as well as to control the intensity of activities, saves time in activities and last but not least has a great forming effect given the specificity of the load.

From the literary overview we can summarize that the motivation of the students and their interest in sports is related to offering curricula with modern models and new fitness activities. This provokes us to look for new approaches

through which to increase the interest and activity of students for sports activities. In circular training, exercises range from 4 to 15 (in one circle), with different muscle groups, periods and repetitions. Usually performed within 30-90 seconds in combination with 30-90-second rest intervals. Basic multi-joint exercises are used, with heavier ones (those involving more muscle groups) performed at the beginning of a circle and lighter ones at the end of it. An advantage of circular programs is that due to the use of lower loads, there is less likelihood of getting injuries. This facilitates the development of the current model and defines the indicators that need to be explored.

Complex of circular workout exercises

The selection of exercises and the compilation of the complex is consistent with several criteria. Groups are formed at random, and therefore they include people with different physical abilities, for this reason the exercises we have chosen are easily accessible and can also be practiced by beginners. As in the test battery we examine the indicators of physical qualities: strength and strength endurance, dynamic strength and flexibility, we have developed an experimental model with the means of circular training based on interval principle (1:1), which includes a complex of exercises for their development. To establish the load volume, each participant recorded the number of repetitions of all exercises in the complex made in the three circles, through protocols. The measurement was carried out twice at the beginning and at the end of the experiment during the roundabouts.

At the beginning of the experiment, participants studied the technique of performing each exercise individually, with a dosage of three series of 10 repetitions. The exercises that we have included in the main part of the complex are:

- 1. Burpee (exercise)** is an exercise that combines several different movements at the same time as: squats, push-ups and bounces (in our complex, the performance of the exercise is without push-ups) and loads the

whole body, develops strength, explosiveness and endurance. Method of execution: the starting position is standing, with the legs at the width of the shoulders, squatting, then support, again squatting and bouncing with your hands up.

2. **Push-ups** are performed, the starting position is a knee support, the palms are on the line of the shoulders, the hands fold and unfold in the elbow joints. The exercise is aimed at loading the muscles of the chest, arms and shoulder girdle.

3. **Kettlebell swing of 2 kg** is a conditioning exercise that improves the stability of the waist, strains the muscles of the hips and buttocks, while at the same time developing strength endurance and explosiveness. The exercise is performed from the starting position stretched out, hands have caught the kettlebell, the legs are bent slightly in the knee joints, the body is slightly bent forward. From this position, the kettlebell swings, passes between the legs, at the same time the knees are stretched, hands are raised to eye level, and then returned to the starting position. During execution, the back should be upright.

4. **Scissor Lunge Jumps** is a multi-joint exercise that strains the muscles of the buttocks and hips. Improves explosive strength, affects balance. It is performed from a starting position deep attack, the legs are folded at the knees, bounces dynamically upwards, the legs change in the air and lands on the other leg.

5. **Plank with dissolving legs** is a complex cardio exercise that strengthens the central part of the body, during performance includes the muscles of the shoulders, back, arms, legs and buttocks, accentuating the abdominal area. It is performed from a position for push-ups, as the abdominal muscles are tight, the body is upright all the time, the look is down. From this position, the legs dissolve slightly wider than the shoulders, bounce slightly and then return to the starting position, leaving the upper body still.

6. Jump Squat is also a multi-joint complex movement that develops the strength endurance and explosive strength of the femoral, gluteal muscles. Performed from the starting position half-squat with dissolved legs at the width of the shoulders, the toes point slightly outwards, a squat is made followed by a dynamic bounce with his hands stretched back.

7. Bicycle crunch are for loading all abdominal muscles. Their performance leads to improved physique and abdominal musculature. The exercise is carried out on a mat. It begins with lifting one leg, which is folded into the knee joint, the other leg is strained, follows folding the body in the abdomen so that the opposite elbow touches the raised knee and vice versa.

Exercises follow the chosen sequence, since the load on them is optimally distributed in all muscle groups and we follow their alternation as mentioned above in the organization in circular training activities.

These seven exercises, make one circle, performing alternately on stations. Each exercise is done in a half-minute time, with a break between them of 30 seconds in a total of three rounds. The intended break between the circles is three minutes and is passive.

To improve the cardio-respiratory system, dynamic strength and strength endurance, which we report with indicator No7 "jump in length from place" and No12 "beep test" from the test battery, we chose the exercises with complex impact– Burpee; Kettlebell swing; Jump Squat и Scissor Lunge Jumps, which develop strength endurance and strain the muscles of the buttocks and thighs. Scissor Lunge Jumps, also affect the balance and equilibrium we measure with the Flamingo test for equilibrium resistance. To improve the abdominal musculature, we chose the exercise plank with dissolution of the legs and bicycle crunch. The effect of these exercises, we will count by test No. 8 "Sit-ups". For the development of upper limbs and shoulder girdle, we have included a modified variant of push-ups on the knees, hoping to improve the strength of the upper

limbs and taking into account the results with test No 9 "Push-ups". In the complex of the experimental model we have selected exercises for the development of all muscle groups and tailored to the principles of circular training. To improve the quality flexibility that we track and measure with test No6 "Sit and reach", we included exercises for stretching individual muscle groups and stretching exercises, which are performed after the complex, at the end of the activity.

Method of execution of the complex

In order to establish the initial levels of physical performance, it is envisaged that students will be tested at the beginning and end of the experimental period. The requirements for conducting the test battery are in accordance with the material and technical provision provided in the methodology and the sports base. The aim is to analyse the values of the physical performance of the persons surveyed, to prove or reject the working hypothesis.

The activities last 60 minutes, and in the beginning the intensity is lower due to the study of the individual exercises and the functionalities of the students. In connection with the application of the proposed model, a lecture course was developed, with a focus on the impact of circular training on physical fitness. Participants were familiar with the lecture material, in the form of 10-minute talks. At the end of each lecture, we gave students the opportunity to express conclusions and opinions on the topics. Our pedagogical observation showed that the educational element in our methodology was adopted with interest and desires for active participation in the next talks and lectures.

CHAPTER THREE

ANALYSIS OF RESULTS

III.1. ANALYSIS OF THE RESULTS OF THE TEST BATTERY

The study involved 44 students, women aged between 18 and 22, studying at Sofia University "St. Kliment Ohridski". The sample is formed by simple random selection and is representative of all 150 students, women who have recorded sports-profiled activities under "Circular Training" for the 2018-2019 school year.

During the testing, the participants aim to maximize their capabilities and achieve the best result for them.

For determining the functional capacity and physical qualities of the surveyed persons, the adapted eurofit-based test battery is applied by us. It includes the following assessment tests before and after the application of the proposed experimental methodology:

III.1.1. Physical qualities

III.1.2. Functional capacity

III.1.3. Anthropometric indicators

III.2. ANALYSIS OF LOAD VOLUME REPORTING PROTOCOLS DURING THE CIRCULAR WORKOUT

III.3. ASSESSMENT OF THE MAGNITUDE OF THE EFFECT

III.4. ANALYSIS OF THE RESULTS OF THE NUTRITION TEST

III.5. ANALYSIS OF THE RESULTS OF INTAKE OF FOOD SUPPLEMENTS

III.1.1. PHYSICAL QUALITY

Jump length from a place with two legs

The results of the testing of the surveyed group of students showed that the average length achieved by them in the jump in length from place before the application of the training methodology was 158.18 cm. Analysis of the data obtained showed that 22.7% of the students surveyed maintained their achievements at the end of the experiment, and 15.9% of them decreased their results between 1 and 3 cm. Improvement in achievements between 1 and 4 cm achieved 61.3% of the persons surveyed. The highest proportion of positive differences between 1 and 2 cm – 43.1%, 18.2% of the persons surveyed recorded a positive growth of 3 and 4 cm.

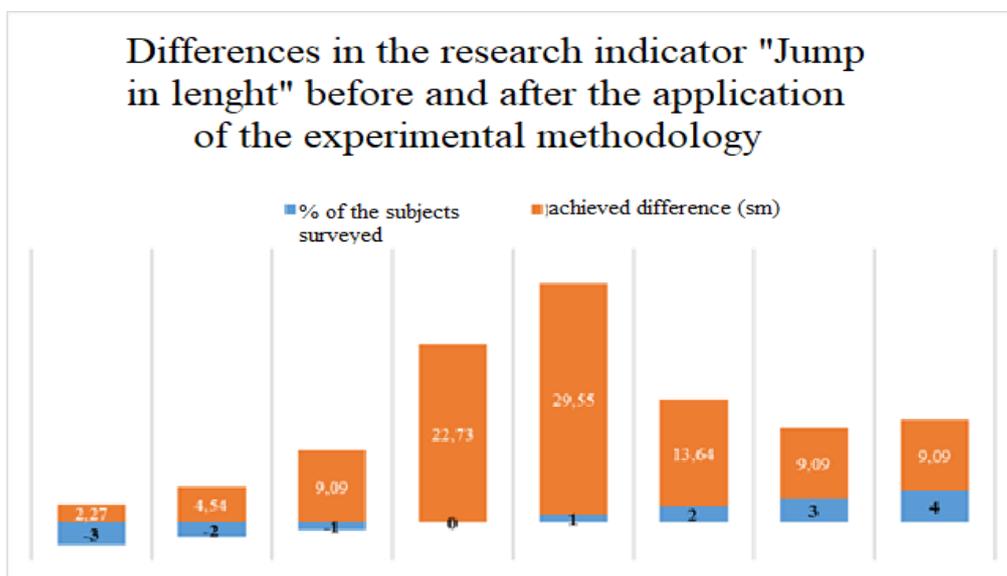


Figure 4. Analysis of the results "Jump length from a place with two legs"

Push-ups (30 seconds)

With regard to this indicator, the average number of push-ups before applying the training methodology is 14 repetitions, and after its application is 15 repetitions. Analysis of the data obtained showed that 29.55% of the students surveyed maintained their achievements at the end of the experiment, and 70.45% of them improved their sports score between 1 (40.91%) and 2 (29.54%) push-ups.

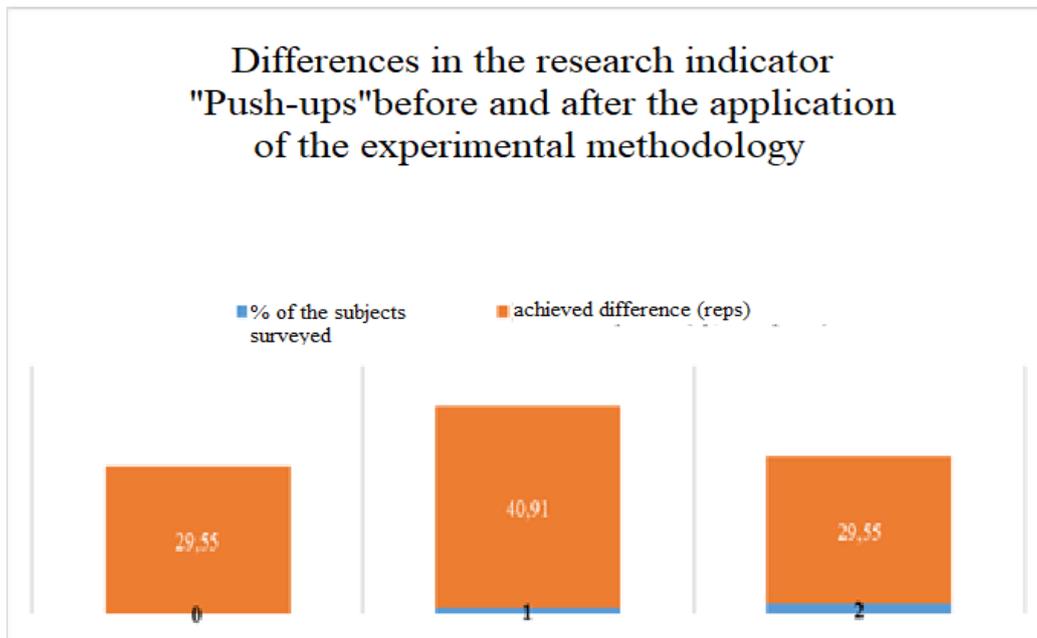


Figure 5. Analysis of push-ups results

Flamingo test

The average duration of holding the body in balance before applying the training methodology was 21.36 seconds, and at the end of the experiment - 21.41. Analysis of the data obtained showed that 40.91% of the students surveyed maintained their achievements at the end of the experiment, and 36.40% of them improved their sports score between 1 (18.18%), 2 (15.91%) and 3 (2.73%) seconds. The remaining 22.8% reduced their achievements between 1 and 3 seconds.

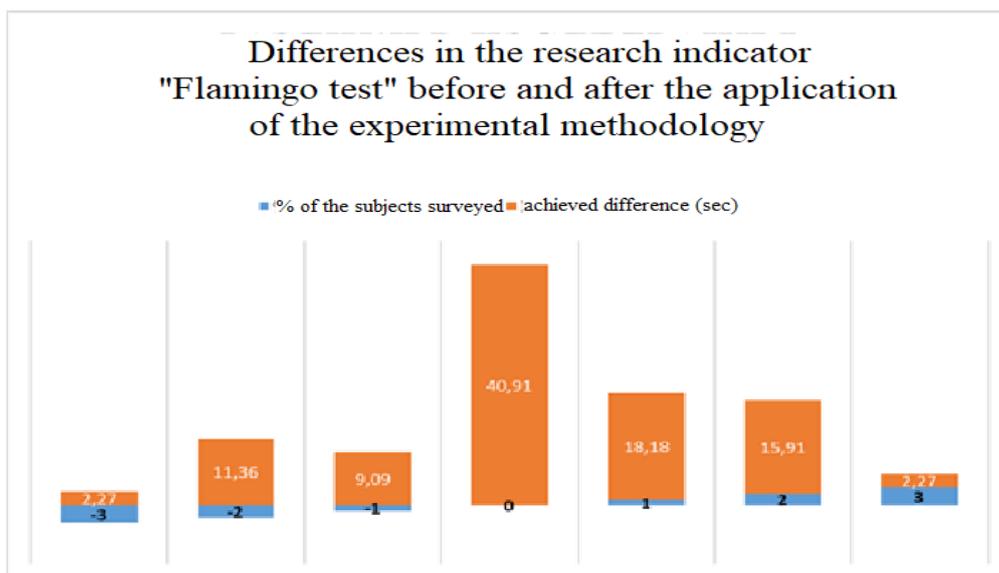


Figure 6. Flamingo test results analysis

Sit and reach

The average depth of inclination of the body before applying the training methodology is -5.30 cm. Analysis of the data obtained showed that 18.18% of the students surveyed maintained their achievements at the end of the experiment, and 75% of them improved their sports score between 1 (38.64%) and 2 (36.36%) cm. The remaining 6.82% decreased their flexibility by 1 cm.

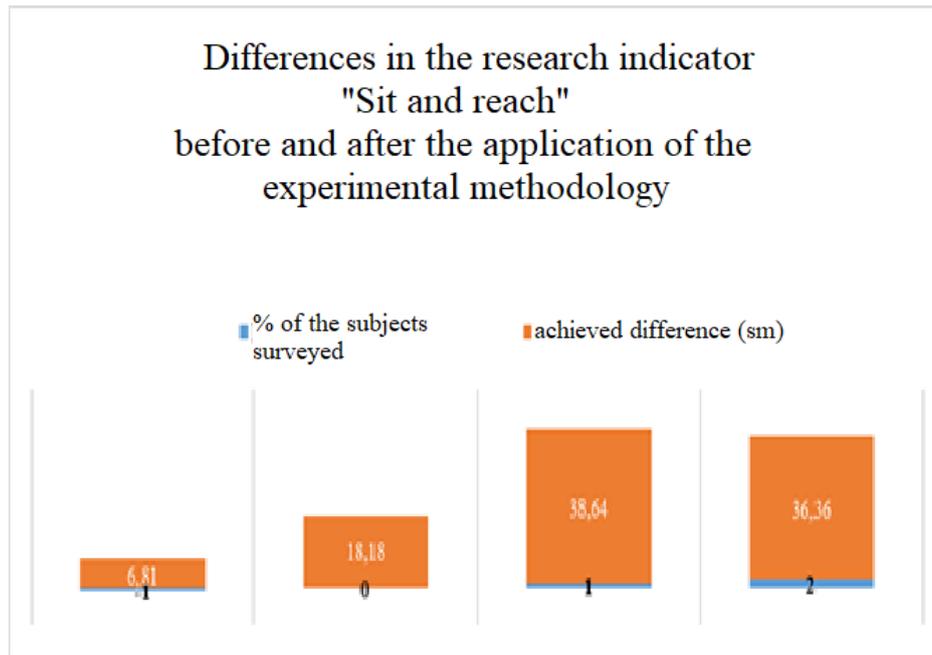


Figure 7. Sit and reach results analysis

Sit-ups for a time of 30 seconds

The average number of sit-ups performed for a time of 30 seconds before applying the training methodology is 14. 50% of the subjects surveyed maintained their achievements at the end of the experiment, and 41% of them improved their sports score between 2 (11.36%), 3 (20.45%) and 4 (9.09) sit-ups. The remaining 9.1% decreased their achievements between 3 and 4 pieces.

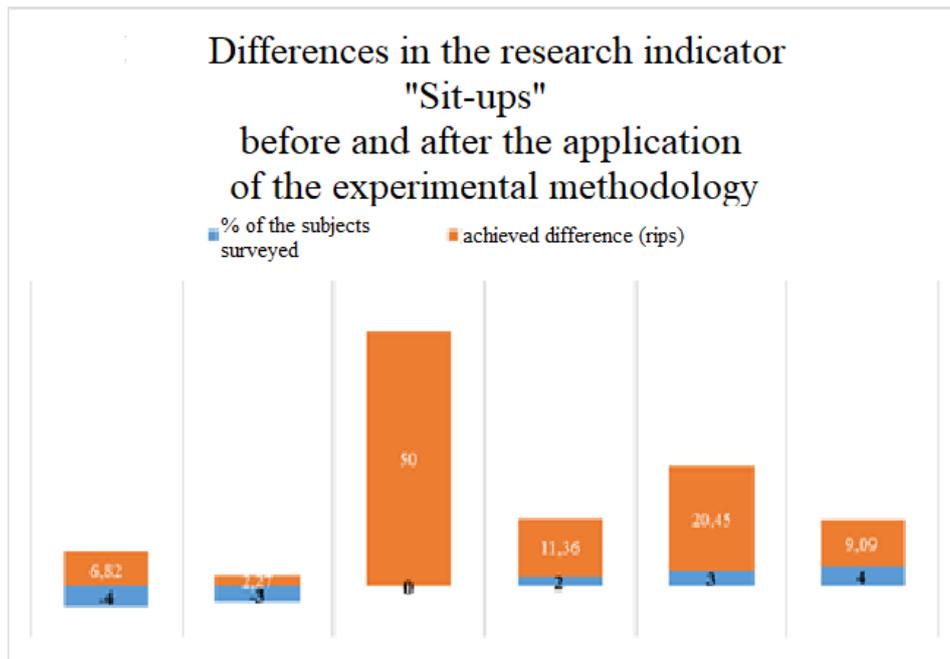


Figure 8. Analysis of the results "sit-ups"

III.1.2. FUNCTIONAL INDICATORS

Beep test

The results of the testing of the surveyed group of students show that the average number of sections before the application of the training methodology is 11, and after its application - 12. Analysis of the data obtained showed that 50% of the students surveyed maintained their achievements at the end of the experiment, and 36.4% of them improved their sports score between 2 (11.36%), 3 (13.64%) and 4 (11.36) pieces of passes. The remaining 13.6% decreased their achievements between 2 and 4 sections.

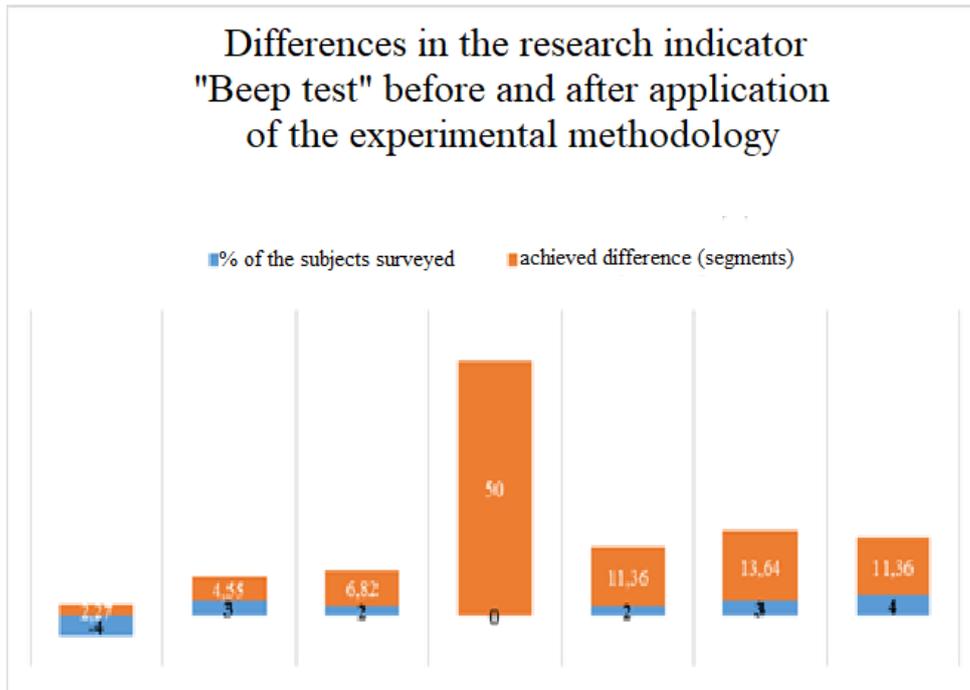


Figure 9. Analysis of beep test results

III.1.3. ANTHROPOMETRIC INDICATORS

Percentage of body fat (Body Fat %)

The average percentage of body fat in the subjects studied prior to the application of the training methodology was 23.27. 61.36 percent of the students surveyed kept body fat at the end of the experiment, and 36.4 percent of them reduced them between 0.10 and 2 percent. The highest proportion of students who reduced their body fat by 1% (22.73%) the opposite effect was received by only 2.27% of participants. They have increased their body fat percentage by 0.40%.

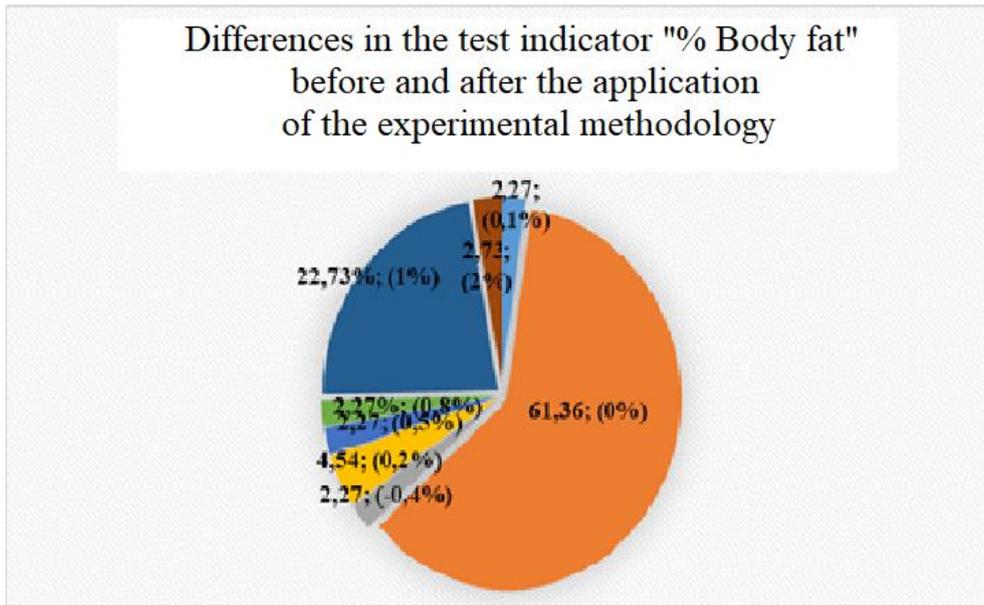


Figure 10. Analysis of results "% Body fat"

Body Mass Index (BMI)

The results of the measurement of the studied group of students showed that the average BMI before the application of the training methodology was 20.57, and after its completion, 20.32, which fell within the range of 18.50 – 24.99 for healthy body weight and a low level of health risk.

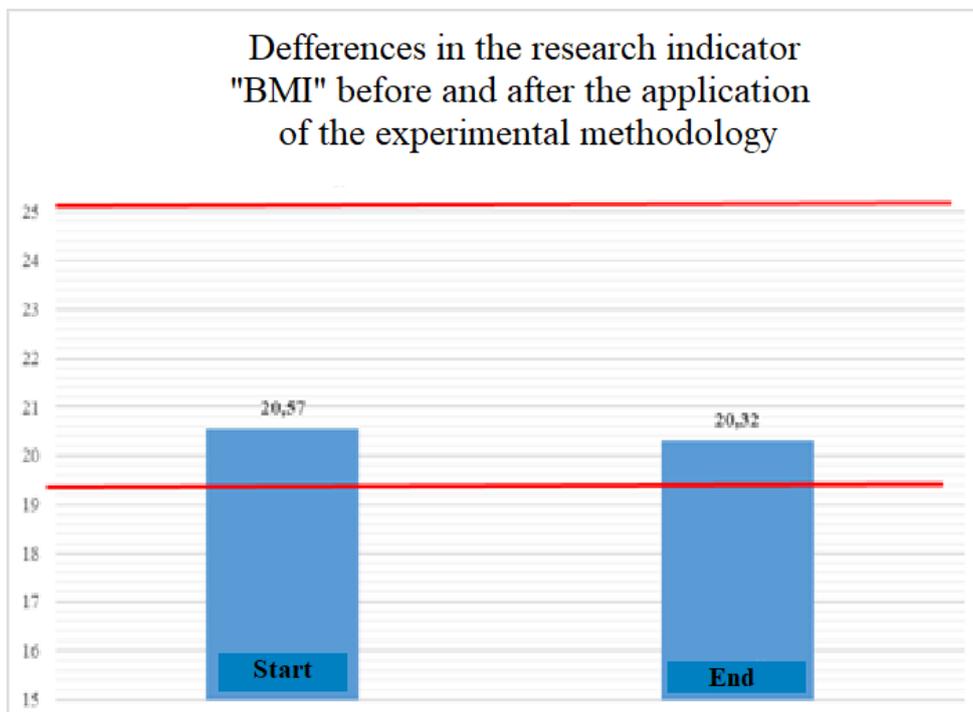


Figure 11. Analysis of the results "Body mass index"

Lean Body Mass (LBM)

The mean value of baseline levels of the anthropometric indicator Lean Body Mass is 43.29 kg. Analysis of the data obtained showed that 40.9% of the students surveyed kept the values at the end of the experiment, and 36.5% of them scored a rise between 0.1 and 1.50 kg. The highest proportion of students who raised the values of this indicator by one kilogram (9.09%) and 0.10 kg (4.54%). Decreased lean body mass values were recorded in 22.8% of subjects.

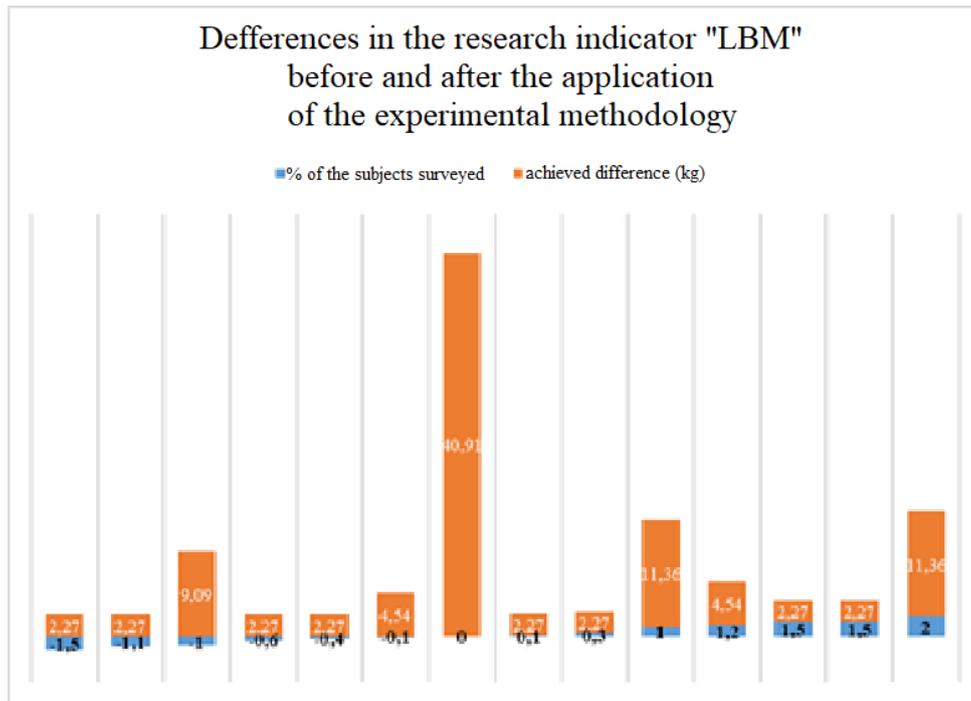


Figure 12. Analysis of lean body mass results

III.2 ANALYSIS FROM THE PROTOCOLS FOR RECORDING THE VOLUME OF LOAD DURING THE CIRCULAR WORKOUT

Jump Squat

The jump squat experimental exercise increased the explosive force of the lower extremities, which was found by the jump length test from place by 1 to 4 cm.

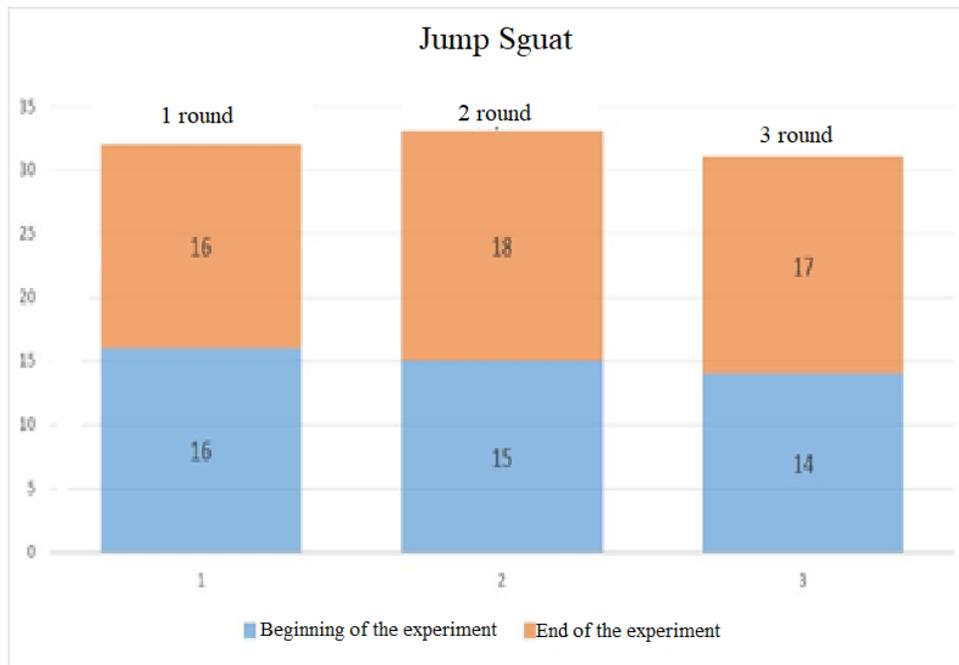


Figure 13. Analysis from the protocol for the number of repetitions of "Jump sguat" *Bicycle crunch and plank with dissolution of the legs*

The increase in the number of sit-ups from the Eurofit battery by 2 to 4 repetitions is due to the exercises of the experimental methodology sit-ups type wheel and plank with dissolving legs.

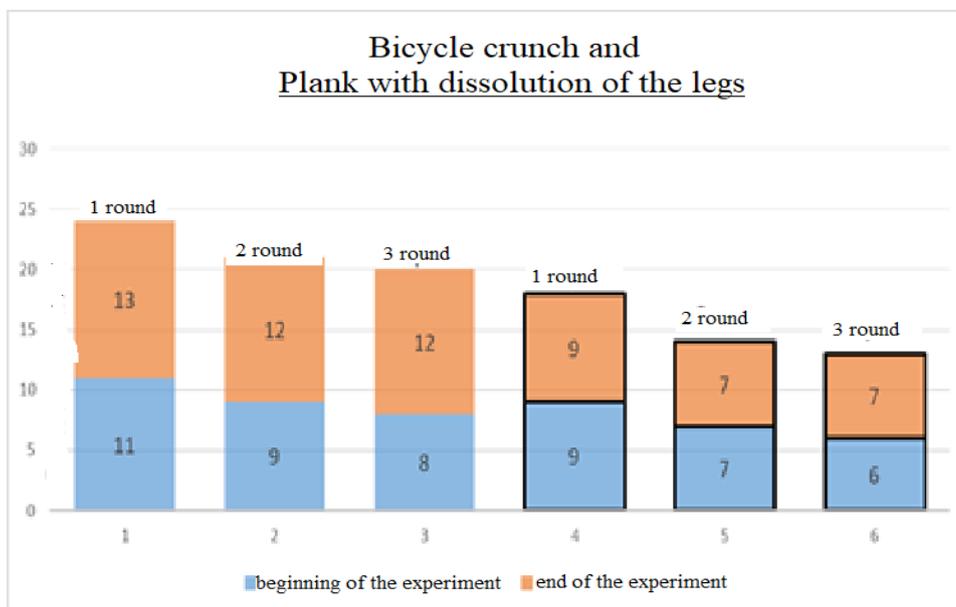


Figure 14. Analysis from the protocol of the number of repetitions made of "Bicycle crunch" and "Plank with dissolution of the legs"

Push-ups and Kettlebell swing

The increase in the number of push-ups from the Eurofit battery by 1.2 repetitions is due to the increased strength endurance of the upper body as a result of the application of exercise push-ups for 30 seconds and kettlebell swing.

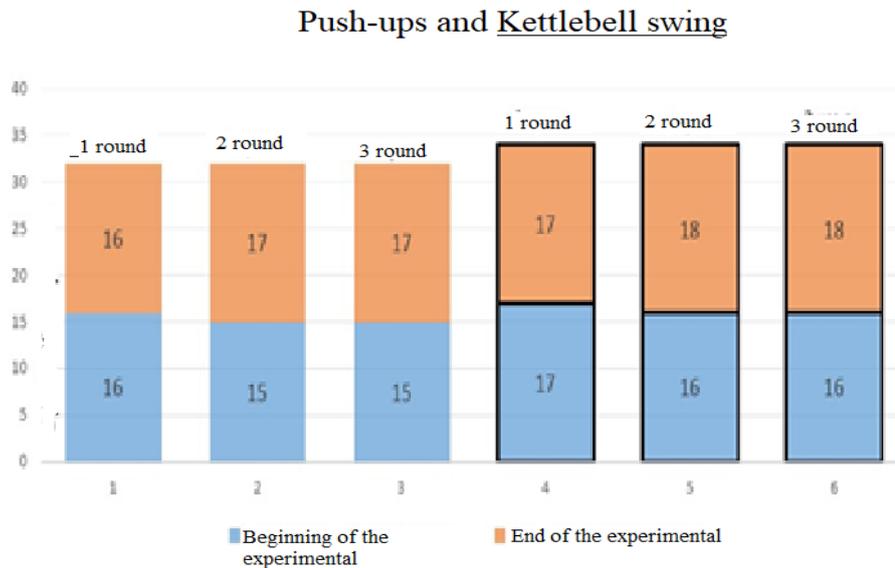


Figure 15. Analysis from the protocol of the number of repetitions of "Push-ups" and "kettlebell swing"

Burpee

The increase in the number of sections of the Beep test of the Eurofit battery by 2 to is due to the Burpy exercise from the experimental methodology, in which we take into account the number of repetitions at the end of the experiment.

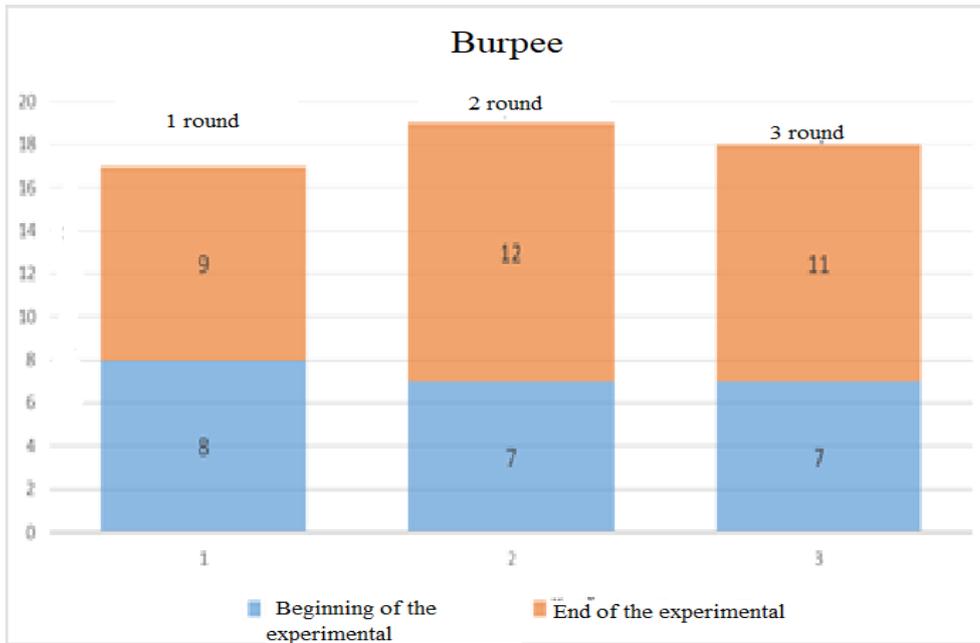


Figure 16. Analysis from the protocol for the number of repetitions of "Burpee"

Scissor Lunge Jumps

The known increase in the number of repetitions in the Scissor Lunge Jumps exercise influenced the equilibrium resistance as measured by the Flamingo test by 1 to 3 seconds.

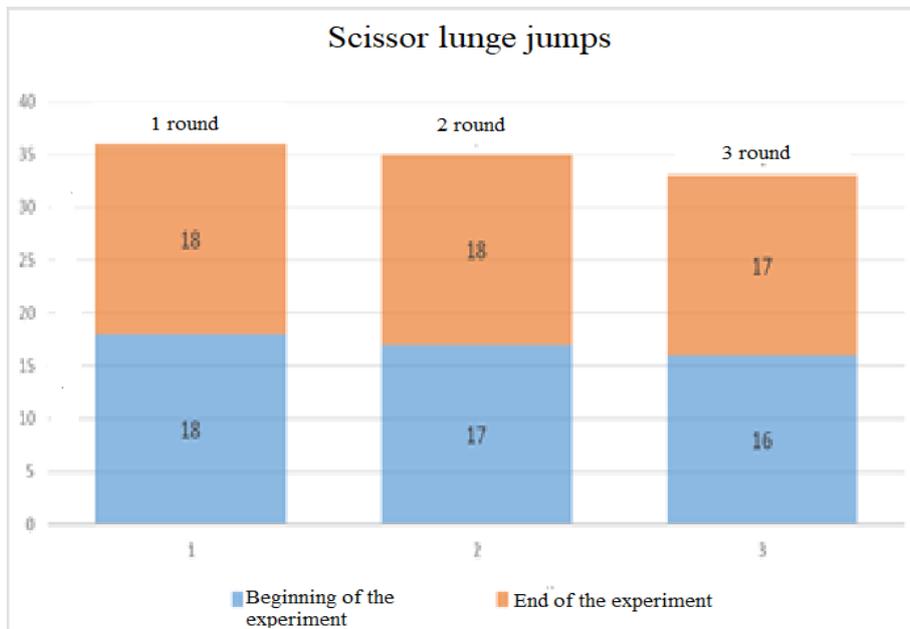


Figure 17. Analysis from the protocol for the number of repetitions of "Scissor lunge jumps"

III.3. ASSESSMENT OF THE MAGNITUDE OF THE EFFECT

Result of practical effect

With the greatest practical effect of the application of the training methodology are the indicators:

- Strength endurance in the upper body;
- Explosive force of lower extremities;
- Mobility of the spine;
- BMI;
- Percentage of body fat.

Medium-sized practical effect is achieved in indicators:

- Cardio-respiratory endurance;
- Lean body mass;
- Strength endurance

A small practical effect was achieved in the indicator

- „Flamingo”.

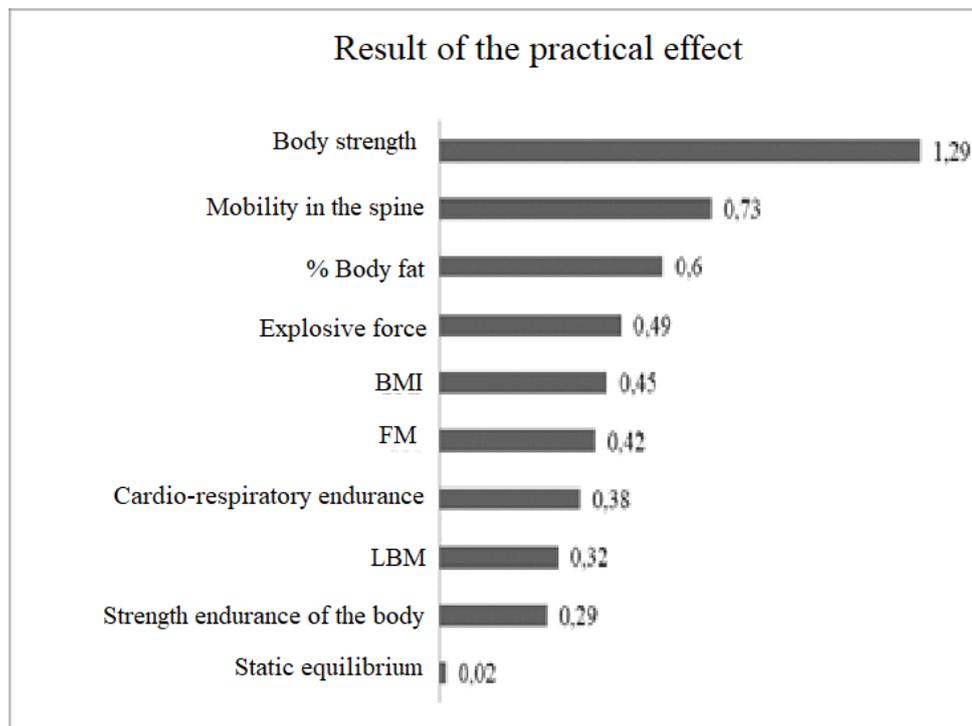


Figure 18. *Size of practical effect*

III.4. ANALYSIS OF THE RESULTS OF THE NUTRITION TEST

Result nutrient intake survey

The figure shows the relative share of proteins, fats and carbohydrates in the daily energy intake of the surveyed individuals, compared with the recommendations for healthy eating, which correspond to those in novice athletes. We report good compliance of carbohydrates consumed (54.1%) compared to the recommended by sports nutrition specialists 55%. Energy derived from proteins (17.8%), again falls within the recommended range of 15-20%. Fat consumption provides 28.1% of energy intake, which slightly exceeds the upper recommended limit of 25%.

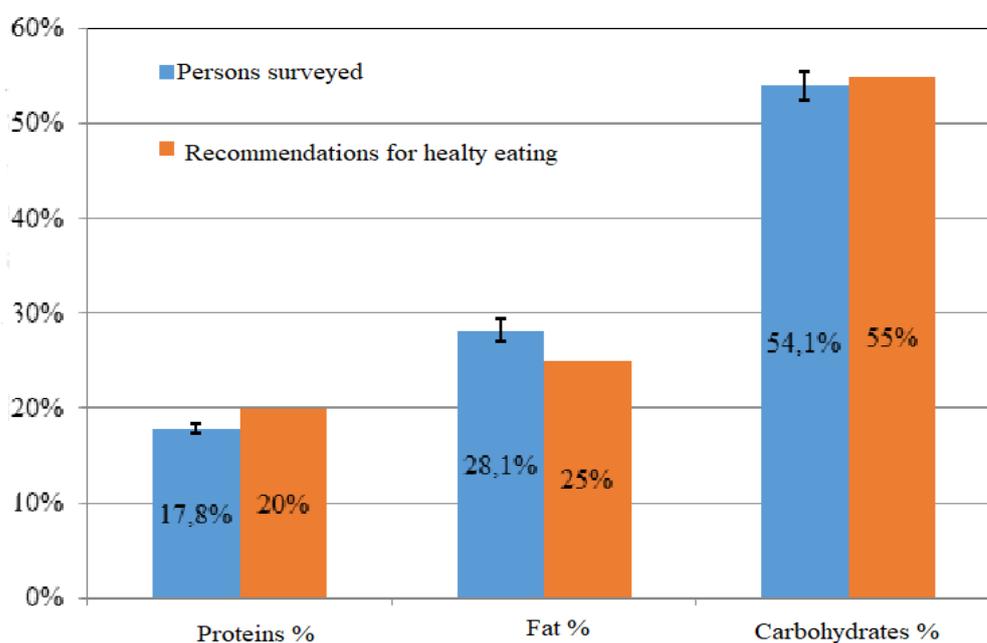


Figure 19. *Relative share of proteins, fats and carbohydrates in the daily energy intake of the studied subjects*

Weekly use of multivitamins in the subjects studied

Eleven of the women studied (25%) did not use multivitamin supplements. Twenty women (45%) indicated daily use of multivitamins (7000 mg), five (11%) consumed the supplement three times a week only on training days (3000 mg), seven (approximately 16%) - five times a week (5000 mg) and only one of the women studied (2%) taking two multivitamin tablets daily (1400 mg).

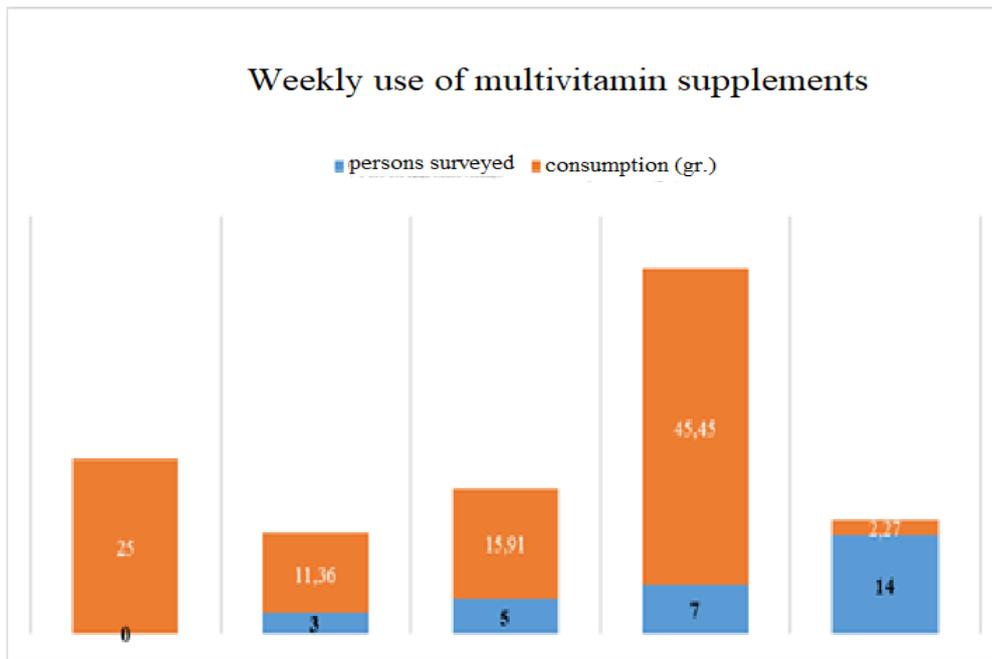


Figure 20. *Weekly use of multivitamins in the subjects studied*

Other food supplements

Weekly calcium use of about 4200 mg (600 mg daily) indicated 26% of the subjects studied, using magnesium of about 17500 mg per week (250 mg daily) indicated 15% of the subjects studied. 23% indicated the consumption of Omega 3 by about 3000 mg daily -21000 mg per week. Vitamin A use indicated 22% of the women studied one tablet per day (1500 µg). Weekly use of B complex indicated 14% of the women surveyed. The average weekly consumption is ~29 mg (on average 1-2 tablets three times a day), which is within the recommendations for consumption at an average protein intake for women of 100 g.

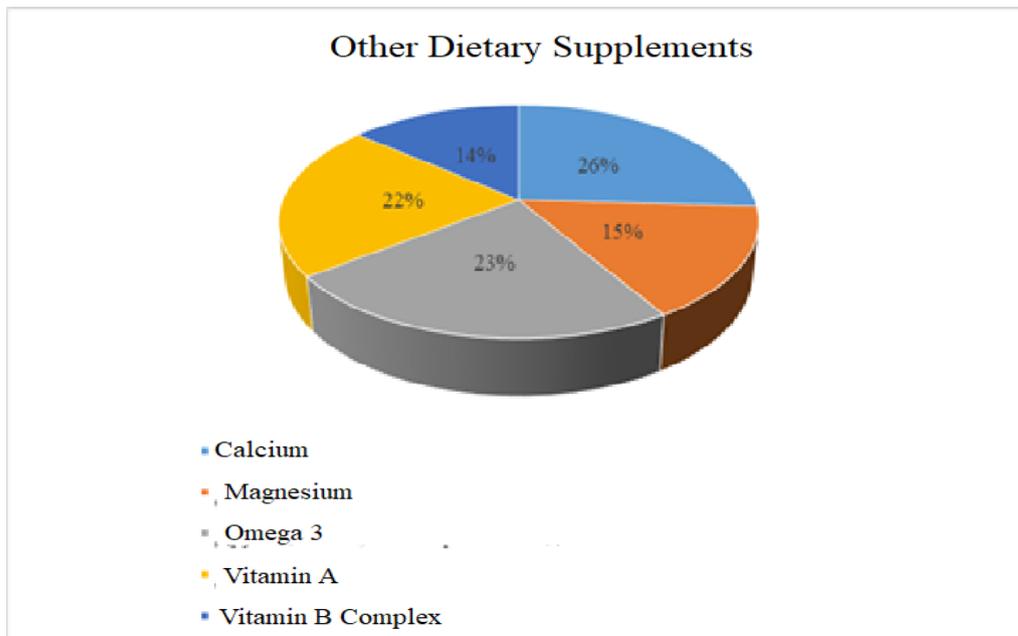


Figure 21. *Other food supplements*

The persons studied did not indicate the use of protein and amino acid supplements, as well as thermogenic products having a significant relation to muscle hypertrophy and fatty reduction.

IV. CONCLUSIONS AND RECOMMENDATIONS

Conclusions:

1. The training model developed by us is applicable and adapted for the purposes of physical education at University St. Kliment Ohridski".

2. The Eurofit test battery used is sufficiently informative in terms of the physical fitness indicators examined.

3. The experimental methodology we applied within the three-month period led to an increase in LBM and some reduction in body fat.

4. We have considered a more significant development of motor qualities: strength endurance in the upper body and carcass; explosive force of lower extremities; cardio-respiratory endurance and spinal mobility. All this confirms the work hypothesis we have raised.

5. External factors that could affect the sporting outcome are diet and intake of dietary supplements. Our survey at the end of the experiment found that the consumption of proteins, carbohydrates and fats is within the recommendations for non-training and in the recommendations for healthy eating.

6. With regard to the intake of dietary supplements in the persons studied, we did not establish the consumption of thermogenic, ergogenic, etc. biostimulating preparations leading to reduced fat reduction, increased muscle hypertrophy and an increase in physical performance.

Recommendations

1. We recommend that the experimental model we develop be performed three times a week and for a longer period of time, which in our opinion would lead to a more significant improvement in physical fitness and optimization of body composition.

2. Future studies on the attached training model would refine the results of its practical effect.

Conclusion:

Phenotypic factors diet and intake of dietary supplements that may affect the sports result are within the recommended in persons who don't exercise and in the recommendations for healthy eating. This finding gave us reason to argue that our proposed experimental methodology based on circular and interval training, with complexes of exercises widely used in Crossfit, has led to an improvement in the physical fitness of students from SU "St. Kliment Ohridski", an increase in LBM and some reduction in body fat.

PUBLICATIONS RELATED TO DOCTOR'S WORK

1. Bocheva, N. Development and classification of fitness gymnastic disciplines, "Modern trends of physical education and sports". ISSN 1314-2275, UE "St. Kliment Ohridski", p. 241-250, Sofia 2020.

2. Bocheva, N. Circular fitness training, "Modern trends of physical education and sports". ISSN 1314-2275, UE „St. Kliment Ohridski", p. 258-262, Sofia 2021.

3. Bocheva, N. *Physical abilities of sofia university “st. Kliment ohridksi” students enlisted for circuit workouts classes*, Trakia Journal Of Sciences, 2021: vol 19, Suppl. 1, ISSN 1313-7050, ISSN (online):1313-3551, doi:10.15547/tjs.2021.s.01.147, p. 935-939, Stara Zagora.