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**MONITORING THE EFFECT OF KINESITHERAPY METHODOLOGY  
IN UNIVERSITY STUDENTS WITH MUSCULOSKELETAL  
DYSFUNCTIONS, OVERWEIGHT AND OBESITY**

**ABSTRACT**

of dissertation for awarding Educational and scientific degree “PhD” in  
professional field 1.3. Pedagogy of education in... (Methodology of education in Physical  
Education and Sport – kinesitherapy)

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The dissertation work is structurally shaped by a list of used abbreviations, introduction, five chapters, bibliography and applications. The volume is 194 standard pages, including 158 pages of main text, 20 pages of bibliography, 14 pages of applications, a declaration of originality and a list of scientific publications of the author on the theme of the dissertation, including 4 titles. The actual material is presented in 38 tables and 16 figures. The bibliography contains 177 information sources, including 60 in Cyrillic, 111 in Latin and 6 websites.

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## **ABBREVIATIONS USED IN THE DISSERTATION WORK**

VAS – visual analog scale

DEI – daily energy intake

EG – experimental group

SP – starting position

BMI – body mass index

SF – skin fold

KT – kinesitherapy

ME – main exchange

GE – general exercises

WHO – World Health Organization

PA – physical activity

PES – physical education and sport

CNS – central nervous system

%BF – body fat percentage

HDL – High-density lipoprotein

HR – heart rate

HRmax – maximum heart rate

MC4R – melanocortin-4 receptor

## INTRODUCTION

Increasing dependence on technology in modern society promotes a sedentary lifestyle and hypodynamia. A decrease in physical activity is a prerequisite for the emergence of a number of chronic diseases, including overweight and obesity.

Obesity is a chronic disease that can seriously damage health, deteriorating quality of life and reduce its duration. Overweight and obesity are major risk factors for multiple diseases, leading to serious disabilities that cause significant social, economic and psychological damage to individuals, families and society as a whole.

In recent decades, there has been a large increase in the incidence of overweight and obesity worldwide, in different age groups, including among students. The obesity epidemic is mostly associated with the factors of modern lifestyle – reduced physical activity and unhealthy diet.

Sports and regular physical activity are some of the main factors for the prevention and treatment of excess weight. The World Health Organization recommends for people aged 18 to 64 at least 150-300 minutes/week of moderate-intensity aerobic physical activity or at least 75-150 minutes/week of high intensity.

Strategies for the prevention of overweight and obesity should focus on regular physical activity and a healthy diet. It is important to disseminate health education information about the role of physical activity for health, as well as to increase the minimum number of compulsory classes of the discipline “Physical Education and Sport” in the programs’ curricula for university students.

Despite all the changes that have been made to improve the quality and content of the sport curriculum, the management of the Universities underappreciates the important role of physical activity and sport for the physical

and mental health of university students. Hours are insufficient for the prevention of many socially significant diseases, in particular obesity.

Due to the seriousness and topicality of the problem, it is necessary to improve the methods and means of kinesitherapy in the curriculum of the discipline “Sport” in Universities, in order to have a complex impact on overweight and obese people.

This scientific study attempts to experimentally, scientifically justify the effect of an applied kinesitherapy methodology of varying weekly frequency, combined with diet therapy and included lecture course, to respond to overweight and obesity in university students with musculoskeletal dysfunctions.

## CHAPTER ONE. THEORETICAL STAGING OF THE PROBLEM

Overweight and obesity are defined as excessive accumulation of body fat (subcutaneously, in the abdominal cavity, around the internal organs), which can seriously damage health and reduce life expectancy (Haslam D. et al., 2006).

They affect a large number of people of active age in Bulgaria and worldwide, but there is also a tendency to increase the prevalence of obesity in childhood.

According to the WHO, in 2016, 39% of adults aged 18 or over are overweight and 13% of the world's adult population are obese. According to the Annual Report on Youth in Bulgaria, in 2014, 19.4% of the population aged 15-29 are with pre-obesity (BMI 25.0 – 29.99), and 3.4% are with obesity class I (Youth Report, 2014).

Body mass index (BMI) is recommended as a screening test to identify individuals who are underweight, overweight, or obese (Table 1).

**Table 1.** Assessment of nutrition according to body mass index (WHO, 2000)

<b>Classification</b>	<b>BMI (kg/m<sup>2</sup>)</b>
Underweight	Под 18.5
Normal weight	18.5 – 24.9
Overweight	25.0 – 29.9
Obesity class I	30.0 – 34.9
Obesity class II	35.0 – 39.9
Obesity class III	≥40

In 2000, the World Health Organization (WHO), in its report “Obesity: Prevention and Management of the Global Epidemic”, described obesity as a “chronic disease” (WHO, 2000).

Although the risk of complications is associated with increased BMI, the distribution of adipose tissue is a more significant factor in the development of

morbidity and mortality. According to G. Iacobellis (2009), waist circumference is a better indicator, compared to BMI, of the distribution of body fat, determining the risk of metabolic complications.

According to the WHO, when waist circumference  $\geq 80$  cm in women and  $\geq 94$  cm in men, there is talk of increased cardiometabolic risk. If the waist circumference in men is  $\geq 102$  cm and  $\geq 88$  cm in women, there is a significantly increased cardiometabolic risk (WHO, 2011). The waist/hip ratio is used to assess the redistribution of adipose tissue and determine the type of obesity (android or gynoid type). With a result of  $\geq 0.90$  cm in men and  $\geq 0.85$  cm in women, there is a significantly increased risk of metabolic complications (Dimitrova D., 2016).

According to numerous studies, waist/height ratio is a better tool for screening the risk of cardiometabolic complications (hypertension, type 2 diabetes, dyslipidemia, metabolic syndrome and general cardiovascular diseases) in both children and adults, in both sexes, in different nationalities and ethnic groups, than waist circumference, waist/hip ratio and BMI (Ashwell M., Gunn P., Gibson S., 2012; Schneider H. et al., 2010). With a result  $< 0.5$  cm – there is no increased risk, with a result of 0.5 cm to  $< 0.6$  cm – there is an increased risk, and over 0.6 cm – a significantly increased risk of metabolic complications (Ashwell M., Gibson S., 2016).

Central obesity (android, visceral), characterized by the accumulation of adipose tissue around the organs in the abdominal cavity is a major factor for the occurrence of metabolic syndrome. Central (visceral) obesity carries a greater health risk than peripheral. It increases the risk of developing metabolic syndrome (Nikolopoulou A., Kadoglou N., 2012). According to many studies, quality of life deteriorates in overweight and obese people (Fontaine K., Barofsky I., 2001; Kolotkin R., Andersen J., 2017).



In the android (central) type of obesity, an increased accumulation of visceral adipose tissue is characteristic. In this type of obesity, glucose tolerance (prediabetes), type 2 diabetes mellitus, dyslipidemia (high triglyceride levels and low levels of “good” - HDL-cholesterol), hyperuricemia (high levels of uric acid), arterial hypertension, ischemic heart disease are often present (Buchwald H. et al., 2007).

In gynoid (female) type of obesity, an increased accumulation of adipose tissue is characteristic mainly in the lower half of the body (hips, thighs). According to F. Christopher and K. Brownell (2002), it has a higher risk of mechanical complications such as varicose veins, arthritis and arthrosis associated with increased load on the lower extremities.

The causes of obesity are a number of genetic factors and neuroendocrine disorders, but according to M. Marekov et al. (2000) in over 95% of cases, obesity is exogenous.

Exogenous obesity is due to high energy imports and a sedentary lifestyle, with insufficient physical activity. It is the basis of the increasing incidence of arterial hypertension and type 2 diabetes mellitus in childhood and adolescent age.

Secondary obesity is a consequence of endocrine disorder or disorder in the centers of appetite regulation in the hypothalamus.

Overweight and obesity are major risk factors for multiple diseases and lead to serious disabilities: arterial hypertension, stroke, ischemic heart disease, type 2 diabetes, hormonal disorders, joint diseases, some cancers, sleep apnea, psychological disorders, and others.

A number of studies have shown that the most effective treatment for overweight and obesity are programs involving diet therapy, increased physical

activity, behavioral therapy, medication treatment, surgical methods, and a multidisciplinary team (Dashti S. et al, 2014; Fock K., Khoo J., 2013; Hills A. et al., 2011; Johns D. et al., 2014).

Obesity and its accompanying complications cause significant social, economic and psychological damage to individuals, families and society as a whole.

Due to the high morbidity and mortality, the prevention of obesity should start in infancy, as an important role is played here by both family and medical professionals and teachers in the building and strengthening habits for a healthy lifestyle – healthy eating and regular physical activity, and sports.

Despite numerous attempts and recommendations to reduce the prevalence of overweight and obesity and its accompanying complications, obesity remains a global medico-social problem of modern society.

## WORKING HYPOTHESIS

Despite the precautionary measures taken, the trend to increase the incidence of overweight and obesity worldwide continues in different age groups, which is mostly associated with reduced physical activity and unhealthy eating.

A large percentage of university students do not follow WHO recommendations for people aged 18 to 65 years for at least 150-300 minutes/week of moderate-intensity aerobic physical activity or at least 75-150 minutes/week of high intensity (WHO, 2020).

Based on the literature review, we believe that kinesitherapy in overweight and obesity has been studied, but not sufficiently developed and still an unresolved social significant problem.

Our available literature does not reveal data for reporting the effect of kinesitherapy, at varying weekly frequency, on overweight and obesity response in university students with musculoskeletal dysfunctions.

This is a reason to develop and experiment methodology of kinesitherapy in overweight and obesity, applied at different weekly frequency, in university students with musculoskeletal dysfunctions.

The following working **hypothesis is formulated:**

We assume that the application of the methodology of kinesitherapy, combined with diet therapy and included lecture course once a week to Sofia University “St. Kliment Ohridski” students, who are overweight, obese, and with musculoskeletal dysfunctions, will lead to a decrease in body weight and improvement of their functional status, but the methodology applied three times a week will have a more pronounced therapeutic effect.

## **CHAPTER TWO. PURPOSE, TASKS, METHODOLOGY, AND ORGANISATION OF THE STUDY**

### **II.1. PURPOSE AND TASKS OF THE STUDY**

**The aim** of the current study is to track the effectiveness of applied kinesitherapy methodology with different weekly frequency, combined with diet therapy and included lecture course, in Sofia University “St. Kliment Ohridski” students, with musculoskeletal dysfunctions, overweight and obesity.

#### **Tasks of the study:**

1. To examine and analyze specialized information sources related to the problem under consideration.
2. To select appropriate, sufficiently informative, indicators and methods for assessing the effectiveness of the prepared and applied kinesitherapy methodology.
3. To develop and approve an experimental methodology of kinesitherapy, combined with diet therapy and included lecture course and to be applied at a different weekly frequency to university students who are overweight and obese.
4. To establish the effectiveness of the developed methodology of kinesitherapy, applied at different weekly frequency, combined with diet therapy and included lecture course, in students with musculoskeletal dysfunctions, overweight, and obesity, by disclosing the condition and dynamics of indicators of physical development and capacity before and after the experiment.
5. To process and analyze the results of the study and to make relevant conclusions and recommendations for clinical practice.

## **II.2. METHODOLOGY OF THE STUDY**

### **II.2.1. Subject and object of the study**

**The subject** of the study is research and reporting the therapeutic effect of kinesitherapy methodology, applied at different weekly frequency, combined with diet therapy, and included lecture course in university students with musculoskeletal dysfunctions, overweight, and obesity.

**The object** of the study is the incidence of overweight and obesity and indicators determining the overweight and the degree of obesity, the distribution of adipose tissue, the amount of body fat, and the functional state of the students.

### **II.2.2. A contingent of the study**

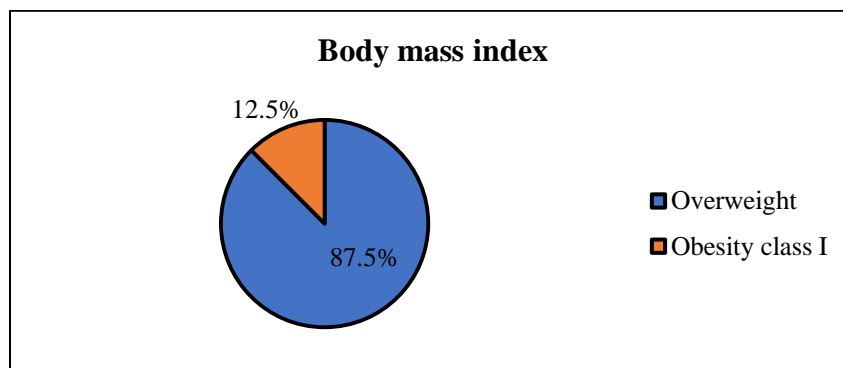
A total number of 218 students (162 women and 56 men), from 1th to 4th course of Sofia University “St. Kliment Ohridski”, aged 19 to 25 ( $20.55 \pm 1.68$ ), with health problems, attending “Sport – Kinesitherapy” were examined.

The body mass index shows that of the 218 students surveyed, 23% were overweight and 4% were obese.

Of the women who expressed their desire to participate in the pedagogical experiment, with a BMI of  $\geq 25.0$  kg/m<sup>2</sup>, and/or a waist circumference  $>80$  cm, and the presence of musculoskeletal dysfunctions, 2 experimental groups are formed, each group consisting of 20 university students.

87.5% of the surveyed students, from EG 1 and EG 2, were overweight and 12.5% were obese class I. Students with obesity class II and class III did not take part in the formed groups (Figure 1). According to the WHO, in overweight people,

the risk of comorbidities is increased, and in I class obese people– the risk is high (WHO, 2000).



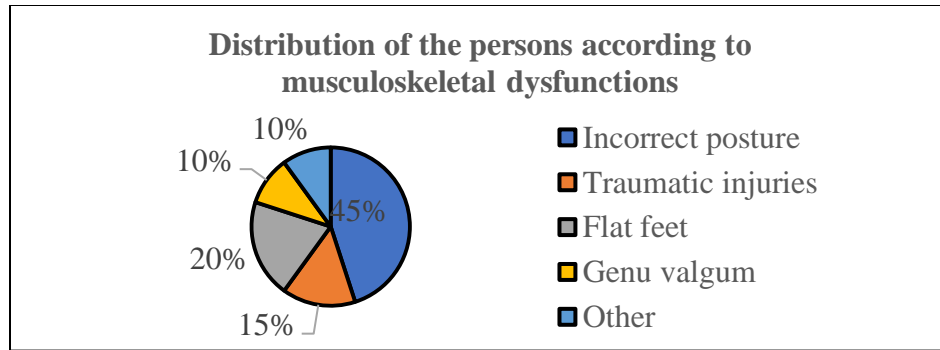
**Figure 1.** Distribution of the surveyed persons according to BMI (%)

Figure 2 showing the distribution of students according to musculoskeletal dysfunctions shows that the percentage of students with incorrect posture is highest – 45%.

Incorrect posture leads not only to spinal distortions, but also to fatigue of the body, as a result of which it leads to loss of tone, capacity, and back pain (Kostov K., 2018)

Prolonged static position during education classes or working process are prerequisite for incorrect body posture, therefore regular kinesitherapy, in particular corrective gymnastics, is necessary.

Musculoskeletal dysfunctions are some of the most common conditions in which kinesitherapy is widely used. Characteristic symptoms are pain, edema, stiffness, muscle weakness, muscle imbalance, limited mobility, joint instability.



**Figure 2.** Distribution of the persons according to musculoskeletal dysfunctions (%)

**The university students included in the experiment met the following conditions:**

- Regarding to anthropometric indicators:
  - BMI  $\geq 25.0$  kg/m<sup>2</sup>;
  - And/or waist circumference >80 cm for women.
- There should be no general contraindications for applying kinesitherapy.
  - Acute infectious diseases and increased body temperature above 37.5 °C;
  - Malignant tumors;
  - External and internal bleeding;
  - An active form of tuberculosis and acute lung diseases;
  - Inflammatory processes during the acute stage;
  - Acute forms of ischemic heart disease;
  - Acute attacks of arterial hypertonic and hypotonic crises.

➤ In individual musculoskeletal dysfunctions, there should be no special contraindications for performing the physical exercises included in the kinesitherapeutic complex.

The students are separated unintentionally, in EG 1 and EG 2, in the order of coming to enroll in the discipline “Sport – kinesitherapy” for students with health problems.

All students from both groups participated in two 15-week rehabilitation courses. The activities of the students who are included in EG 1 are held once a week and those from EG 2 – three times a week. Participants in the experiment underwent 60-minute physical exertion of moderate-intensity and hypocaloric diet. During the winter session, students perform at home only the studied complex of exercises but do not observe a hypocaloric diet (Table 2).

**Table 2.** The organization of the persons surveyed in the experiment

<b>Group</b>	<b>Experimental group 1</b>	<b>Experimental group 2</b>
<b>Number of persons</b>	20 students with musculoskeletal dysfunctions, overweight and obese	20 students with musculoskeletal dysfunctions, overweight and obese
<b>Number of activities for the winter semester</b>	15 kinesitherapy classes (once a week) and diet therapy	45 kinesitherapy classes (three times a week) and diet therapy
<b>Number of activities for the summer semester</b>	15 kinesitherapy classes (once a week) and diet therapy	45 kinesitherapy classes (three times a week) and diet therapy

### **II.2.3. Methods of examination**

In order to achieve the aim of the study, to solve the tasks assigned, and to verify the hypothesis, the following methods of scientific examination are used:

1. Research, analysis, and summarizing of the used information sources;
2. Observation;



3. Survey method;

4. Pedagogical experiment;

5. Methods for examining physical development and capacity – to achieve the aim and tasks of the experiment, a test battery has been drawn up to obtain information on the research carried out.

The test indicators are divided into two groups – anthropometric and functional indicators (Tables 3 and 4).

Anthropometry is a method of examining physical development by measuring the human body using various measuring instruments (Table 3).

**Table 3.** Anthropometric indicators

<b>Anthropometric indicators</b>				
<b>№</b>	<b>Indicator</b>	<b>Unit</b>	<b>Accuracy</b>	<b>Direction</b>
1.	Weight	kg	0,1	+/-
2.	Height	cm	0,5	+
3.	BMI	indices	0,01	+/-
4.	Waist circumference	cm	0,5	+/-
5.	Hip circumference	cm	0,5	+/-
6.	Waist/hip ratio	cm	0,5	+/-
7.	Skin folds	mm	0,5	+/-
8.	Body fat percentage	%		+/-

To determine the functional state of the university students, the Ruffier test with standard physical exertion and the static strength endurance test of the muscle of the trunk (by Krauss-Weber) were used.

Due to the nature of the contingent, a quantitative pain assessment and posture assessment (Table 4) were made to monitor the effect of the applied experimental methodology.

**Table 4.** Functional indicators

<b>Functional indicators</b>				
<b>№</b>	<b>Indicators</b>	<b>Unit</b>	<b>Accuracy</b>	<b>Direction</b>
1.	Heart rate	bpm	1	+/-
2.	Ruffier Test	indices		+/-
3.	Static strength endurance of abdominal musculature	sec	0,01	+/-
4.	Static strength endurance of paravertebral musculature	sec	0,01	+/-
5.	Visual-analog scale for quantitative pain assessment	score	1	+/-
6.	Posture assessment	degrees		+/-

6. Mathematical and statistical methods for processing the results of the study – Excel and IBM SPSS 19:

- Alternative and Frequency analysis;
- Descriptive analysis;
- Comparative analysis with Student’s t-test;
- Comparative analysis with Mann-Whitney U test;
- Comparative analysis with Wilcoxon’s test;
- Fischer’s F-test (ANOVA).

### **II.3. ORGANISATION OF THE STUDY**

The experiment was conducted, between May 2017 and April 2021, at the Center for Kinesitherapy at Sofia University “St. Kliment Ohridski” and in Sports Center, Student Town, Block 8, taking place in three stages:

- First stage: preliminary (preparatory) stage of the study – May – September 2017
- Second stage: pedagogical experiment – October 2017– June 2019
- Third stage: final stage – July 2019 to April 2021.

## **CHAPTER THREE. METHODOLOGY OF KINESITHERAPY IN OVERWEIGHT AND OBESITY**

### **III.1. PURPOSE AND TASKS OF KINESITHERAPY**

**The aim** of the kinesitherapy methodology is to reduce the weight and improve the functional condition of the university students participating in the study.

#### **Tasks of kinesitherapy:**

- General strengthening of the body;
- Normalization and improvement of metabolism;
- Improving the function of the gastrointestinal tract;
- Improving intestinal peristalsis;
- Improving blood circulation in the abdominal area;
- Improving general blood circulation and lymph circulation;
- Improving trophy of the musculature;
- Improving the function of the cardiovascular and respiratory system;
- Recovering muscle balance;
- Improving the strength of the paravertebral, abdominal and gluteal muscles and muscles involved in hip joint movements;
- Improving the static strength endurance of abdominal and paravertebral musculature;
- Reducing or overcoming pain;

- Breaking the habit of improper posture and building a habit of proper posture;
- Improving the posture;
- Improving balance and coordination;
- Improving physical capacity;
- Improving complex motor skills and habits;
- Total psycho-emotional response and improving self-esteem;
- Prevention from complications.

#### **Tasks of diet therapy**

- Reduce energy intake (1200-1400 kcal/day), increase energy expenditure and create a negative energy balance;
- Provide the necessary macro- and microelements of the body.

#### **Lecture course tasks:**

- Improving students' knowledge of topics related to:
  - ✓ the essence of a healthy lifestyle;
  - ✓ complications of obesity;
  - ✓ the benefits of regular physical activity and sport;
  - ✓ healthy diets;
  - ✓ prevention of socio-significant diseases.

### **III.2. MEANS OF KINESITHERAPY**

In the methodology of kinesitherapy, the main tool used for impact on the body is physical exercise – active exercises, resistance exercises, exercises with appliances, and without appliances, locomotor exercises.

Physical exercises are methodically, correctly selected, targeted and meaningful movements, with the help of which a certain task is achieved – prophylactic or therapeutic.

They are performed from different positions – standing, lying down on the belly, lying down on the back, lying side, four point position.

Exercises are mostly cyclic, performed more often in aerobic mode of moderate-intensity, at a slow to moderate tempo, without the presence of pain.

Main exercises applied in the methodology of kinesitherapy:

- General development exercises for all muscle groups. They are the most accessible exercises to increase physical training, improve general and peripheral blood circulation;
- Active exercises without appliances, with and on appliances – exercises with and on a Swiss ball; small ball; gymnastic stick;
- Resistance exercises;
- Isometric and isotonic exercises;
- Balance and coordination exercises – balance exercises are used for the prevention of spinal distortions. Coordination exercises contribute to greater plasticity, mobility, and balance of nerve processes;
- Correctional exercises – to correct incorrect postural habits in sitting, standing and during movement. Particular attention should be paid to muscles

building the so-called “corset muscle”, which supports and stabilizes the spine and thus protects it from overstrain, pain and trauma. Symmetrical exercises are used for the prevention and treatment of incorrect posture;

- Breathing exercises – static (diaphragmatic breathing) and dynamic, in which breathing is accompanied by exercises for the upper extremities, trunk and lower extremities. Respiratory exercises affect not only the respiratory system, but also the body as a whole. This is especially pronounced in dynamic breathing exercises. These exercises are accompanied by greater, and in some cases, significant physical exertion, which causes vegetative changes, increases metabolism and increases the need for oxygen (Karaneshev G. et al., 1991), and oxygen is necessary for fat oxidation. Correct posture is of great importance for the respiratory process. In the performance of breathing exercises, care was taken not to hold breathing and not to lead to hyperventilation;

- Stretching;
- Relaxing exercises – to gradually reduce the load and normalize physiological processes.

When applying kinesitherapy, good results can be obtained only when certain requirements and rules are observed, which can be divided into three groups: pedagogical, physiological and therapeutic.

### **III.3. Scheme of kinesitherapy procedure**

In order to achieve graduality in the load, the kinesitherapy activity is divided into three parts: preparatory; main, in which the main therapeutic tasks are solved, and the final part. Controlling the load during procedures is the most important. The load must be of a gradually increasing nature. The most appropriate way to control

the workload is to measure the heart rate. During the activities, the subjective state of the students is monitored – pain, dizziness, shortness of breath.

- **Preparatory** – 10-15 minutes of the total duration of the kinesitherapy activity. The main tasks are to increase attention and preparation of the cardio-respiratory system and the musculoskeletal system for the impending workload. The main exercises to be applied are: general development exercises for all muscle groups, and breathing exercises, from the standing position and position lying down on the back

- **Main (actual) part** – lasting 35-40 minutes and it solves the main therapeutic tasks. To solve the tasks, the following exercises are used: active exercises without, with and on appliances; balance and coordination exercises, correctional exercises. The starting positions to be used are standing, lying down on the belly, lying down on the back, lying side, four point position.

- **Final part** – lasting 5-10 minutes from the total duration of the kinesitherapy activity, aimed at bringing functional changes in the body to their baseline. The main exercises that are applied are breathing exercises and relaxing exercises from the position of lying down on the back.

The total duration of the kinesitherapy procedure is from 45-60 minutes. The procedures are held once a week with university students from EG 1 and three times a week with the university students from EG 2.

## **CHAPTER FOUR. RESULTS AND ANALYSIS**

### **IV.1. ANALYSIS OF SURVEY RESULTS**

#### **1. Study and analysis of the subjective assessment of students attending kinesitherapy classes on their health and physical activity**

For the study and analysis of the subjective assessment of the state of health and physical activity of the university students attending kinesitherapy classes, a survey containing 11 closed questions was compiled, with a choice of one answer (Application 1).

The survey was conducted at the beginning of 2017 – 2018 and 2018 – 2019 academic years, among 218 students, from the 1st to the 4th course of Sofia University “St. Kliment Ohridski”, aged 19 to 25 years. An alternative analysis is used to process responses (Table 5).

The health of adolescents and young people must be a priority of the countries and society as a whole. According to the WHO, health is a state of complete physical, mental and social well-being, not just the absence of illness or disability. When asked “How would you rate your health overall?”, 54.13% of respondents replied that they were in good health and 26.6% were in very good health. In this regard, according to 5.96% of the students surveyed, their functional state was unsatisfactory, and 68.81% said it was satisfactory. At the same time, the question “What in intensity pain did you have during the last month?”, only 26,61% replied “No pain”, and in the remaining 73.39%, there was a different in intensity pain. The pain affects not only the physical condition, but also the mental state. Worrying are the data from the answers to the question “In the last month, to what extent have you



been bothered by emotional problems?": 6.88% replied "Extremely", over 24% "Quite a bit", and 43.58% – "Moderately".

A person can not change his genes, but he can change his motor and eating habits. It is up to us to stay healthy. Survey data showed that 64.22% of students surveyed did not observe good eating habits, which may be a prerequisite for illness. The data from the survey, aimed at understanding how students usually spend their spare time, is also alarming. Only 13.76% of students responded that they exercised in their spare time. 20.64% of respondents spend their free time on social media and searching the global network, and 6.88% watch TV, which speaks to the high percentage among young people with sedentary lifestyles, which increases the risk of developing chronic diseases. 67.89% of students realize that they do not spend enough time on sports. It was found that 25.23% of the university students believe they spend enough time on sport, which is a high percentage, but as seen in Table 5, only 10.55% meet the recommended WHO requirements. The discrepancy in the data may mean that students are not informed about the recommended weekly frequency and duration of PA classes. When asked "How many times a week do you play sports?", 6.88% of the university students replied that they play sports 3-5 times a week and 3.67% every day, meaning they are motivated enough for a regular PA. At the same time, a total of 89.45% of the students surveyed were below the recommended PA frequency for 18 to 64 year olds. Unfortunately, a lot of young people do not play sports. 86.35% of overweight students and 76.5% of obese students were with low PA, which we believe shows that reduced physical activity is a factor determining the high prevalence of overweight and obesity. The problem with the low PA is not the lack of financial opportunities and accessible places and facilities for sports. 57.34% of the students surveyed had access to sports halls and facilities, and 22.02% had accessible sports facilities but they did not have time to

visit them. The problem is first and foremost in physical culture, in lifestyle and organizing the spare time.

An unhealthy diet and reduced physical activity are risk factors for many chronic diseases, in particular overweight and obesity. Of the 218 students, 23.44% felt they needed to reduce their body weight. The BMI screening found that of the 218 students surveyed, 23% were overweight and 4% were obese (Figure 1). This can mean that 3.56% of students are unaware of the presence of overweight, which can lead to many complications, and also shows the important role of screening.

To the question “What effect do you expect from kinesitherapy classes?” – 38.07% of the students responded “health improvement”, 27.98% – to improve body posture, and 22% – reduction in body weight (Table 5).

**Table 5.** Subjective assessment of students for their health and physical activity

<b>Question</b>	<b>%</b>
<b>1. How would you rate your health overall?</b>	
Excellent	0.00
Very good	26.6
Good	54.13
Satisfactory	15.14
Bad	4.13
Very bad	0.00
<b>2. How would you rate your functional state?</b>	
Very good	25.23
Satisfactory	68.81
Unsatisfactory	5.96
Grossly unsatisfactory	0.00
<b>3. What intensity of pain have you had in the last month?</b>	
No pain	26.61
Very mild	18.35
Mild	27.52
Moderate	22.94
Severe	2.29
Very severe	2.29
<b>4. In the last month, to what extent have you been bothered by emotional problems?</b>	
Not at all	6.88
Slightly	18.35
Moderately	43.58
Quite a bit	24.31
Extremely	6.88
<b>5. Do you follow good eating habits?</b>	
Yes	35.78
No	64.22
<b>6. How do you spend your spare time most often?</b>	
Internet	20.64
Watch TV	6.88
I play sports	13.76
Friends	43.58
Read books	11.47
Other	3.67
<b>7. Do you spend enough time on sports?</b>	
Yes	25.23
Not	67.89
I don't know	6.88
<b>8. How many times a week do you play sports?</b>	
Every day	3.67
3-5 times	6.88
1-2 times	61.93
I don't play sports	27.52
<b>9. Are there enough places to play sports?</b>	
There are enough places to play sports	57.34
There are, but they are far away	9.17
There are, but I have no money	8.72
There are, but I don't have time	22.02
There are no places to play sports	2.75
<b>10. Does your weight need to change?</b>	
Yes, I need to lose weight	23.44
No, it doesn't	68.3
Yes, I need to gain weight	8.26
<b>11. What effect do you expect from kinesitherapy activities?</b>	
Improving health	38.07
Weight loss	22.02
Reducing pain	10.09
Improving the body posture	27.98
I have no expectations	1.83

Increasing dependence on technology promotes a sedentary lifestyle and hypodynamia, which leads to the risk of disease. Physical activity is a path to good health, but motivation and discipline are needed to get involved in everyday life. This outlines the important role of the subject “Sport”, in particular kinesitherapy, in building and strengthening healthy lifestyle habits, preventing and treating obesity, and improving university student health.

## **2. Study and analysis of students’ awareness of physical activity and prevention of chronic diseases**

Our information survey and pedagogical observation showed that in recent years, a large percentage of students have reduced physical activity and low awareness of issues related to it and the prevention of chronic diseases.

In order to confirm or reject these allegations, we have set the task of examining the knowledge of students in this field. We have compiled a survey consisting of 9 questions (Application 2). The survey was conducted at the beginning of 2017 – 2018 and 2018 – 2019 academic years, among the same 218 students. An alternative analysis was used to process the data received.

The data from the survey confirmed our claims about students’ low awareness of physical activity, health and prevention of chronic diseases and the need for a lecture course to improve their health culture (Table 6).

**Table 6. Students' awareness**

<b>Question</b>	<b>%</b>
<b>1. What should be the frequency of weekly activities with moderate physical activity according to the World Health Organization (WHO)?</b>	
1 time per week	14.22
2-3 times a week	20.18
5 times a week	65.60
<b>2. How many minutes a week should moderate-intensity PA be, according to the WHO?</b>	
60 mins	10.09
120 mins	17.43
At least 150 minutes	72.48
<b>3. Can you give a definition of "health"?</b>	
Yes, I can	10.55
No, I can't	89.45
<b>4. Can you list 10 poses from regular physical activity?</b>	
Yes, I can	36.70
No, I can't	63.30
<b>5. What is the main risk factor threatening your health?</b>	
Alcohol	6.88
Smoking	32.57
Stress	9.63
Insufficient physical activity	18.81
Unhealthy diet	32.11
<b>6. Are you sufficiently informed about the prevention of obesity and other chronic diseases?</b>	
Yes, I am	25.23
No, I am not	66.51
I don't care about this problem.	8.26
<b>7. Which of these factors may be involved in the prevention of obesity and other chronic diseases? /more than one response can be indicated/</b>	
Physical activity	87.61
Maintaining normal body weight	33.94
Health awareness	47.25
Healthy diet	83.49
<b>8. In your opinion, can the disease process be avoided with timely preventive measures?</b>	
Yes, you can	88.53
No, you can't	11.47
<b>9. Is further training needed to improve the health culture?</b>	
Yes, it is necessary	62.84
No, it's not necessary	37.16

### **3. Research and analysis of students' opinion about the conducted kinesitherapy classes for overweight and obesity**

In order to establish the effect of the applied methodology of kinesitherapy in overweight and obese students, as well as their opinion on the problems of educational activities in the discipline "Sports", we compiled a survey of 5 closed questions with a choice of more than one answer (Application 3).

Frequency analysis is used to process the data.

The main motive for the regular attendance of kinesitherapy classes in both groups is the improvement of health, and secondly – the improvement of appearance as a result of weight reduction.

The low percentage of students attending the classes because their specialty requires a compulsory assessment in “Sports” may mean that students are aware of the important role of the regular PA in the prevention and treatment of obesity.

When asked “What discourages you from attending kinesitherapy classes regularly?” the largest percentage of students at EG 1 (70%) and EG 2 (90%) cited the busy curriculum and the lack of scheduled sports hours.

In the Higher Education Development Strategy 2021-2030 there is a measure affecting the inclusion of compulsory sports classes in all curricula of the Universities.

Despite this measure, classes in the discipline “Sport” are not enough for the prevention and treatment of chronic diseases such as obesity, type 2 diabetes, arterial hypertension, as well as for the prevention and treatment of incorrect posture.

All students find positive change after participating in the experiment. It is noticed that in EG 2 all 20 students indicated that their body weight had reduced, and in EG 1 – only 16 students, although in all there was a decrease in body weight and circumference. This may be due to dissatisfaction with insufficient weight loss, as they only had activities once a week.

Higher is the number of students in EG 2 (18 persons), compared to students at EG 1 (14 persons) who find a change in their motor and eating habits, which determines the important role of teachers and kinesitherapists in building and strengthening habits for a healthy lifestyle.

85.0% of the participants from EG 1 indicate that the mandatory “Sport” classes in the curriculum of the studied specialty are not enough, according to 45% of them they are not enough, but should also increase. In EG 2, 18 students (90%) noted that classes were not enough, according to 55.0% of them should be increased. The high percentage may be due to improving students’ awareness of issues related to the impact of exercise on the body and the consequences of hypodynamia. Recommendations from the participants in the experiment will help to improve the learning process and increase the effectiveness of kinesitherapy activities (Table 7).

**Table 7.** Student opinion on the activities carried out

Question	EG 1	EG 2
	n (%)	n (%)
<b>1. What motivates you to attend kinesitherapy classes regularly?</b>		
Improving health	20 (100.0)	20 (100.0)
Psycho-emotional toning	7 (35.0)	5 (25.0)
Improving the self-esteem	4 (20.0)	6 (30.0)
Gaining new knowledge and skills	11 (55.0)	13 (65.0)
Improving appearance	16 (80.0)	14 (70.0)
The sport discipline assessment	1 (5.0)	2 (10.0)
Other	0 (0.0)	0 (0.0)
<b>2. What discourages you from attending kinesitherapy classes regularly?</b>		
The busy curriculum and the lack of scheduled sports hours	14 (70.0)	18 (90.0)
The sport facilities	7 (35.0)	6 (30.0)
The lack of a good teacher - kinesitherapist	0 (0.0)	0 (0.0)
Other	2 (10.0)	3 (15.0)
<b>3. Do you find a positive change in yourself after participating in the experiment?</b>		
Yes, it reduces my weight and body circumferences	16 (80.0)	20 (100.0)
I’ve changed my motor and eating habits	14 (70.0)	18 (90.0)
Yes, pain symptomatology decreased/disappeared	10 (50.0)	11 (55.0)
Yes, I’ve improved my posture	4 (20.0)	8 (40.0)
I have acquired new knowledge and skills	9 (45.0)	12 (60.0)
I’ve had a rise in self-esteem.	2 (10.0)	6 (30.0)
No, I can’t find	0 (0.0)	0 (0.0)
<b>4. Do you think the mandatory sports classes in the curriculum of the specialty you are studying are sufficient?</b>		
Yes, it is sufficient to	3 (15.0)	2 (10.0)
No, they’re not enough.	8 (40.0)	7 (35.0)
No, they’re not enough and they need to increase	9 (45.0)	11 (55.0)
<b>5. What recommendations would you make to optimize the learning process and increase the effectiveness of kinesitherapy activities?</b>		
To increase the number of compulsory sports classes in the curriculum of all majors	17 (85.0)	18 (90.0)
Improving the sports facilities	16 (80.0)	14 (70.0)
Inclusion of a compulsory lecture course to improve health culture	13 (65.0)	16 (80.0)

The survey outlines the problems related to the discipline “Sport” in the University: insufficient mandatory physical activity and sports activities and the need for health education.

## **IV.2. ANALYSIS OF THE RESULTS OF THE PEDAGOGICAL EXPERIMENT**

In order to establish the baseline levels of the test indicators, measurement was carried out at the beginning of the experiment before the first procedure. To take into account the effect of our kinesitherapy methodology, a second measurement was made at the end of the experimental period. In three of the indicators, intermediate measurements were made – weight, BMI, and waist circumference.

The aim is, by determining and comparing any changes in the difference in results, to prove or reject our working hypothesis. We assume that the application of the methodology of kinesitherapy, combined with diet therapy and included lecture course once a week to Sofia University “St. Kliment Ohridski” students, who are overweight, obese, and with musculoskeletal dysfunctions, will lead to a decrease in body weight and improvement of their functional condition, but the methodology applied three times a week will have a more pronounced therapeutic effect.

### **1. Disclosure of the average level and variability of the test indicators**

With regard to the variation analysis made, it can be summarised that the two experimental groups by most indicators are homogeneous or satisfactorily homogeneous, with normal distribution. The exception is the indicators:

1. Static strength endurance of abdominal musculature – at the beginning of the experiment EG 1 and EG 2 are inhomogeneous, but at the end of the experiment they are satisfactorily homogeneous;



2. The quantitative assessment of pain – at the beginning and the end of the experiment EG 1 and EG 2 are inhomogeneous. At the end of the study, the values of As and Ex exceed the critical values;

3. Posture assessment – at the beginning of the experiment EG 1 and EG 2 are inhomogeneous, but at the end, they are satisfactorily homogeneous.

## **2. Comparative analysis of the arithmetic mean of the indicators and their growth between EG 1 and EG 2**

With a variation analysis, the average levels and variability of the test indicators in EG 1 and EG 2 were established, at the beginning and the end of the pedagogical experiment.

The significance in the difference of the test indicators in EG 1, where the kinesitherapy methodology is applied once a week should be established (Table 8), and then in EG 2, where the methodology is applied three times a week (Table 9).

The interpretation of the data will provide information to establish the effectiveness of the applied kinesitherapy methodology, with varying weekly frequency, as well as the extent to which the differences identified are significant. Student's t-test for dependent samples and variables with normal distribution is used.

For the abnormal distribution indicator (pain assessment), Wilcoxon's comparative test is used.

For indicators with intermediate measurement, a dispersion analysis (ANOVA) was made.

As shown in Table 8, for EG 1, almost all indicators observed a statistically significant difference between the initial and final measurements.

The only indicator by which there was no statistically significant difference between the initial and final measurements was the waist/hip ratio. This may be due to a parallel decrease in waist circumference and hip circumference, therefore no changes in waist/hip ratio occur.

**Table 8. Significance of the difference (d) of the test indicators in EG 1**

Indicators EG 1	I test		IV test		d	t	P(t)
	$\bar{X}_1$	$S_1$	$\bar{X}_4$	$S_4$			
1. Weight	78.6	8.08	72.25	7.84	-6.35	20.88	100.00
2. Hight	167.63	5.41	167.63	5.41	0.00	0.00	0.00
3. BMI	27.90	1.58	25.64	1.59	-2.26	19.89	100.00
4. Waist circumference	86.2	8.54	79.88	8.25	-6.33	19.84	100.00
5. Hip circumference	110	5.11	103.38	4.89	-6.63	7.21	100.00
6. Waist/hip ratio	0.79	0.08	0.77	0.07	<b>-0.02</b>	<b>1.68</b>	<b>89.02</b>
7. Abdominal skinfold	32.75	3.60	21.7	3.63	-10.05	26.43	100.00
8. Suprailiac skinfold	22.3	3.97	14.2	3.72	-8.10	37.43	100.00
9. Midaxillary skinfold	24.45	4.21	17.5	3.30	-6.95	18.98	100.00
10. Thigh skinfold	35.1	3.58	28.1	2.77	-7.00	18.57	100.00
11. Subscapular skinfold	28	5.84	22.2	4.67	-5.80	12.11	100.00
12. Skinfold over the patella	20.3	3.13	13.7	2.36	-6.60	18.42	100.00
13. % BF	32.59	2.65	25.45	2.59	-6.13	47.62	100.00
14. Ruffier test	11.11	2.15	9.44	2.04	-1.67	4.90	99.99
15. Static strength endurance of abdominal musculature	37.75	13.90	47.95	13.24	10.20	10.89	100.00
16. Static strength endurance of paravert. musculature	41.85	9.29	50.4	9.93	8.55	4.70	99.98
17. VAS pain	2.25	1.89	1.3	1.66	-0.95	3.87	99.90
18. Posture assessment	2.25	0.85	2.45	0.69	0.20	2.18	95.79

*K=19 and  $\alpha=0.05$ , critical value of  $t_\alpha=2.09$   
Ruffier test: K=17 and  $\alpha=0.05$ , critical value of  $t_\alpha=2.11$*

In EG 2, all indicators observed a statistically significant difference between the initial and final measurements (Table 9).

**Table 9. Significance of the difference (d) of the test indicators in EG 2**

Indicators EG 2	I test		IV test		d	t	P(t)
	$\bar{X}_1$	$S_1$	$\bar{X}_4$	$S_4$			
1. Weight	77.24	10.10	67.02	8.35	-10.23	11.36	100.00
2. Hight	166.40	6.76	166.40	6.76	0.00	0.00	0.00
3. BMI	27.75	1.92	24.14	1.75	-3.61	12.86	100.00
4. Waist circumference	85.65	8.08	75.00	6.79	-10.65	14.45	100.00
5. Hip circumference	109	5.85	99.93	5.66	-9.08	16.11	100.00
6. Waist/hip ratio	0.79	0.06	0.75	0.06	-0.04	5.89	100.00
7. Abdominal skinfold	31.35	5.77	19.04	3.44	-11.95	15.26	100.00
8. Suprailiac skinfold	21.2	2.86	12.1	2.65	-9.10	24.18	100.00
9. Midaxillary skinfold	23.9	3.63	15.4	3.20	-8.50	17.00	100.00
10. Thigh skinfold	34.2	4.63	24.65	4.13	-9.55	10.20	100.00
11. Subscapular skinfold	24.2	4.93	17.1	4.52	-7.10	18.20	100.00
12. Skinfold over the patella	18.6	2.35	10.7	1.63	-7.90	15.42	100.00
13. % BF	30.81	1.91	23.06	1.81	-7.74	39.61	100.00
14. Ruffier test	10.42	2.12	7.85	1.81	-2.56	10.25	100.00
15. Static strength endurance of abdominal musculature	35.95	12.78	57.5	14.77	21.55	13.93	100.00
16. Static strength endurance of paravert. musculature	37.65	10.85	58	13.43	20.35	7.52	100.00
17. VAS pain	2.05	1.64	0.3	0.66	-1.75	5.87	100.00
18. Posture assessment	2.15	0.93	2.7	0.47	0.55	4.07	99.93

*K=19 and  $\alpha=0.05$ , critical value of  $t_\alpha=2.09$   
Ruffier test:  $K=17$  and  $\alpha=0.05$ , critical value of  $t_\alpha=2.11$*

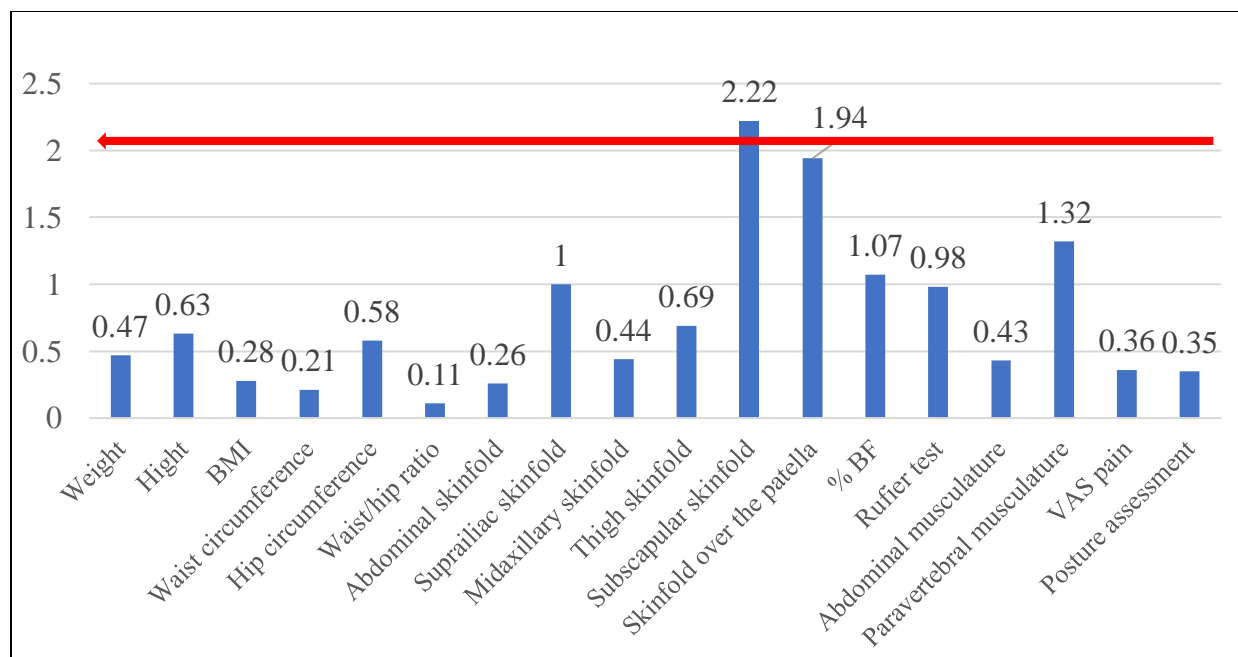
To verify the statistical significance of the differences between the results of the two groups studied **at the beginning of the experiment**, the mean levels of the indicators shall be compared using the Student T-test for independent samples and quantitative variables with a normal distribution at guarantee probability  $P(t) \geq 95\%$  ( $K=38$  and  $\alpha=0.05$ , critical value of  $t_\alpha=2.02$ ; for Ruffier test:  $K=34$  and  $\alpha=0.05$ , critical value of  $t_\alpha=2.03$ ). Mann-Whitney's U-criterion for an independent sample is used for the pain assessment indicator.

The variational analysis of the data from the beginning of the experiment shows a normal distribution of the test indicators. At the beginning of the experiment, a statistically significant difference was found between the mean values

of the two experimental groups by one indicator – subscapular skinfold ( $t_{emp}=2.22$ ,  $P(t)=96.78\%$ ) (Table 10 and Figure 3).

**Table 10.** Significance of differences in mean levels of test indicators of the two experimental groups at the beginning of the experiment

Indicators	$\bar{X}_{EG_1}$	SD <sub>EG 1</sub>	$\bar{X}_{EG_2}$	SD <sub>EG 2</sub>	d	t	P(t)
1. Weight	78.6	8.08	77.24	10.10	1.36	0.47	35.91
2. Hight	167.63	5.41	166.40	6.76	1.22	0.63	46.94
3. BMI	27.90	1.58	27.75	1.92	0.16	0.28	22.10
4. Waist circumference	86.2	8.54	85.65	8.08	0.55	0.21	16.46
5. Hip circumference	110	5.11	109	5.85	1.00	0.58	43.19
6. Waist/hip ratio	0.79	0.08	0.79	0.06	0.00	0.11	8.87
7. Abdominal skinfold	32.75	3.60	31.35	5.77	0.40	0.26	20.61
8. Suprailiac skinfold	22.3	3.97	21.2	2.86	1.10	1.00	67.87
9. Midaxillary skinfold	24.45	4.21	23.9	3.63	0.55	0.44	33.94
10. Thigh skinfold	35.1	3.58	34.2	4.63	0.90	0.69	50.41
11. Subscapular skinfold	28	5.84	24.2	4.93	3.80	2.22	<b>96.78</b>
12. Skinfold over the patella	20.3	3.13	18.6	2.35	1.70	1.94	94.05
13. % BF	32.59	2.65	30.81	1.91	0.78	1.07	70.86
14. Ruffier test	11.11	2.15	10.42	2.12	0.69	0.98	66.44
15. Static strength endurance of abdominal musculature	37.75	13.90	35.95	12.78	1.80	0.43	32.77
16. Static strength endurance of paravert. musculature	41.85	9.29	37.65	10.85	4.20	1.32	80.37
18. Posture assessment	2.25	0.85	2.15	0.93	0.10	0.35	27.48



**Fig. 3.** Significance of differences between the two experimental groups (beginning)

$K=38$  and  $\alpha=0.05$ , critical value of  $t_{\alpha}=2.02$

Ruffier test:  $K=34$  and  $\alpha=0.05$ , critical value of  $t_{\alpha}=2.03$

The average levels of the test indicators achieved **at the end** of the experiment were compared after the kinesitherapy methodology was applied by the students in the two experimental groups. The statistical significance of the differences obtained with the Student's t-test independent samples and indicators having a normal distribution with a high guarantee probability  $P(t) \geq 95\%$  shall be verified. For the pain assessment indicator, in which an abnormally distributed variation analysis is established, the Mann-Whitney comparative U-criterion for independent samples was used. The effectiveness of the developed and applied experimental methodology of kinesitherapy was established.

The variational analysis of the data from the end of the experiment shows a normal distribution of the test indicators, with the exception being the indicator pain assessment. This indicator checked with Mann-Whitney's comparative U-criterion, which found that pain decreased in both groups, but is statistically significantly

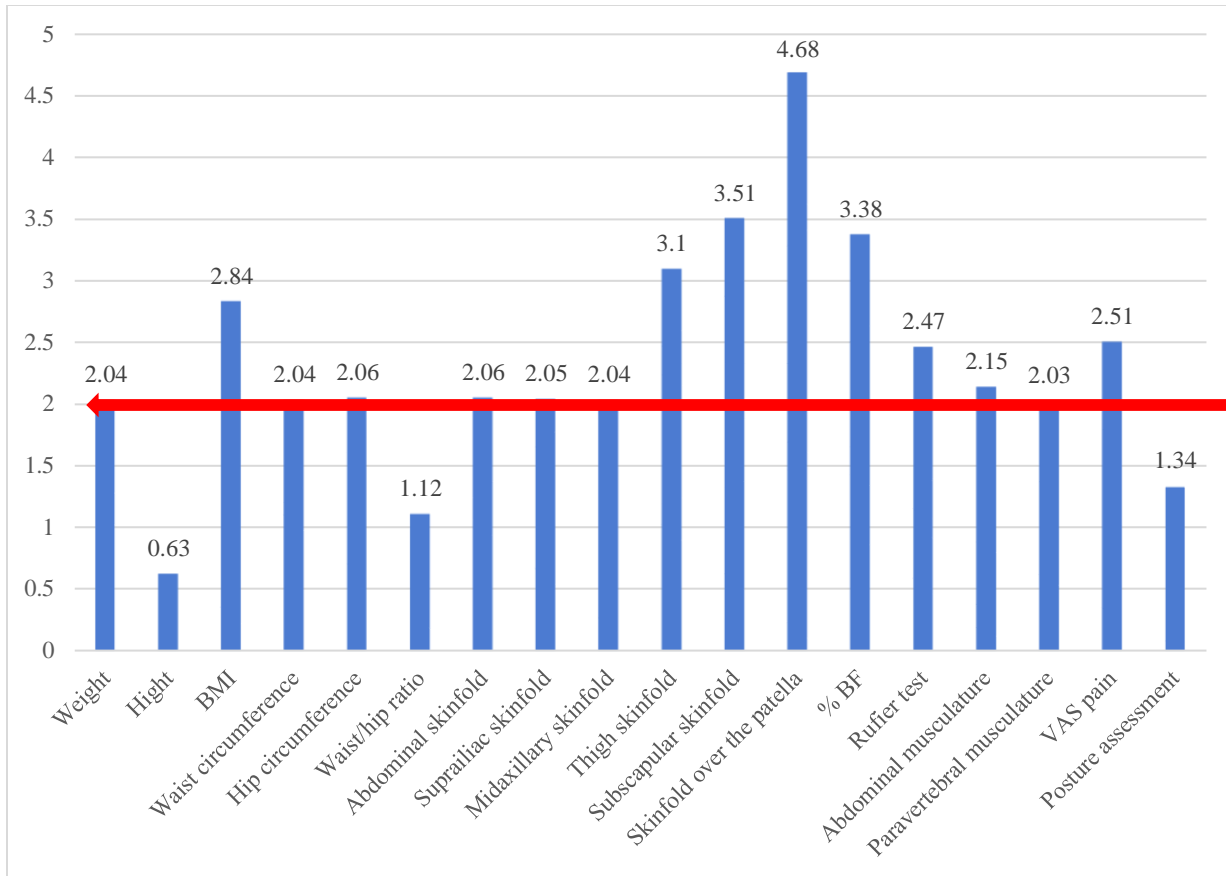
higher in the second measurement in EG 1(Mdn=23.6) compared to EG 2 (Mdn=17.4),  $U=138,0$ ,  $z=-2.02$ ,  $p=0.043$ .

As shown in Table 11 and Figure 4, a statistically significant difference was found between the mean values, in both experimental groups, of almost all the indicators studied. The exception is the indicators height, waist/hip ratio, and posture assessment.

**Table 11.** Significance of differences in mean levels of test indicators of the two experimental groups at the end of the experiment

Indicators	$\bar{X}_{EG_1}$	$S_{EG_1}$	$\bar{X}_{EG_2}$	$S_{EG_2}$	d	t	P(t)
1. Weight	72.25	7.84	67.02	8.35	5.23	2.04	95.19
2. Hight	167.63	5.41	166.40	6.76	1.22	0.63	<b>46.94</b>
3. BMI	25.64	1.59	24.14	1.75	1.50	2.84	99.28
4. Waist circumference	79.88	8.25	75.00	6.79	4.88	2.04	95.17
5. Hip circumference	103.38	4.89	99.93	5.66	3.45	2.06	95.40
6. Waist/hip ratio	0.77	0.07	0.75	0.06	0.02	1.12	<b>73.08</b>
7. Abdominal skinfold	21.7	3.63	19.04	3.44	2.30	2.06	95.34
8. Suprailiac skinfold	14.2	3.72	12.1	2.65	2.10	2.05	95.32
9. Midaxillary skinfold	17.5	3.30	15.4	3.20	2.10	2.04	95.19
10. Thigh skinfold	28.1	2.77	24.65	4.13	3.45	3.10	99.64
11. Subscapular skinfold	22.2	4.67	17.1	4.52	5.10	3.51	99.88
12. Skinfold over the patella	13.7	2.36	10.7	1.63	3.00	4.68	100.00
13. % BF	25.45	2.59	23.06	1.81	2.39	3.38	99.83
14. Ruffier test	9.44	2.04	7.85	1.81	1.59	2.47	98.13
15. Static strength endurance of abdominal musculature	47.95	13.24	57.5	14.77	-9.55	2.15	96.23
16. Static strength endurance of paravert. musculature	50.4	9.93	58	13.43	-7.60	2.03	95.11
18. Posture assessment	2.45	0.69	2.7	0.47	-0.25	1.34	<b>81.31</b>

$K=38$  and  $\alpha=0.05$ , critical value of  $t_\alpha=2.02$   
*Ruffier test:*  $K=34$  and  $\alpha=0.05$ , critical value of  $t_\alpha=2.03$



**Fig. 4.** Significance of differences between the two experimental groups (end)  
 $K=38$  and  $\alpha=0.05$ , critical value of  $t_{\alpha}=2.02$   
*Ruffier test:*  $K=34$  and  $\alpha=0.05$ , critical value of  $t_{\alpha}=2.03$

In order to monitor the effect of the methodology applied at different weekly frequencies, a comparative analysis of the growth of the results by the relevant indicators of the two groups was carried out and the statistical significance of the differences in growth between them was established using the Student comparative T-criterion for independent samples, with a high guarantee probability  $P(t) \geq 95\%$  (Table 12).

As shown in Table 12, the applied experimental methodology of kinesitherapy in university students from Sofia University “St. Kliment Ohridski” with overweight, obesity and musculoskeletal dysfunctions once a week (EG 1) leads to

a decrease in the values of the studied anthropometric indicators and an improvement in their functional state, but the methodology applied three times a week has a more pronounced therapeutic effect (EG 2).

**Table 12.** Reliability of differences in growth of results in EG 1 and EG 2

Indicator	d EG 1	d EG 2	d	t	P(t)
1. Weight	-6.35	-10.23	3.87	4.07	99.98%
2. BMI	-2.26	-3.61	1.34	4.44	99.99%
3. Waist circumference	-6.33	-10.65	4.33	5.38	100.00%
4. Hip circumference	-6.63	-9.08	2.45	2.27	97.12%
5. Waist/hip ratio	-0.02	-0.04	0.02	2.51	98.37%
6. Abdominal skinfold	-10.05	-11.95	1.90	2.18	96.47%
7. Suprailiac skinfold	-8.10	-9.10	1.00	2.30	97.32%
8. Midaxillary skinfold	-6.95	-8.50	1.55	2.50	98.32%
9. Thigh skinfold	-7.00	-9.55	2.55	2.53	98.42%
10. Subscapular skinfold	-5.80	-7.10	1.30	2.10	95.80%
11. Skinfold over the patella	-6.60	-7.90	1.30	2.08	95.56%
12. % BF	-6.13	-7.74	1.61	6.87	100.00%
13. Ruffier test	-1.67	-2.56	0.89	2.12	95.84%
14. Static strength endurance of abdominal musculature	10.20	21.55	-11.35	6.28	100.00%
15. Static strength endurance of paravert. musculature	8.55	20.35	-11.80	3.62	99.01%
16. VAS pain	-0.95	-1.75	0.80	2.07	95.48%
17. Posture assessment	0.20	0.55	-0.35	2.14	96.13%

*K=38 and  $\alpha=0,05$ , critical value of  $t_{\alpha}=2,02$*

*Ruffier test: K=34 and  $\alpha=0.05$ , critical value of  $t_{\alpha}=2.03$*

It is clear from the comparative analyses made that the applied methodology of kinesitherapy once a week (EG 1) to Sofia University “St. Kliment Ohridski” students, who are overweight, obese and with musculoskeletal dysfunctions lead to a decrease in body weight, body circumference, skin folds, and also to an improvement in the functional state, but the methodology applied three times a week has a more pronounced therapeutic effect (EG 2).



## **CHAPTER FIVE. CONCLUSIONS, RECOMMENDATIONS AND SCIENTIFIC CONTRIBUTIONS**

### **1. CONCLUSIONS**

The analysis of the results of the scientific experiment gives rise to the following more important conclusions:

1. The theoretical analysis of specialized information sources on the issues of thesis reveals that overweight and obesity have been studied, but still an unresolved socially significant problem. In the available literature, we do not find data for reporting the effect of kinesitherapy, at varying weekly frequency, on the influence of overweight and obesity in students with musculoskeletal dysfunctions.

2. The survey confirmed low levels of physical activity, bad eating habits and low student awareness.

3. The developed and applied kinesitherapeutic methodology in students with musculoskeletal dysfunctions, overweight and obesity has a positive therapeutic effect on:

- body weight, body circumference and in terms of the reduction of the studied skin folds;
- the adaptation of the cardiovascular system to physical activity and functional status;
- static strength endurance of the abdominal and paravertebral musculature;
- subjective pain indicator;
- the body posture of the university student.

4. More pronounced, statistically significant improvements were found in EG 2, where the kinesitherapy methodology is applied three times a week, and smaller ones in EG 1, where the experimental methodology is applied once a week.

5. Combining regular physical activity with diet therapy leads to a greater reduction in body weight than treatment with exercise alone.

6. It has been proven that applying a methodology of kinesitherapy in students with overweight, obesity and musculoskeletal dysfunctions once a week leads to a reduction in body weight, body circumference, skin folds, as well as to the improvement of the functional status of students, but the methodology applied three times a week has a more pronounced therapeutic effect.

7. The approbated methodology of kinesitherapy proves the need for:

- regular physical activity, by increasing the compulsory classes in the discipline “Sports” in students’ curricula for both prevention and treatment of obesity, incorrect posture and spinal deformities in students with overweight, obesity and musculoskeletal dysfunction.

- inclusion of thematic lectures in the students’ curricula in the discipline “Sport”.

## **2. RECOMMENDATIONS FOR PRACTICE**

The positive results of the applied methodology of kinesitherapy in students with musculoskeletal dysfunctions, overweight and obesity allow us to make the following recommendations:

1. Due to the seriousness and topicality of the problem, it is necessary to improve the methods and means of kinesitherapy in the curriculum of the discipline “Sport” at university in order to have a complex impact on overweight and obese students.

2. The obtained results give reason to recommend the inclusion and/or increase of the mandatory classes in the discipline “Sports” in the students’ curricula for prevention and treatment of obesity, bad posture, spinal deformities.

3. For greater effectiveness, we recommend the physical exercises be combined with diet therapy.

4. Inclusion of a lecture course in the curricula of students in the discipline “Sport”, courses and seminars in socio-significant diseases, as well as the creation of a health bulletin to increase the health culture of the university students.

5. Based on the established positive therapeutic effect of the experimental methodology of kinesitherapy, we recommend its application as a means of prevention and treatment of overweight and obesity.

### **3. SCIENTIFIC CONTRIBUTIONS**

#### **Contributions of scientific and theoretical nature:**

1. A lecture course has been prepared, contributing to the improvement and enrichment of students' knowledge and health culture, which lays the groundwork for changing their motor and eating habits

2. A kinesitherapys' curriculum has been prepared for students with overweight, obesity and musculoskeletal dysfunctions.

#### **Contributions of scientific and applied nature:**

3. Original data are presented showing the important role of regular physical activity in the prevention and treatment of overweight and obesity and in strengthening the health of the younger generation, which confirms the need to increase the compulsory classes in the discipline "Sports".

4. A methodology of kinesitherapy applied with different weekly frequency has been developed, for overweight and obese students, which can be included among other forms of physical activity in the education of the university students.

5. The achieved results and the conclusions made by them are a supplement to the theory and methodology of kinesitherapy in overweight and obesity, a studied but still unsolved problem, as well as insufficiently developed from the point of view of kinesitherapy in students with musculoskeletal dysfunction and obesity.

## **PUBLICATIONS RELATED TO DISSERTATION**

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3. Despotova G. Study of students’ subjective assessment of their physical activity – a method for prevention of obesity. “Modern trends of physical education and sports”. ISSN 1314-2275, Sofia University “St. Kliment Ohridski”, 2020, Sofia; 180-187.

4. Despotova G. Reporting the effect of applied kinesitherapy with various frequency in people with overweight and obesity. “Modern trends of physical education and sports”. ISSN 1314-2275, Sofia University “St. Kliment Ohridski”, 2020, Sofia; 188-195.