



MONITORING THE EFFECT OF AN APPLIED KINESITHERAPY METHODOLOGY IN OVERWEIGHT AND OBESE UNIVERSITY STUDENTS

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ABSTRACT

Kinesitherapy has a wide application in both the prevention and treatment of overweight and obesity as well as in the prevention of the complications associated with them. The PURPOSE of this study was to determine the effect of an applied kinesitherapy methodology with varying weekly frequency in overweight and obese young people. METHODS: Students, aged 18 to 25, in their 1st to 4th year of studies at University "St. Kliment Ohridski" were examined. For monitoring the effect of the methodology applied, we calculated the percentage of body fat using calipermetry. The amount of subcutaneous fat, as a percentage of body mass, was calculated by regression equations based on a different number of skin folds. RESULTS: The analysis of the study's results shows that depending on the weekly frequency, the applied methodology causes small to large changes in the indicators – "Skin folds" and "Amount of body fat". CONCLUSIONS: The applied methodology of kinesitherapy has a positive effect in reducing the thickness of skin folds and in decreasing the percentage of body fat. For the prevention and treatment of obesity and other chronic diseases, the author recommends introducing mandatory Physical Education and sports classes in all Bachelor and Master's programmes' curricula.

Key words: skinfold, body fat, obesity, university students, physical activity

INTRODUCTION

During the different eras, the idea of overweight and obesity went through the formation of different concepts: from the perception of a protective mechanism, through the symbolism of fertility and well-being, the ironization and stigmatization, to the concept of "a state of disease" and its negative effects on human health (1).

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 (2).

In 2008 and 2014 The National Statistical Institute conducted a survey and compared the

data from the two waves of the study. The results show an increase in the percentage of obese people from 11.5% (2008) to 14.8% (2014), with a greater increase in men (from 11.6 to 15.5%) than in women (from 11.3 to 14.2%). In 2014, overweight or obese, were 62.2% of men and 46.8% of women, aged 18 and over. Among the men in the 18 to 24 age group – 24.1% were overweight and 5.5% - obese, and in women of the same age group, 7.4% were overweight and obese - 3.5% (3).

I. Peltekova (2019), studied 77 Sofia University's students in a regular form of education from different faculties and majors. All students had "Sport" as a compulsory subject in their curriculum and they have chosen to practice basketball. The researched students aged 18–26 years. The author found that with "overweight" were 10.6% of women and 18.2% of men. In the group "obesity", there were 4.55% of men and no women registered (4).

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In recent years, a number of studies have linked the obesity epidemic to factors of the modern living environment, most importantly the unhealthy eating pattern and reduced physical activity (5).

Overweight and obesity are major risk factors for multiple diseases and may lead to serious disabilities: arterial hypertension, stroke, ischemic heart disease, type 2 diabetes, hormonal disorders, joint diseases, some types of cancer, sleep apnea, psychological disorders and others (6).

A number of studies have shown that the most effective treatment of overweight and obesity are programs including diet therapy, increased physical activity, behavioral therapy, medication treatment, surgical methods, all conducted by multidisciplinary team (7).

The WHO recommends for persons aged 18 to 64 years a minimum of 30 minutes physical activity of moderate-intensity 5 times a week or at least 25 minutes of high intensity 3 times a week, which totals in minimum 150 minutes of moderate-intensity aerobic activity, or 75 minutes of high-intensity aerobic activity per week (8).

Due to a number of well-known problems in the system of Physical Education in Bulgaria, in recent years there has been a tendency ever-increasing percentage of the newly admitted university students to have an ever-lower physical activity and low motivation for active exercise and sport activities. According to the Bulgarian Ministry of Youth and Sport, the tendency for the ever-growing immobilization of the rising generation is unfavorable – 51.0% of the total adolescents are highly immobilized. The level of their physical development and fitness, compared to previous generations of their peers, is significantly reduced (9).

Therefore, the purpose of the subject Physical Education and Sport in the system for higher education is to accustom as many young people as possible, to a regular exercise, thus preserving and/or improving their health and create knowledge, skills and habits for future healthy lifestyle. Higher education is the final stage of the educational system and accordingly, the last chance to perform this important task (10).

As an expression of the Bulgarian State policy, and in accordance with EU recommendations, the Bulgarian Physical Education and Sport Act (into force since 18.01.2019), defines: Art. 57:

(1) Physical activity, physical education and sport in universities shall be part of students' education in the form of compulsory and optional classes with a minimum horarium of 60 compulsory classes per academic year for all students acquiring Bachelor or Master degree (11).

Despite all the changes that have been made for improving the curriculum of the subject "Sport", due to economic interests, sports classes constantly are being reduced and instead of 60 classes for each academic year, the total horarium now is 60 or 120 for the entire period of study in almost all universities in Bulgaria. These classes are absolutely insufficient for the prevention and treatment of chronic diseases, and in particular obesity.

The above mentioned facts and the topicality of the problem provoked us to develop and study the effect of an applied methodology of kinesitherapy, with varying weekly frequency, on overweight or obese students of Sofia University „St. Kliment Ohridski“.

The aim of the presented study was to track and account the effect of a kinesitherapy methodology with different weekly frequency on the indicator percentage of body fat in overweight and obese students.

METHODS

The subject of the study was the state and the dynamics of the indicator "Percentage of body fat" (% BF).

40 students, aged 19 to 25 years in their 1st to 4th year of Bachelor studies at university "St. Kliment Ohridski", took part in the study. They were all enlisted sport classes – kinesitherapy, designed for students with health problems. The study was conducted during 2017/2018 and 2018/2019 academic years.

Two experimental groups were formed:

➤ **Experimental group 1 (EG1)** – of 20 students enlisted for kinesitherapy classes, who underwent 60 minutes of moderate-intensity physical exercise once a week and a were on recommended hypocaloric balanced diet (1200-1400 kcal/day). This group had 30 classes over a period of one academic year.

➤ **Experimental group 2 (EG2)** – also of 20 students, enlisted for kinesitherapy classes, who underwent 60 minutes of moderate-intensity physical exercise three times a week and were on a recommended hypocaloric balanced diet (1200-1400 kcal/day). 90 activities were conducted over a period of one academic year.

During the winter exam session, a hypocaloric balanced diet was not observed, but for maintaining weight, recommendation for energy-based food to match (zero energy balance) or to be 100-200 kcal lower than energy consumption, were given

For achieving the study's objectives, we used the following research and mathematical-statistical methods:

- Anthropometry – a method of examining physical development, by measuring the human body. In this study, before the first and after the last class, 7 skin folds were measured, through which we determined the percentage of body fat;
- Variance analysis;
- Comparative analysis with The Student's t-test for dependent and independent samples

In this experiment, the Jackson/Pollock equation with 7 skin folds was used to calculate body fat percentage (%BF):

- Triceps (on m. triceps brahii)
- Chest (on m. pectoralis major)
- Midaxillary (on the front armpit, at level X intercoastal)
- Subscapular (under angulus inferior scapulae)
- Suprailiac (on spina iliaca anterior superior)
- Abdominal (on first 1/4 of the line connecting the navel and spina iliaca anterior superior)
- Thigh (on front thigh at seat fold level)

According to S. Petkov et. al. (2003), normal values of the percentage of body fat for ages 18-25 years are averaged 15% for men and 25% for women. At values, 5% higher than the indicated above, obesity is assumed (12).

Methodology of the kinesitherapy applied.

The aim is to reduce the percentage of body fat and reach optimal and healthy values for the individual.

Tasks of kinesitherapy:

1. To reduce energy intake to 1200-1400 kcal/day, increase energy consumption and create a negative energy balance.
2. General strengthening of the body.
3. Normalization and improvement of metabolism.
4. Improving the function of the gastrointestinal tract. Improving intestinal peristalsis.
5. Improving blood circulation in the abdominal area.
6. Improving general blood circulation and lymph circulation.
7. Improving blood circulation and trophicity of musculature.
8. Improving the function of the cardiovascular and respiratory system.
9. Strengthening the musculoskeletal system and creating systemic motor habits.
10. Improving the muscle strength of the paravertebral, abdominal and gluteal muscles, as well as the muscles involved in the movements in the hip joints.
11. Improving the body posture.
12. Improving balance and coordination.
13. Improving physical capacity and working capacity.
14. Overall psycho-emotional improvement. Improving self-esteem and self-confidence.
15. Prevention from complications.

Means of kinesitherapy

- Generally developing exercises;
- Active exercises;
- Exercises with and on equipment.
- Resistance exercises;
- Isometric and isotonic exercises;
- Exercises for balance and coordination;
- Stretching and relaxing exercises;
- Breathing exercises.

RESULTS

In terms of the indicator "Percentage of body fat" in EG1, the average was 32.59% at the beginning and decreased to 25.45%, at the end of the experiment. The values of asymmetry and excess are lower than the theoretical critical (at $N = 20$ and $\alpha = 0.05$, critical values of $As_{0,05} = 1,024$ and $Ex_{0.05} = 1.985$). As shown in **Table 1**, the parameters characterizing the dissipation around the mean values of the indicator "Percentage of body fat" define EG1 as homogeneous ($V \leq 10\%$) at the beginning, but only satisfactorily homogeneous at the end of the experiment ($10 \leq V \leq 30$).

The variance analysis of the results in EG2 showed that the average value of the indicator “Percentage of body fat” was 30.81% at the beginning and decreased to 23.06%, at the end of the experiment. The values of asymmetry and excess are lower than the theoretical critical (at N = 20 and $\alpha = 0.05$, critical values

of $As_{0.05} = 1,024$ and $Ex_{0.05} = 1.985$). The parameters characterizing the dissipation around the mean values of the indicator determine EG2 as homogeneous ($V \leq 10\%$) both at the beginning and at the end of the experiment (**Table 1**).

Table 1. Variance analysis of the results of the indicator percentage of body fat in EG 1 and EG 2

group		n	X_{min}	X_{max}	R	\bar{X}	S	V	As	Ex
EG1	I test	20	28.2	36.27	8.07	32.59	2.65	8.39	0.44	-1.104
	II test	20	21.91	30.34	8.43	25.45	2.59	10.19	0.464	-0.959
EG2	I test	20	26.81	34.16	7.35	30.81	1.91	6.21	-0.395	-0.554
	II test	20	19.85	26.24	6.39	23.06	1.81	7.86	-0.15	-0.915

At N=20 and $\alpha = 0.05$, critical values of $As_{0.05} = 1.024$ and $Ex_{0.05} = 1.985$

In EG1, at the first test, the average body fat percentage was 32.59%, and at second test decreased to 25.45%. The growth of this indicator was large – $d = -6.13$ (19.42%) with Cohen's $d = 10.65$. The estimated value of growth (-6.13 %) is statistically significant, supported by a high guarantee probability ($t_{emp} = 47.62$, $P(t) \geq 95\%$).

In EG2, at the first test, the average body fat percentage was 30.81%, and at second test decreased to 23.06%. The growth of this indicator was large – $d = -7.74$ (-25.14%) with Cohen's $d = 8.86$. Student's t-test for dependent samples showed that the growth is statistically significant ($t_{emp} = 39.61$, $P(t) = 100\%$).

This means that in the study period the percentage of body fat was reduced in both groups, where as in EG2, where the kinesitherapy methodology was applied 3 times a week the reduction is greater. The comparison of the mean values of both groups at the start of the experiment showed that the difference between them was 0.78 % with Cohen's $d = 0.34$ and not statistically reliable ($t_{emp} = 1.07$, $P(t) = 70.86\%$). Therefore, the two groups were relatively homogeneous and comparable to this indicator. At the end of the

experiment, EG2 had a credible ($t_{emp} = 3.38$, $P(t) = 99.83\%$) greater reduction in body weight, with a difference $d = 2.39$, with Cohen's $d = 0.95$ being significant. Over the course of the experiment, EG2 achieved significantly higher growth ($d = -7.74\%$) than EG1 ($d = -6.13\%$). The difference between their growths of 1.61% with Cohen's $d = 1.47$ was big and statistically significant ($t_{emp} = 6.87$, $P(t) \geq 95\%$) (**Table 2**). Therefore, the methodology of kinesitherapy administered three times a week leads to greater statistically significant changes in the percentage of body fat than the methodology applied once a week. According to S. Petkov et. al. (2003), normal values of the percentage of body fat for ages 18-25 years are averaged 15% for men and 25% for women. At values, 5% higher than the indicated above, obesity is assumed (12). At the first test, both experimental groups had average body fat rates above 30% and obese is considered. At the second test, in both groups, the mean values of the indicator were within the normal values for women aged 18-25 years, but in EG1 the mean was 25.45%, which is slightly above the average for women of this age (25%) and is indicating the need of increasing the physical activities.

Table 2. Comparative analysis of the results of the body fat indicator in EG1 and EG2

Indicator % of Body Fat	n	I test		II test		Growth			Statistical significance	
		\bar{X}_1	S_1	\bar{X}_2	S_2	d	d%	Cohen's d	t_{emp}	P (t)
EG1	20	32.59	2.65	25.45	2.59	-6.13	-19.42	10.65	47.62	100.00
EG2	20	30.81	1.91	23.06	1.81	-7.74	-25.14	8.86	39.61	100.00
difference	d	0.782		2.39		1.61				
	Cohen's d	0.338		0.950		1.470				
Statistical significance	t	1.07		3.38		6.87				
	P(t)	70.86		99.83		100.00				

CONCLUSION

The complex methodology for treating obesity, including diet therapy and kinesitherapy administered three times a week, results in greater statistically significant changes in the values of the body fat indicator than the methodology applied once a week.

Reduced physical activity is one of the main factors for overweight and obesity. Unfortunately, the increasing dependence on smart technologies promotes sedentary lifestyle and hypodynamia, and physical activity is the only path to good health, but motivation and discipline are needed to include it in our daily lives.

RECOMMENDATIONS

The analysis of the study's results allows the following recommendations for the practice to be made:

- For the prevention and treatment of obesity and other chronic diseases, should be increased the number of the subject "Physical Education and Sport" classes per week in the programs' curricula for students acquiring "Bachelor" and "Master" degree at Sofia University "St. Kliment Ohridski".
- Conducting lectures with health-educational information on the role of physical activity for the physical and mental health.
- Raising students' awareness of the consequences of hypodynamia and the risks associated with obesity.

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