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ORIGINAL ARTICLE

The Influence of Various Fitness Forms on the Reduction of the Adipose Tissue

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A – Study Design
B – Data Collection
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E – Manuscript Preparation
F – Literature Search
G – Funds Collection

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Abstract

Background: *An assessment of the influence of a six-week cycle of fitness activities on the state of the adipose tissue in students and an assessment of the efficiency of chosen fitness exercises (STEP, LOW and TBC) in the reduction of the adipose tissue.*

Material/Methods: *Subjects performed physical exercises of the fitness character within a period of 6 weeks. Exercises took place three times a week. Three types of fitness forms of the same intensity were chosen for the research: STEP, LOW and TBC. The subjects were recommended a change in the hitherto existing way of nutrition. The parameters measured were: the height and the mass of the body and the thickness of chosen skin folds (on a shoulder, under a scapula, on the abdomen, on a shin).*

Results: *Systematic participation in fitness exercises as aerobic forms is an efficient and a safe form of the reduction of the adipose tissue; however, six weeks' long STEP, LOW and TBC fitness forms with a frequency of 3 times per week, in the class of 75 examined students, did not bring statistically essential changes of these parameters in those examined. Without a change of the already existing diet, a decrease in the body mass was noted in 54.7% of them; however, a reduction of the adipose tissue followed in 58.7%. For the lack of the possibility of the inspection of the diet of the examined participants, this result can be considered as satisfying. LOW proved to be the activity most efficiently affecting the decrease in the body mass, where the reduction occurred in 61.5% of those exercising. TBC is the most efficient form in the reduction of the adipose tissue. The effect was obtained by 66.7% of those exercising in this class.*

Conclusions: *The applied program of exercises did not have an essential influence on the reduction of both the body mass and the level of the adipose tissue. To prevent the occurrence of overweight and obesity, the applied program of exercises can be used as a form of everyday activity.*

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Introduction

Obesity is considered to be a compound metabolic illness, characterized by a considerable enlargement of the level of the adipose tissue in the organism. For over 20 years in the majority of fully developed countries of the world, a constant and noticeable increase in the frequency of the occurrence of overweight and obesity has been observed [1].

According to the American Heart Association, obesity is at the bottom of many unfavourable changes in the organism which are directly proportional to developing of the illness. This is not only a matter of the aesthetics of the body, but first of all it is a health problem. Excessive body mass leads to straining the osteoarticular system, then overburdening, mostly in the lumbar area of the spine, hip joints, knees and feet [2, 3].

Intensive adiposity discriminates respiratory movements of the chest, diminishing the respiratory amplitude. Additionally, a diminished quantity of oxygen in blood unfavourably bears on the whole circulatory system, especially on the heart, contributing to circulatory insufficiency. Moreover, obesity is believed to be one of the main factors of atherosclerosis. One cannot also omit metabolic results of obesity. Almost 70% people with diabetes are characterised with overweight, which proves a considerable connection to these illnesses [4, 5, 6, 7].

Physical effort significantly increases the use of calories, improves metabolism and the cycle of metabolism, favouring the physiological reduction of the body weight [8, 9, 10, 11]. Every form of movement causes enlarging of the energy-expense; however, not every effort warrants the reduction of energy accumulated in form of the adipose tissue. Properly chosen aerobic exercises, such as running, quick march, swimming or cycling are the most effective forms of movement, helping the process of burning the adipose tissue. If the intensity and the duration of exercises are properly chosen, then fatty acids determine most of the substrates in energy alterations. Physical effort should be prolonged, of moderate, constant intensity; then suitable supply of oxygen to all cells is warranted and this assures the proper utilization of the fat as an energy substrate [12, 13, 14, 15].

According to widely acknowledged opinions, fitness is defined as a dynamic state (a system) of research of the comfort from the psychological and sociological point of view, in conjunction with the pursuit of the maximum (for an individual) physical fitness – with various motoric forms adapted to the ability, taste, expectations of the individual, who consistently takes on considerable responsibility for the functional improvement of his/her own organism. In the face of plurality of existing fitness forms, the research on the most efficient ones in obtaining the desired health effects becomes legitimate.

As research proves, energy input in each type of training shows the variability dependent on the subjects' sex. Morgan et al. prove that women in progress of training of the strength character spend greater energy than men, to a greater degree also basing themselves on aerobic mechanisms [16]. Therefore, there is a question if the aerobic training, even of the same intensity, brings different effects (in the reduction of the adipose tissue) depending on its type.

The aim of the present research was the qualification of the influence of a six-week cycle of fitness exercises on the state of the adipose tissue in students of Warsaw Medical University. Furthermore, an attempt has been made at the qualification of the efficiency of the fitness form in the reduction of the adipose tissue.

Material and Methods

The study involved a group of 75 women, students of Warsaw Medical University, aged from 20 to 24 years. The participants declared not being on a reductive diet or participating in disposed exercises on the body mass reduction within a period of the year prior to the research; however, the participation of persons undertaking such activities earlier was not excluded.

The participants performed physical exercises of the fitness character for a period of 6 weeks. The classes took place three times a week. Three types of fitness forms of the same intensity were selected for the research: STEP, LOW and TBC. The subjects were recommended not to change the hitherto existing manner of nutrition both in respect of the quantity and the proportion of eaten meals. From among 75 people classified to the study, participants were assigned to each class

randomly. For organizational reasons the number of classes was not similar and it was accordingly: STEP – 31, LOW – 26, TBC – 18.

Measurements of the body mass and the thickness of fatty folds were made twice – on the first and on the last day of the study. The participants took part in fitness classes in compliance with the allowance to the class: STEP, LOW or TBC (Total Body Condition). All the groups had choreographic classes, where the arrangement of movements and exercises determine the logical whole, have the specific beginning, ending, directions and movement plains and settlement, inseparably joint with the music. However, the time (60 minutes) and the intensity of the classes (controlled with the frequency of heart beats per minute by means of Polar RX 400 monitors) was similar (within 70-75% HR_{max}). Each form favoured a characteristic element:

- LOW – exercises typically of the efficiency character, where one leg always has contact with the basis.
- STEP – exercises of the endurance character with the utilization of a 15-centimeter-high platform onto which the participant climbed and went down in a cycle of steps forming choreography.
- TBC – training of the strength character, involving strengthening exercises in standing positions with the use of accessories (weights, steppers, balls).

The height and the body mass were measured at the beginning of the study. Also the BMI was calculated before and after the experiment. In compliance with the obligatory methodology, thickness of fatty skin folds was measured in four places: on a shoulder, under a scapula, on the abdomen, on a shin.

The measurement was made with the use of a caliper with the exactitude of 1 mm. The content of the adipose tissue was presented by means of percentage values (% FAT), counting it on the ground of markings of the body thickness [17].

The significance of differences within the range of body mass, the proportional content of the adipose tissue during the first and second measurement in each class, was qualified by means of the t-Student test. Dependences at the level of up to the mark of 0.05 were accepted as significant.

Results

The subjects' body mass was within norm (Fig. 1) and participation in the classes did not have an influence on essential changes within the BMI.The conducted cycle of exercises brought diverse effects in all groups. Two of them (STEP and LOW) contributed to a decrease in the average of body mass; however, the LOW class did not note the diminution of the level of the adipose tissue (Tab. 1). No significant changes were observed within the range of the analysed parameters among those exercising TBC.

Tab. 1. The average body mass and the percentage of the adipose tissue (1st and 2nd examination) in all the subjects and with regard to the division into groups

	Body mass [kg] STEP	**Body mass [kg] LOW**	**Body mass [kg] TBC**	**Body mass [kg] ALL**	**% FAT STEP**	**% FAT LOW**	**% FAT TBC**	**% FAT ALL**
Average group results before (1st examination)								
$\bar{x}$	60.64	55.1	56.5	57.7	26.0	24.9	25.4	25.5
Min	45.0	42.2	45.0	42.2	22.3	21.5	23.7	22.3
Max	71.9	67.4	68.0	71.9	29.9	27.4	27.7	29.9
±SD	7.6	5.2	6.8	7.0	2.1	1.5	1.3	1.7
Average group results after (2nd examination)								
$\bar{x}$	60.3	54.9	56.7	57.5	25.3	25.1	25.4	25.4
Min	44.0	42.5	45.1	42.5	22.7	21.7	23.4	21.7
Max	72.0	66.3	67.5	72.0	29.1	27.0	27.5	29.1
±SD	7.2	5.1	6.7	6.8	1.8	1.4	1.1	1.6
T test	p=0.07	p=0.06	p=0.19	p=0.06	p=0.19	p=0.37	p=0.39	p=0.26

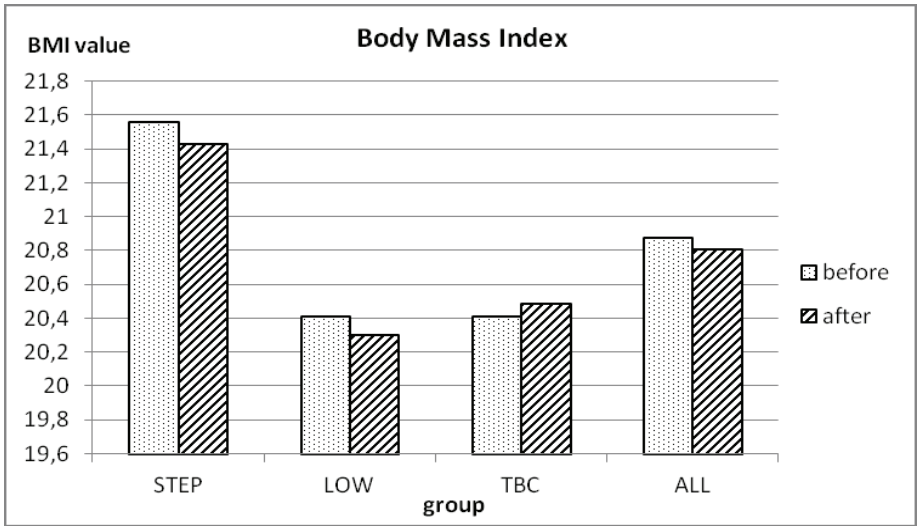

Fig. 1. Changes in the magnitude of the BMI in the examined groups

Tab. 2. The percentage of changes within the body mass and the proportional content of the adipose tissue influenced by the exercises, among all the subjects and with regard to the division into groups

	Loss of body mass	Loss of adipose tissue	Increase in body mass	Increase in adipose tissue	Without change in body mass	Without change in adipose tissue
STEP	51.6%	54.8%	41.9%	41.9%	6.5%	3.2%
LOW	61.5%	57.7%	34.6%	30.8%	3.8%	11.5%
TBC	50.0%	66.7%	50.0%	27.8%	0.0%	5.6%
ALL	54.7%	58.7%	41.3%	34.7%	4.0%	6.7%

Among the majority of students taking part in 6-week-long fitness classes, with the frequency of 3 times a week, there appeared a decreasing tendency both in the body mass and the proportional quantity of the adipose tissue in the organism (Tab. 2). In none of the groups, nor in the case of the majority of the examined, the magnitude of changes of each parameter (body mass and the proportional content of the adipose tissue) proved be statistically significant ($p>0.05$), yet in the case of body mass, especially in LOW and the whole group, they were close to the significant boarder (Tab. 1).

Discussion

Among people with overweight and obesity the reduction of body mass and its pace depend on the energy balance. The entire energy input consists of: rest energy input (approx. 60% the entire energy expense), thermal effect of nourishment (10% the entire energy expense) and energy input connected with activity (approx. 30%). During a therapy reducing the body mass one uses a rise of energy expense (it is connected to the enlarged use of energy substrates stored in the adipose tissue) and also diminished energy provision in form of alimentary products. It is also possible to influence the first and the second factor simultaneously [12, 13, 18, 19]. The research on “the golden means”, where the adipose tissue would be burnt best, is connected with the possibility of a given individual to attempt to adjust to to factors maximally influencing its reduction.

There were many researchers who sought the optimum manner to burn the adipose tissue, modifying and comparing factors able to influence this process, among other things the type of training, its duration or intensity. However, so far there has been no unanimity between them. Wilmore and Costill claim that 30-minute-long effort of a 23-year-old woman with 75% max

intensity quantitatively resulted in the same use of fat as similar effort with 50% intensity, whereas the use of carbohydrates was twice greater [20]. Melanson also found no differences in the use of fat during effort with 40% and 70% maximum ability [21], yet Romijn and Coyle ascertained that the greatest fat burning appeared during effort with intensity equal to 65% HR_{max} [15]. Simultaneously, each of the researchers confirmed that the use of carbohydrates increased together with the magnitude of the effort intensity.

One ought to pay attention to the fact that with lengthening of the duration of the effort, the participation of fats in covering the energy need increases too. In the 90^{th} minute of the effort with 75% intensity, proportions of fat to carbohydrates burning are 1:1, and in the third hour of such effort already only 40% of energy comes from carbohydrates [22]. Such long and intensive training can be performed by few, so the above considerations have a theoretical character.

In the above work only the type of training with constant intensity and the same duration in all classes was analysed. The lack of statistically important changes both in body mass and the level of the adipose tissue permitted rejecting the hypothesis of various influence of exercises, depending on their type (e.g. strength or aerobic). Additionally, people taking part in the study were not recommended to change their existing diet, which could also have an influence on the results, because we do not know in what quantities the participants supplemented energy substances. Complex proceedings in the case of obesity require individualized treatment including the type of training, diet or lifestyle modification [23]. The increase in body mass in each case could be due to both an increase in the muscular mass connected with a higher volume of physical exercises [24] and to the enlargement of the amount of the adipose tissue as a result of unchecked, additional energy balance. Certainly the change of this factor and setting a diet of a defined kcal content per day at the beginning of the study would make the inspection of the undesirable increase in the adipose tissue easier.

Next major factors whose change would allow correcting the results of the present work are the frequency and duration of the study. A three months' period of exercises was shown by Buemann et al. [25] as too short and restricting the influence of the training. Byrne and Wilmore propose at least a 20-month-long cycle of exercises to optimize the effects [26]. On the other hand, Sawczyn and Kuehne emphasize that even 16 weeks of training with the frequency of exercises twice per week significantly improves the resting metabolic rate [27]. However, the latter authors examined obese women (in contrast with the examined here group of students located in the norm), which could affect the effectiveness of exercises. It seems, however, that it is not the type of exercises but their intensity that has the key meaning for obtained reductive effects in recreational fitness training [27, 28].

Basing on comparable results from the available literature and the results of research one can ascertain that systematic participation in aerobic fitness forms is an efficient and safe form of the reduction of the adipose tissue [11, 27, 29, 30, 31]. The role of fitness clubs in implementing healthy lifestyle is getting more and more understandable. In most cases they extend their offer and open to the needs of people afflicted with civilization diseases, among others with obesity. Increasingly more often one notices the presence of dieticians, psychologists and physiatrists in such sports facilities, and this permits ascertaining that healthy fitness forms gain a preventive value as well as a curative one, being the answer to the growing problem of obesity and consequential health problems.

Looking at multifaceted problems mentioned in this work, we notice that when undertaking physical activity one ought to take into account all factors which can have an influence on its efficiency (even its type or intensity). Choosing suitable parameters of effort, keeping all indications and contraindications to physical activity by a given individual is in the competence of coaches, teachers, instructors or physiatrists. Additional knowledge on the range of modern fitness forms, their specifics and efficiencies (which was the aim of this work) in the reduction of the adipose tissue is a new challenge standing before those working in the area of physical education.

Conclusions

To sum up, one can ascertain that six-week-long fitness exercises with the frequency of 3 times a week have no essential influence either on a decrease in body mass or on the reduction of the adipose tissue. For the purpose of prevention of the overweight and obesity occurrence, the applied program of exercises can instead find use as a form of an everyday activity.

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