

# The effectiveness of swimming in treating and preventing obesity

## Utilizarea înotului în profilaxia și tratamentul obezității

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### **Abstract**

*Background.* Due to the influence it exerts on the body, swimming is considered one of the most important means of physical therapy, recommended to persons with overweight problems and obesity. Obesity is a serious global health problem with enormous economic impact. Obesity is a metabolic disease characterised by weight gain, as a result of the accumulation of body fat, food excess and a sedentary life.

*Aims.* The purpose of this research is to find the most effective and specific swimming methods to relieve excess weight. The research hypothesis: swimming activity conducted under special programs can prevent and reduce obesity.

*Methods.* The research was conducted from October 15, 2012 to April 15, 2013. The investigated somatic indices were: height, weight, abdominal circumference and body mass index (BMI).

*Results.* For all indicators in the study, significant differences between initial and final measurements were reported.

*Conclusions.* Research findings confirm the hypothesis that swimming can have a decisive role in maintaining health and also, in preventing and relieving obesity. Knowledge of nutrition problems in close interrelation with swimming practice will help prevent and combat overweight problems and obesity.

**Key words:** swimming, obesity, students.

### **Rezumat**

*Premize.* Datorită influențelor pe care le exercită asupra organismului, înotul este considerat unul dintre cele mai importante mijloace ale kinetoterapiei, recomandate persoanelor cu exces ponderal și obezitate. Excesul ponderal reprezintă o gravă problemă de sănătate la nivel mondial, cu un enorm impact economic. Obezitatea este o boală de metabolism, caracterizată prin creșterea în greutate, în urma acumulării de țesut adipos, prin exces de alimente și viață sedentară.

*Obiective.* Scopul cercetării îl constituie găsirea celor mai eficiente metode și mijloace specifice înotului, pentru ameliorarea excesului ponderal și a obezității. Ipoteza cercetării: activitatea de înot desfășurată în baza unor programe poate avea efecte benefice în prevenirea și ameliorarea obezității.

*Metode.* Cercetarea s-a desfășurat în perioada 15 octombrie 2012-15 aprilie 2013. Indicii antropometrici, care au fost investigați, au fost: înălțimea, greutatea, perimetrul abdominal și indicele de masă corporală (IMC).

*Rezultate.* La toți indicatorii luați în studiu s-au constatat diferențe semnificative între măsurătorile inițiale și cele finale.

*Concluzii.* Concluziile cercetării confirmă ipoteza; înotul poate avea un rol hotărâtor în menținerea sănătății, în prevenirea și ameliorarea obezității. Cunoașterea problemelor legate de alimentație, în strânsă interdependență cu practicarea înotului, va contribui la evitarea și contracararea excesului ponderal și obezității.

**Cuvinte cheie:** înot, obezitate, studenți.

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## Introduction

Swimming is a pleasant physical activity, having individual and social utilities unmatched by any other sport (Marinescu, 2002).

It has a great beneficial influence on health and can be practiced anytime, starting from the first months of life until old age, due to the ease with which one can divide the effort into different stages.

Practiced in an academic environment, swimming today becomes a requirement with choices and large sanogenetic applications due to the students' specific work, where physical exercise occupies a small part of the students' time as opposed to the prevalence of mental and intellectual pursuits and stress (Stoica, 2009). Swimming also improves lung capacity and helps in reducing excess weight.

Through swimming, good results can be obtained in the prevention and treatment of obesity. Today, it is widely accepted that dieting or taking certain medicines cannot have long-lasting effects if they are not combined with physical exercise. Swimming gives very good results in this case, stimulating the burning of excess fat, preventing its deposition on the thighs, abdomen and hips; it also normalizes the function of endocrine glands (seriously affected by this illness). The superiority of swimming over other means of physical exercise in treating this illness resides in the fact that part of energy is also used in maintaining a stable body temperature.

Swimming helps develop and maintain the vital body processes and by using the entire muscular system, the body can develop harmoniously. The shoulders broaden, the well-developed thorax protects powerful lungs, the muscles, long and proportionate, enable good working capacity and can adapt to any kind of activity (Colwin, 1992).

The favourable effects exerted on the body are generally provided by the association with natural environmental factors – air, water, sun – improving health (Vasile, 2007). Due to these influences, swimming becomes one of the most important means of physical activity recommended to people with overweight problems and obesity.

Activity performed in water with a temperature of 17°C burns 2 calories per minute; moderate activity in water with a temperature of 17-21°C burns 9.5 calories per minute; when swimming fast, the number of calories increases to 12 per minute. The calories the body needs for the swimming motions and for cold water adaptation are generated through the acceleration of metabolism in general (Vasile, 2007).

Metabolism is required to make a bigger effort in burning calories, and metabolic energy production becomes more efficient through systematic swimming workouts. Heat loss in turn determines a substantial increase in tissue fat burning and generally accelerates metabolism (Stoica & Stoica; Stoica et al., 2012). The endocrine glands, especially the thyroid, are further stimulated in a beneficial way. This effect justifies swimming as a prescribed sport for those suffering from obesity, when metabolism becomes slow.

Physical activity in youth is an important public health issue, and regular participation of young people in physical activity can enhance their physical, psychological and

social well-being. Parents are key factors in influencing the physical activity of their children. Building moderate-intensity physical activity into the daily routine may help parents model this desirable behaviour of their children (Biddle & Mutrie, 2001).

Due to the influence it exerts on the body, swimming is considered one of the most important means of physical therapy, recommended to people with overweight problems and obesity. Obesity is considered a serious problem worldwide and has a big negative economic impact. It is a metabolic disease characterised by weight gain, as a result of body fat accumulation through excess food and a sedentary lifestyle. These people must make an effort to lose weight, as individuals are exposed to all kinds of health problems such as high blood pressure, type 2 diabetes mellitus, coronary heart disease or stroke (Ganciu, 2012).

If the body tends to accumulate fat in the abdominal area, these deposits release fatty acids directly into the blood flow for immediate energy elimination in case of short-term activities (doctors cannot yet explain why this process is so harmful to health) (Mot, cited by Ganciu, 2012).

The waist circumference represents the second most important measurement after the BMI (Dumitru, 2007). It indicates where most of the fat is stored.

This accumulation of fat in the abdominal area is called an "apple shape", while the fat stored around the hips and thighs is called a "pear shape". If the waist circumference is larger than 102 cm in men and 88 cm in women, an increased risk for health is indicated, especially in the case of a BMI higher than 25 (Dumitru, 2007).

The BMI must be interpreted relative to age and sex (Reilly, 2006).

In the management of obesity, including morbid obesity, a 5-10% reduction of the initial weight brings a lot of benefits for comorbidities (Karlsen et al., 2013).

Changes in lifestyle (diet, behaviour, attitude, physical activity) are basic strategies in the intervention on obesity on a long-term basis (Wadden et al., 2013).

Widespread adoption of BMI-for-age will depend on continued efforts to train individuals in the appropriate use of national and international growth references (Anderson et al., 2006).

Direct but simple measures of body fatness and measures of body fat distribution may be helpful in such individuals to further stratify them according to their level of body fatness (Romero-Corral et al., 2008).

## Objectives

The aim of this research is to find the most efficient swimming methods and programs to eliminate excess weight and obesity.

Physical activity practically represents the most accessible, agreeable and efficient "medicine" in fighting many health risk factors (Dumitru, 2007).

## Hypothesis

It is assumed that different swimming methods and prolonged physical effort, of over 40 minutes 3 times a week, along with dietary measures, will lead to an improvement of body shape and weight.

## Material and methods

### Research protocol

#### a) Period and place of the research

The research was conducted from 15 October 2012 to 15 April 2013, at the "Lia Manoliu" Swimming Pool in Bucharest.

We mention that according to the Helsinki Declaration, the Amsterdam Protocol and Directive 86/609/EEC, the approval of the Ethical Commission of the Department of Physical Education and Sport of the University of Bucharest regarding research on human subjects was obtained, and all the subjects gave their consent to participate in this research.

#### b) Subjects and groups

The research was conducted over the course of an academic year and included 25 participants, students at the University of Bucharest aged between 18-25 years, who participated in 3 swimming lessons of 100 minutes each every week. The group also followed a low-calorie diet of 1200-1500 calories, for one year.

To determine the effectiveness of the activity in the experimental group, a control group of 25 students was formed, who preferred a moderate activity provided by their school schedule, thus taking part in only one weekly swimming lesson instead of three.

#### c) Tests applied

For this research, initial and final tests were conducted every 3 months.

These tests assessed the extent to which the independent variable influenced the difference between the data obtained from the 2 tests (Epuran, cited by Stoica & Stoica, 2012).

Biddle tested a model predicting intentions from perceived competence, achievement goals and ability beliefs in Hungarian youths. He found that entity beliefs predicted an ego goal orientation, whereas incremental beliefs predicted a task orientation. In addition, behavioural intentions were predicted by a task, but not an ego goal orientation (Wang & Biddle, 2014).

Sallis suggests that motivational variables centred on achievement orientation and perceptions of competence are worth to be studied. Indeed, the sport and exercise psychology literature over the past decade has shown that such constructs are popular (Biddle et al., 1998) with numerous studies of achievement goal orientations and perceptions of autonomy, self-determination or intrinsic motivational processes.

The investigated somatic indicators were: height, weight and abdominal circumference, and were obtained from both groups at the start and end of the experiment. On the basis of these results, the body mass index (BMI) was then calculated.

The workout schedule respects the principle of longevity in both duration and intensity (Dominteanu cited by Stoica, 2009).

The recovery program was mentioned in the records and included the following data: the length of immersion; the length of exercise; the motion axes; rhythmicity; the difficulty of these elements (accessibility); the times when the level of difficulty was increased; the general physical condition; age, sex, history; physical abilities; possible

complications during physical activity etc.

The swimming sessions were divided into 3 weekly lessons:

- 2 x 1000 m with an active pause;
- 3 x 600 m with an active pause;
- 6 x 200 m with an active pause;
- 10 x 50 m with a 10 second pause;
- 2 x 4 x 50 m with a 10 second pause; a 2 second pause between every series
- 2 x 4 x 50 m with a 5 second pause; a 1 minute active pause between the series

A methodical process of steady effort was used to help lose excess weight and develop stamina (Maglischo, 1992).

We present below a training program for each of the 3 weekly lessons:

#### Monday

300 m – Warm-up  
8 x 50 m Crawl – Start at 1:00"  
4 x 200 m Crawl – Pause at 1:00"  
4 x 50 m Feet – Crawl  
3 x 600 m with an active pause  
100 m Relax  
Total 3,600 m

#### Wednesday

300 m Warm-up  
2 x 50 m Feet – Butterfly stroke  
4 x 50 m Butterfly stroke - Start at 1:45"  
2 x 50 m Back feet  
4 x 50 m Backstroke – Start at 1:45"  
2 x 50 m Feet - Bras  
4 x 50 m Breaststroke – Start at 1:45"  
2 x 50 m Feet - Crawl  
4 x 50 m Crawl - Start at 1:20"  
2 x 1000 m with an active pause  
100 m Relax  
Total: 3,600 m

#### Friday

300 m – Warm-up  
4 x 50 m Sprints - Crawl  
500 m - Crawl  
4 x 50 m Sprints Feet - Crawl  
500 m - Crawl  
300 m Relax  
Total 2,100 m

Physical activity in the case of people suffering from excess weight was conducted in 3 stages (Ganciu, 2009):

- 1<sup>st</sup> stage: intense, short-term physical exercise is used to burn excess fat, under conditions of controlled breathing associated with a low-calorie, low-fat diet
- the 2<sup>nd</sup> stage is aimed at correct muscle development through exercises steadily increasing in intensity and duration, thus ensuring the gradual reduction of fatty deposits
- 3<sup>rd</sup> stage: when adipose tissue has been reduced to acceptable levels and the muscles are built up, further physical exercise practice is recommended to maintain the results and prevent relapse.

We are now presenting a specific eating program with 5 meals a day, recommended to the participants in this program (Peter & D'Adamo, 1996):

- *Breakfast*: yoghurt (150 ml), fruit juice (250 ml), black bread (2 slices), cereals (150 g), honey (25 ml).
- *Snack*: 1 fruit.
- *Lunch*: vegetable soup (200 ml), salad (100 g), poultry/fish meat (100 g), black bread (2 slices), fruit salad (200 g).
- *Snack*: fruit juice (200 ml).
- *Dinner*: salad soured with lemon (150 g), baked vegetables (150 g), poultry/fish meat (100 g).

At least 2.5 l of water, green tea, fruit juice, herbal tea is indicated. Banned food: sweetened drinks, fat and salty cheese, fat meat, white bread, puddings, sweets and salt in big quantities.

*d) Statistical processing*

The statistical indicators used in this research were: the arithmetic mean, the differences between the final and the initial tests, the differences in percentage, the standard deviation and the “t” coefficient. The Student test was used to verify whether there were important differences between the initial and final tests. The computer programs used for statistical calculation were Microsoft Word, Microsoft Excel (Tudor, 2008).

**Results**

After statistical and mathematical processing of the results obtained from both groups, the following conclusions were drawn:

**Table I**

Groups	Waist circumference > 88 cm.	
	Initial testing	Final testing
Experimental Group	71.7 %	47.8 %
Control Group	70.8%	67.6%

**Table II**

Groups	Body Mass Index (BMI).					
	Normal Weight		Overweight		Obese	
Experimental Group	IT	17.6 %	IT	64.4 %	IT	17 %
	FT	35.2 %	FT	61.6 %	FT	3.2 %
Control Group	IT	19.5%	IT	68.2%	IT	12.3%
	FT	21.6%	FT	67.2 %	FT	11.2 %

- In both cases, the final results were better than those recorded at the beginning of the experiment.
- In the experimental group, there was a significant difference in the BMI between the final and the initial testing: the value of  $t = 2.31$ , thus  $p < 0.05$ , as opposed to the control group, where the difference between the initial and the final testing was much smaller, as demonstrated by  $t = 1.34$ , thus  $p > 0.05$ .
- In the experimental group, there was a significant improvement in the two indices used, while in the control group, the small rise was not significant for any of the indices used for testing.

**Discussions**

This research includes female students who can swim and want to keep their weight under control, using swimming as a means for preventing obesity.

The idea underlying the formation of the 2 groups was that of group therapy: grouping them by similar

weight provides psychological support, stimulates active participation and motivates the students to obtain the desired results.

In designing the diet, one must take into account the following:

- The diet must include products in caloric percentages from all food groups.
- Within the same group, isocaloric substitutions can be made by taking into account the preferences of the student or athlete.
- Every meal must include animal meat, vegetables and fruits.

It is necessary to calculate how much energy the diet will provide for the individual. The amount of carbohydrates the participants must intake is directly related to the degree of physical exercise, as carbohydrates are the perfect food for muscles. It must be noted that the working regime of the students is characterised by intellectual activity mainly conducted while sitting down.

Sedentary behaviour is often found in teens suffering from obesity, unlike in those with normal weight. Thus, minimising sedentary behaviour represents an important objective, especially in childhood, to prevent obesity. Reducing access to some of these sedentary activities can in fact generate other sedentary tendencies or heighten the excesses (Crockett, 2010).

The absence of physical exercise caused by psychological or social factors represents a problem in one’s lifestyle. Obese children and teens, especially girls, do not seem to understand that they are less active than their counterparts from movies (Gorely, cited by Ayvaz & Cimen, 2011).

Two researchers, Wang & Biddle (2014), have demonstrated that sedentariness can be reduced by applying certain methods aimed at the desire of children and teens to adopt physical activities in their lives.

The interventions based on diet changes combined with physical activity proved to be more successful in the reduction of weight and BMI compared to the interventions based on only one of these components (Stephens et al., 2014).

Ross et al. (2004) reported that a loss of 6 kg by physical exercise resulted in a 6.5 cm reduction of the waist circumference and a 30% decrease of intra-abdominal fat.

The progress made after intense swimming practice refers to the improvement of morphological indices (weight, abdominal circumference), as follows:

*In the experimental group*: at the first testing, 71.7% of the subjects had over 88 cm in the abdominal area, but the percentage decreased to only 47.8% at the final testing (Dumitru 2007).

Previous studies proved that changes in the waist circumference were correlated with modifications of intra-abdominal fat. Slentz et al. (2005) demonstrated that a weight loss of 2 kg was associated with a 7% reduction of body fat.

- The BMI changed accordingly: at the time of the initial testing, 17.6% of the participants had an adequate weight, 64.4% were overweight and 17% were obese, as opposed to the final testing, where 35.2% had an adequate weight with a BMI < 25, 61.6% had a BMI between 25-30

(overweight), and only 3.2% had a BMI higher than 30 (obese).

In the control group who attended the basic lessons provided by the school program, only a minor improvement could be seen; at the initial testing, 70.8% of the students had a waist circumference larger than 88 cm, and the percentage decreased to 67.6% at the time of the final testing.

- The BMI values did not increase or decrease significantly: initially, 19.5% of the students had a normal weight, 68.2% were overweight and 12.3% were obese. In the final testing, 21.6% had a normal weight, 67.2% were overweight and only 11.2% were obese.

## Conclusions

1. This research concluded that almost 24% of the participants changed from an increased risk of obesity to normal values after the swimming lessons combined with a low-calorie diet, as calculated based on abdominal fat.

2. Approximately 14% of the participants changed from the obese to the overweight category.

3. Swimming determined visible changes in the body shape. The main physical effects were a decrease of the body mass index and of abdominal circumference.

4. In the beginning, 17% of the subjects were obese, 17.6% were normal weight and 64.4% were overweight. At the end of the experiment, only 3.2% of the students remained in the obese category, 35.2% were normal weight and 61.6% were overweight.

5. Somatic parameters demonstrate a drop in weight and an improvement of the abdominal circumference, which indicate the efficiency of the program applied and of swimming as a means of preventing and treating obesity.

6. Dietary measures are linked to a rise in the quality of food while decreasing the number of calories (generous amounts of fibre-rich food are recommended, such as whole grains, vegetables, fruits, and avoiding fats, sugar, processed foods and snacks loaded with calories and too few nutrients).

7. Swimming lessons based on a schedule can be very beneficial in preventing and treating obesity.

8. Educating willpower in doing physical activity systematically over the course of life is extremely important for improving the quality of life.

9. The findings of this research confirm the hypothesis that swimming can play a decisive role in maintaining health, as well as in treating and avoiding obesity. Knowledge of nutrition issues carefully paired with swimming will help in reducing excess weight and obesity.

## Recommendations

The recommendations for people who follow a schedule for losing weight are the following:

- at least 30 minutes of daily moderate physical activity, which involves consuming about 250-300 kcal (1050-1260 kJ) per session;

- to effectively reduce weight, moderate physical activity for about 45-60 minutes daily is necessary.

Specific schedules should encourage regular physical exercise and counter a typical decline of physical development in growing children (Hughes, cited by Soos, 2014).

## Conflicts of interests

There are no conflicts of interest.

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