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Efficiency of Physical Therapy for Improving Hemodynamic Parameters in Young Obese Patients

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Abstract

Aim: The paper aims to demonstrate the efficiency of an individualized exercise training protocol on preventing cardiovascular complications, by improving hemodynamic parameters and body composition of young obese patiens. *Material and method:* The group included 35 subjects from which 21 female and 14 male with age between 18 and 25 years and the period of the study was 9 months of which 6 of training. At the beginning and at the end of training, subjects were assessed in regard to body composition and hemodynamic parameters. To design an individualized exercise training program, testing and monitoring protocol was based on using of some modern methods among which: cardiopulmonary exercise testing and bioimedance body composition analyses. Statistical analysis was performed by using paired t test. Value of the coefficient p under 0.05 was considered statistically significant. *Results:* Training programs performed during 6 months have brought significant improvements in the following parameters: body mass index, resting heart rate, systolic blood presure and dyastolic blood pressure, allong with maximal blood presure in effort. *Conclusions*: The concept of individual intervals training brought improvements of targeted parameters, causing weight loss but also improvements of cardiovascular risk.

***Key words**: Obesity, exercise training, blood pressure*

Rezumat

Scop: prevenirea complicaţiilor cardiovasculare şi ameliorarea parametrilor hemodinamici prin implementarea unui program individualizat de kinetoprofilaxie la tineri obezi. *Material si metodă:* Lotul a cuprins iniţial 35 de subiecţi dintre care 21 de sex feminin şi 14 de sex masculin cu vârsta cuprinsă între 18 şi 25 de ani, perioada de desfăşurare a studiului fiind de 9 luni dintre care 6 luni de antrenament fizic. La începutul şi la sfârşitul perioadei de antrenament, subiecţii au fost evaluaţi din punct de vedere hemodinamic si al compozitiei corporale. În vederea conceperii unui program individualizat de kinetoprofilaxie, protocolul de testare şi monitorizare s-a bazat pe folosirea unor metode avansate dintre care amintim: ergospirometria, evaluarea compoziţiei corporale prin bioimpedanta electrica. Analiza statistică a parametrilor analizaţi s-a efectuat aplicând testul t student pereche. Valoarea coeficientului P sub 0,05 a fost considerată semnificativă statistic. *Rezultate*: Programele de antrenament desfăşurate pe parcursul a 6 luni de zile au adus îmbunătăţiri semnificative ale următorilor parametrii: indicele de masă corporala, frecvenţa cardiacă de repaus, tensiunea arteriala sistolică şi diastolică de repaus, tensiunea arteriala maximală de efort. *Concluzii:* Conceptul de antrenament individualizat pe intervale a adus îmbunătăţiri ale parametrilor vizaţi în studiul de faţă, determinând atât scaderea ponderală a subiecţilor cât şi reducerea riscului de boală cardiovasculară.

***Cuvinte cheie**: obezitate, antrenament fizic, tensiune arterială*

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Background

Obesity is a widespread nutritional and metabolic disorder, characterized by overweight that exceeds with 20% over ideal body weight. The vast majority of nutritionists agree that men with more than 25% body weight excess and women with over 30% are obese. Obesity can be evaluated using weight to squared height ratio (body mass index) or waist circumference (for central obesity). An increase in body mass index (BMI) greater than 27kg/m^2 or a waist to hip ratio greater than 0.9 in men and 0.8 in women may increase cardiovascular risk. (1)

Lifestyle changes requires some rules to follow: adapted food intake, physical activity, maintaining a healthy diet after weight loss, sign up in support groups, keeping a fixed time for meal and so on. (2)

Daily physical activity performed of a moderate intensity maintains good muscle tone and increased energy consumption. Harvard Unversity studies shows that making 10.000 steps a day ensure energy consumption needed to maintain normal weight. Regular physical activity prevents excess fat, improves heart rate and more than that, prevents cardiovascular, metabolic and lung diseases. The intensity of effort is recommended to be 60-80% of functional capacity assessed after performing a maximal exercise test, but to register a positive effect it have to begin with 25-50% of this value with gradually increase until reach around 60-80% of maximal 0^2 uptake (or the heart rate corresponding to maximal 0^2 uptake). (3)

Interval exercise training method is widespread since it is based on the principle of the division of the interval effort with rest and exercise planned periods. Rest intervals are not used for a full recovery – pulse rate reaches 120-130 beats/minute (intermediate stage of recovery) when the next effort stage starts. This exercise training method used high speed execution of exercises. The factors of progress consist in increasing the execution speed and/or reducing the breaks imposed by the adaptation of the athlete to the effort. (4)

The purpose of the present study is to demonstrate the efficiency of an individualized exercise training protocol on preventing cardiovascular complications, by improving hemodynamic parameters and body composition of young obese patiens.

Material and method

The study group included 35 subjects, 21 females and 14 males with age between 18 and 25 years. The study period was 9 months, out of which 6 of exercise training. The dropout rate was 20%, 28 subjects performed all 6 months of training.

At the beginning and at the end of the study the subjects were evaluated in terms of BMI, resting systolic and diastolic blood pressure (SBP and DBP), maximal systolic and diastolic blood pressure (SBPmax and DBPmax) during cardiopulmonary exercise testing, resting heart rate (HRrest) and maximal heart rate during effort (HRmax).

For achieving individual workouts there was used cardiopulmonary exercise testing results of each subject, thus establishing individual heart rate zones. In order to monitor heart rate during exercise were used Polar F3 heart rate monitors in order to maintain exercise intensity into recommended intervals.

The structure of the training program was: 6 main stages of interval training followed by exercises for upper limb muscles, legs and trunk in order to develop muscle strength, mobility and flexibility.

An example of training program that have had complied with the values and indications during the training program contains:

- Stage 1 (warm-up stage) - joint and muscle stretching, walking on treadmill for 5 minutes; HR reached around 120 beats/minute.
- Stage 2 – cycling on ergometere for 10 minutes; HR reached between 140-155 beats/minute, followed by 3 minute of active recovery.
- Stage 3 - exercise on cross-trainer for 10 minutes; HR reached around of 155-167 beats/minute, followed by 3 minute of active recovery.
- Stage 4 – walking on slope/running on a treadmill for 10 minutes; HR reached around of 165-177 beats/minute, followed by 3 minute of active recovery.
- Stage 5 - exercise on stepper for 6 minutes; HR reached around of 155-167 beats/minute, followed by 3 minute of active recovery.
- Stage 6 - walking on slope/running on a treadmill for 10 minutes; HR reached around of 165-177 beats/minute, followed by 3 minute of active recovery.

After 2 weeks of training were performed short intervals up to 1 minute after every 5 to 3 minutes of effort as follows:

- 167-178 beats/minute - on ergometer and stepper or cross-trainer

- 177-188 beats/minute – for walking slope/running on a treadmill.

The statistical analysis was performed using GraphPad software.

Parameters were analyzed using pair t test. The evolution of parameters was considered statistically significant if p coefficient was less than 0.05.

Results

Hemodynamic parameters tested initial and final are represented by BMI, HR at rest, HRmax, DBP, SBP, DBPmax and SBPmax. The evolution of these parapeters is presented in the Table I. These parameters were the main factors in making the decision regarding the effectiveness of physical training programs in the study group described above.

After analyzing the results we found improvements of the following parameters: BMI decreased from 30.93±6.55 kg/m^2 to 30.25 ± 6.63 kg/m^2 p = 0.002 (Figure 1); resting HR decreased from 77 ± 11.67 beats/minute to 70.50 ± 10,8 beats/minute, p = 0.014 (Figure 2); SBP decreased from 132.80 ± 9.76 mmHg to 119.60 ± 5.28 mmHg, p = 0.001 (Figure 3); DBPmax decreased from 90.60 ± 5.98 mmHg to 88 ± 5.02 mmHg, p=0.022 (Figure 4). Parameters not specified above are also improved but they did not reached the statistical significance treshold, namely: DBP decreased from 84.40 ± 6.51 mmHg to 83.50 ± 3.69 mmHg, p = 0.243 (Figure 3); HRmax decreased from 190.50 ± 11.82 beats/ minute to 188.20 ± 9.13 beats/minute, p = 0.157 (Figure 2) and SBPmax decreased from 175.60 ± 12.35 mmHg to 176.30 ± 14.54 mmHg, p = 0.087.

Table I. Evolution of hemodynamic parameters after 6 months of exercise training

Parameters	Initial	Final	p value
BMI (kg/m^2)	30.93 ± 6.55	30.25 ± 6.63	0.002
SBP (mmHg)	132.80 ± 9.76	119.60 ± 5.28	0.001
DBP (mmHg)	84.40 ± 6.51	83.50 ± 3.69	0.243
HR rest (beats/minute)	77 ± 11.67	70.50 ± 10.8	0.014
HR max (beats/minute)	190.50 ± 11.82	188.20 ± 9.13	0.157
SBPmax (mmHg)	175.60 ± 12.35	176.30 ± 14.54	0.087
DBPmax mmHg)	90.60 ± 5.98	88 ± 5.02	0.022

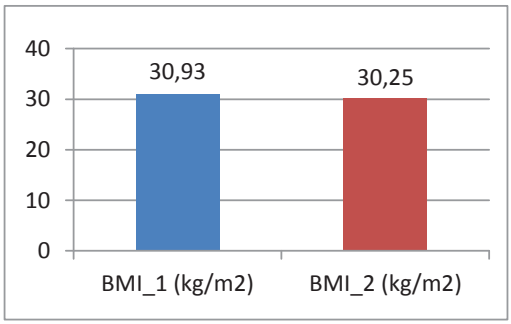

Figure 1. Evolution of body mass index after 6 months of exercise training

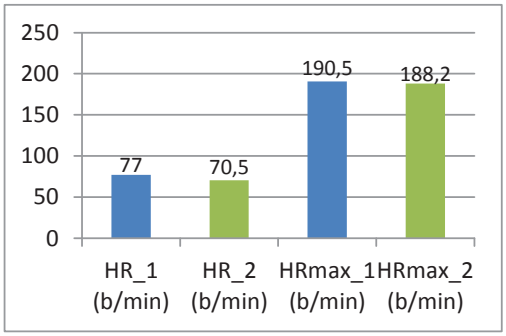

Figure 2. Evolution of resting and effort heart rate after 6 months of exercise training

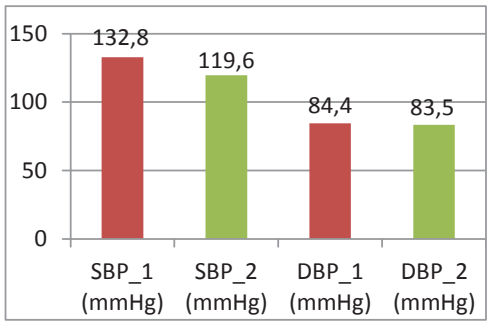

Figure 3. Evolution of resting systolic and diastolic blood pressure after 6 months of exercise training

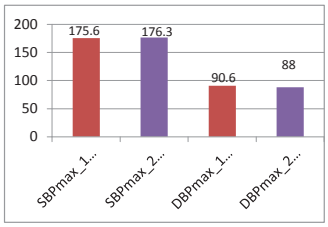

Figure 4. Evolution of maximal systolic and diastolic blood pressure during effort, after 6 months of exercise training

Discussions and conclusions

The analysis and interpretation of the results showed an improvement in hemodynamic parameters after 6 months of exercise training. The body weight has changed causing a further decline of 0.68% from the baseline evaluation, the difference being statistically significant (p = 0.002). Parameters represented by heart rate and maximum heart rate changed during the study so that the average HR fell by 8.45% and HRmax by 1.21%.

The SBP decreased by 10% followed by the decrease of DBP with a 1.07%. SBPmax and DBPmax showed at the end of the study a decrease of 2.2% and 8.45% from baseline, demonstrating the effectiveness of the proposed training program. Physical training programmes brought significant benefits on hemodynamic parameters to obese young subjects and led to a reduction of cardiovascular risk. Individualized and well organized exercise training programmes, with progressive increase in effort, led to significant weight loss, increased effort capacity and improved quality of life for obese young subjects.

References

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