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CHANGES IN SERUM CHOLESTEROL AND GLUCOSE LEVELS OF OBESE PEOPLE DURING A 8 WEEK LONG CYCLE OF PHYSICAL ACTIVITY COMBINED WITH ENERGY DEFFICIENT DIET

Introduction

According to a study of the National Centre of Social Health in 2010-2011 30% of Bulgarian students aged between 6 and 19 were overweighed and 12% were obese. The data for the countries in the Euro zone were even more alarming: between 36.9% and 56.7% of women and between 51% and 69.3% of men were overweight and obese (Health status statistics, 2013). Higher risks for morbidity of diseases with big social impact (such as type 2 diabetes and cardiovascular disease) are associated with obesity in young people (Levine, J. A. and Kotz, C. M., 2005, Pisunyer FX., 1993). At the same time we couldn't find in the scientific literature any widely accepted methodologies (which combined physical activity and dieting) designed to address these problems. In our opinion the methodology presented in this article could be used as a practitioner's guide for treating obesity.

There are a number of studies treating similar problems (Cullinen K, Caldwell M., 1998; Demling RH, DeSanti L., 2000; Doi T, Matsuo T, Sugawara M, et al., 2001; Borsheim E, Bahr R., 2003). Despite the fact that there are studies of daily regimens which combined resistance exercises and negative energy balances, we did not found one which had tested the effectiveness of a methodology similar to ours. The conclusion is that combining resistance training workouts of anaerobic-lactic type with a low-calorie diet is an entirely new approach for treating obesity.

Methods

The aim of the study was to evaluate quantitatively the influence of a daily regimen, consisting of resistance training sessions of anaerobic-lactic type combined with a low-caloric diet on the blood glucose and cholesterol fractions levels in obese people.

We studied 20 sedentary subjects, 16 women and 4 men, aged between 19 and 45 with Body Mass Indexes (BMI)>27. We used the Miflin et al. (Mark D Miflin, 1990) methodology and the Levine and Kotz (Levine, J. A. and Kotz, C. M., 2005) methodology to estimate the theoretical energy expenditure in rest and the theoretical daily energy expenditure for every participant. All subjects completed the experiment successfully.

The following blood tests were made for each participant: glucose (Glu); total cholesterol (TC); high density lipoproteins (HDL); low density lipoproteins (LDL); triglycerides (TG).

We separated the participants randomly into 2 groups. The first one (consisting of 12 female and 4 male) was put on a diet with 30% calorie deficiency (comparing to

the theoretical daily energy expenditure) and the following proportions of the food ingredients: 55-60% of carbohydrates, 15-20% of protein and 25-30% of fats. The diet consisted of 5 meals daily. We controlled the completion of the diet using a feedback loop mechanism – every participant had to fill protocols for the food he/she consumed on a daily basis. The second group (consisting of 4 female and 2 male participants) was a control one – no restrictions on the food intake were put on the subjects.

Every participant accomplished physical training schedule with the following parameters: Duration – 8 weeks; Workouts duration – 30 min; Frequency– 3 times a week; Intensity – about 70% of the maximum, determined as a subjective feeling of muscle failure (12-15 repetitions); Density and volume – 3 sets of a circuit training program, consisting of 10 exercises with 10 – 15 sec. time for rest between them.

The idea behind putting the participants on a training program with such parameters was to achieve maximum density of the workouts combined with a great variety of exercises in order to keep the interest and the motivation of the subjects elevated. We tried to use (as far as it was possible considering the bodyweights of the subjects) complex, basic exercises, which involved big muscles and muscle groups in order to increase as much as possible the energy expenditure of the participants (Peeva, D, Antonov, A, Ianchev, N, 2007). These types of exercises spend a lot of energy and have low values of the Coefficient of Useful Action (Basalkin, Vl, Slepchuk, NA, 1991, Hawkins D[1], Molé P, 1997). These way great amounts of energy substrates have to be chemically decomposed for energy. These substrates are oxidized only partially during the activity and their remainders are decomposed during the rest periods and energy is spent even then. Thus these processes spend a lot more energy then the aerobic exercises which are more energy sparing (D.A. Winter and H.J. Yack, 1987).

In order to improve the cardiovascular fitness of the participants before we switched to abovementioned training methodology, we had put the subjects on a two-week endurance training program consisting of 30 min. jogging or cycling workouts 3 times a week.

Results

For checking differences between the groups for each variable we conducted a standard test for differences in mean values – ANOVA (table 1) (Introduction to ARIMA, DU, 2013, The ARIMA procedure, SAS Online, 2013, TS models algirithms, IBM Support Portal, 2013). We did this to test for the success of the randomization of the groups. We considered the data met the assumptions of the test (approximately). Based on the results shown on the table we could conclude that there are no reasons to reject the hypothesis that there are no differences between the means of the studied variables between the groups ($p \leq 0.05$). Table 2 exhibits the variation analysis of the studied variables.

Table 1. *Variation analysis*

Group	Measure	TC	LDL-C	HDL-C	Glu	TG
1	**Range**	3.15	3.51	6.66	5.13	0.23
1	**Minimum**	1.98	2.07	4.05	3.22	0.15
1	**Maximum**	0.60	0.94	1.54	1.22	0.04
1	**Mean**	2.55	4.73	7.28	5.38	0.18
1	**Standard error**	1.91	0.47	2.38	1.09	0.13
1	**Standard deviation**	3.15	3.51	6.66	5.13	0.23
1	**Variance**	1.98	2.07	4.05	3.22	0.15
2	**Range**	1.73	4.12	5.85	4.98	0.23
2	**Minimum**	1.37	2.58	3.95	3.11	0.19
2	**Maximum**	0.25	0.96	1.21	1.10	0.04
2	**Mean**	1.29	4.30	5.59	5.08	0.18
2	**Standard error**	1.20	0.90	2.10	1.27	0.18
2	**Standard deviation**	1.73	4.12	5.85	4.98	0.23
2	**Variance**	1.37	2.58	3.95	3.11	0.19

Table 2. *ANOVA*

		Total Mean squares	DF	Mean square	F	Significance
TC	**Between groups**	0.11	1.00	0.11	0.17	0.68
	In the groups	10.92	18.00	0.61		
	Total	11.02	19.00			
LDL-C	**Between groups**	0.05	1.00	0.05	0.15	0.70
	In the groups	5.47	18.00	0.30		
	Total	5.51	19.00			
HDL-C	**Between groups**	0.07	1.00	0.07	3.11	0.10
	In the groups	0.40	18.00	0.02		
	Total	0.46	19.00			
Glu	**Between groups**	0.37	1.00	0.37	0.97	0.34
	In the groups	6.84	18.00	0.38		
	Total	7.20	19.00			
TG	**Between groups**	0.13	1.00	0.13	0.56	0.46
	In the groups	4.16	18.00	0.23		
	Total	4.28	19.00			

The differences of the studied variables between the beginning and the end of the experiment are presented table 3. We used t-test for paired samples to calculate the statistical significance (Papoulis, A., 1991).

Table 3. *Paired Samples t-tests*

	Mean	Standard deviation	Standard error	t	Significance	Margin of error
Group 1						
TC	0.31	0.54	0.14	2.11	0.06	0.3
LDL-C	0.29	0.39	0.10	2.84	0.01	0.28
HDL-C	0.04	0.12	0.03	1.30	0.22	<0.04
Glu	0.06	0.48	0.13	0.50	0.63	0.07
TG	.00	0.51	0.14	0.03	0.98	0.00
Group 3						
	Mean	**Standard deviation**	**Standard error**	**t**	**Significance**	**Margin of error**
TC	-0.19	0.71	0.29	-0.65	0.06	0.19
LDL-C	0.25	0.26	0.11	2.32	0.07	0.28
HDL-C	-0.02	0.13	0.05	-0.43	0.69	0.02
Glu	-0.04	0.02	0.01	-5.56	0.00	0.06
TG	-0.96	0.85	0.35	-2.77	0.04	0.97

Discussion

As seen on tables 3 and 4 there are no significant differences between the initial and the final values of the studied variables in the first groups with one exception only – LDL-C. We are obliged to mention that an improvement of the profiles means positive differences in all of the variables, but LDL-C, where the opposite is true. In the second group there are significant differences for two of the variables – Glu and TG, but all of the differences (excluding LDL-C) are in fact negative. Which means that in the second group an overall worsening in the fat and glucose profiles of the blood is detected. When the margins of error (±0.06 for Glu and ±0.97 for TG) are considered, the interpretation of these results becomes more problematic. The exception is LDL-C which profile worsened at a significance level very close to the benchmark of 95% - 93.2% (with a margin of error ±0.26). In group one the significance of TC is in fact quite close to the limit, too – 0.06. This means that probably if a bigger sample was studied this difference would probably be significant.

We reached the following **conclusions**:

1. There are preliminary evidence that a program with such parameters (especially the duration in our opinion) may have a harmful effect on blood levels of LDL-C, but further studies are necessary;
2. The worsening of the blood profiles of Glu and TC in the control group may be considered as preliminary evidence that the physical activity alone is not

sufficient for the improvement of blood lipid profiles. It is possible that the subjects elevated their calorie intake because of the physical activity;

3. In our opinion the lack of statistically significant differences between the values of the other variables in group 1 could be a result of the combined influence of the comparatively low volume of the sample and the short duration of the study. On the other hand some of the significance levels measured are so high that it is quite possible that a bigger sample size would not correct them. Which means that the kind of methodology we implemented had no effect on them whatsoever.

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CHANGES IN SERUM CHOLESTEROL AND GLUCOSE LEVELS OF OBESE PEOPLE DURING A 8 WEEK LONG CYCLE OF PHYSICAL ACTIVITY COMBINED WITH ENERGY DEFFICIENT DIET.

Introduction. The rate of obesity among people in many countries escalated in recent years. A lot of different methodologies were implemented to address this problem. To address these problems in this study we tried to evaluate the impact of a daily schedule, consisting of physical activity of anaerobic-lactic type (duration of 20-30 sec), combined with an energy deficient diet on the blood cholesterol and glucose levels in obese people. Methods: The participants were 20 healthy adults of both sexes with Body Mass Index (BMI) values above 27. They were randomly assigned to 2 groups – the first one underwent an energy deficient diet with a energy restriction of 30% of the theoretically calculated energy balance. The second group was the control one with no dietary restrictions. All participants performed 30 min. circuit training sessions of resistance exercises 3 times a week. The study was 8 weeks long. We measured the following blood components twice – once in the beginning and once at the end of the experiment: 1. Glucose; 2. Total cholesterol; 3. High density lipoproteins (HDL); 4. Low density lipoproteins (LDL); 5. Triglycerides. Results. We found no statistically significant differences ($p \leq 0.05$) in all of the blood serum variables we studied in both groups of participants. Discussion: We found no evidence of any favorable effects of a daily regimen consisting of anaerobic-lactic type of physical exercises and low caloric diet on the serum levels of cholesterol and glucose. When interpreting the results one must consider two facts (important in our opinion): 1. The relatively low number of the subjects and 2. the duration of the study, which was only 8 weeks. It is possible that such a methodology has to be applied for longer periods of time for the achievement of

significant results. This could be a topic for future studies. References: References: 1. Želязkov CV, Daseva D (2002). Osnovi na sportnata trenirovka.[Basics of sports training. In Bulgarian]. Sofия, Gera art. Van Aggel-Leijssen DP, Saris WH, Wagenmakers AJ, et al. (2001). Obes Res, 9(2), 86-96. Brill JB, Perry AC, Parker L, et al. (2002). Int J Obes, 26(11), 1484-93. Borsheim E, Bahr R. (2003). Sports Med, 33(14), 1037-60. Brzycki M (1998). A Practical Approach To Strength Training. McGraw-Hill Baechle TR. Cullinen K, Caldwell M (1998). J Am Diet Assoc; 98(4), 414-8.

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