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Original research article

THE INFLUENCE OF AEROBIC TRAINING ON THE BIOCHEMICAL AND PHYSICAL PARAMETERS OF OBESE WOMEN

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Abstract. *The study was carried out on a sample of 23 working age female subjects of an average age of 38.3 ± 4.45 years from Pančevo, classified based on their body mass index (BMI≥25 kg/m2). Their blood and body composition was measured during the initial and final measuring. The experimental factor involved directed low intensity aerobic training for a period of eight weeks. The aim of the study was to determine the effect of the transformation process and relation of the biochemical parameters at the initial and final body composition variables assessment measuring. The research results obtained by the Paired-Samples T test revealed statistically significant differences in the following variables: Body Weight, Body Fat Mass, BMI, Body Fat Percent, Visceral Fat, Blood Glucose, LDL and HDLD in favor of the final measuring. The regression analysis showed that the system of biochemical parameters determine the BMI to a small extent, Visceral Fat and Body Fat Mass (from 16% to 30% at the initial measuring and from 18% to 32.8% at the final measuring) and that the predictor system was significantly associated in neither of the cases. The biochemical parameters were, for the most part, associated with the nutritional status at the final measuring, while this percentage was lowest for the Visceral Fat criteria at the initial measuring. At the final measuring, the share of biochemical parameters of Body Fat Mass was reduced, while the BMI and Visceral Fat increased slightly. The authors recommend moderate intensity training as an effective way to improve the physical and biochemical parameters of health preservation and weight reduction.*

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INTRODUCTION

The lack of physical activity is one of the major health problems of a nation, and it has been proven that this is a factor that contributes to the development of chronic disease and health disorders (Blair, La Monte & Nichaman, 2004). The World Health Organization (2000a) has proclaimed that insufficient physical activity poses a risk factor. Earlier, only hypertension and obesity had this status. Hence, the great determination and desire of women to improve their health status and reduce their body weight (Jorgić, 2008).

It is well known that physical activity reduces health risk factors and that there are differences in body composition in relation to age (Čokorilo, Mikalački, Korovljev, Cvetković & Škrkar, 2012). It has an impact on the inflammation of the sympathetic activity of the body and a positive effect on the endocrine system. This was confirmed by the results of a study carried out on the population of healthy and ill individuals (including type II diabetes) (Balducci et al., 2012a; Balducci et al., 2012b). The lack of estrogen, abnormal lipid levels, weight gain and hypokinesia factors are associated with an increased prevalence of cardiovascular disease in women (Mikalački et al., 2013; Marchon et al., 2015). However, oriented, organized and systematic physical activity reduces some of these risk factors.

Non-specific parameters such as blood count elements: erythrocytes (RBC) and white blood cells (WBC), hematocrit (HCT) and hemoglobin (Hb), react to intense training (Shaskey & Green, 2000). Other parameters react to physical activity, and their changes occur in a short time and with very large homeostatic potential. This means that these changes happen during the targeted physical activity, and revert parameters such as glucose, triglycerides, and electrolytes to a normal range in a very short period of time.

In a human body, lipid depots are an almost inexhaustible source of energy during physical activity. Their use increases with the duration of an activity. Fatty acids used for energy production in muscles during physical activity originate from adipose tissue, circulating lipoproteins and triglycerides deposits in the muscle cells themselves (Lilić et al., 2009). The increase in sympathetic activity and the reduction of insulin secretion is the principal stimuli for lipolysis during exercise. For example, resistance training causes an increase in the beta-adrenergic sensitivity of adipose tissue, thereby increasing the use of fatty acids as an energy source. In this way the adaptive mechanism reaches its maximum after 4 months. Physical activity of great intensity that exceeds the capacity threshold (e.g. when an anaerobic, lactate metabolism causes a drop in the pH value because it exceeds the buffer capacity of the body) results in an increase in blood lactate levels , which facilitates the conversion of free fatty acids and glycerol to triglycerides. This reduces the availability of free fatty acids as an energy source, leaving carbohydrates as the main source of energy during intense physical exercise (Boraita, 2004). Therefore, it is understandable that different kinesiology activity does not have the same effect on the lipid profile in obese women of different ages. Alterations in blood plasma significantly change under the influence of training in women who have been involved in organized physical exercise programs. It also changes the waist circumference in comparison to the initial measurement (Martins, Veríssimo, Coelho e Silva, Cumming & Teixeira, 2010; Eleutério-Silva et al., 2013). Under the different effects of training (aerobic training, strength training and aerobics combined), the morphological characteristics as well as blood lipids changed (Schwingshackl, Dias, Strasser & Hoffmann, 2013). In previous studies (Colombo et al., 2013) changes in BMI, waist circumference and blood pressure were recorded, but not the parameters of total cholesterol, LDL cholesterol and triglyceride levels, although the level of HDL cholesterol improved. These changes occurred in just 12 weeks of moderate intensity training. Changes in the total amount of body fat, body mass, total mass of skeletal muscle and subcutaneous fat on the abdomen were recorded in experimental groups that were subjected to physical training (Donges, Duffield & Drinkwater, 2010; Donges & Duffield, 2012; Sanal, Ardic & Kirac, 2013). Also, changes in insulin levels after physical training were found (23.3%), with no change in body weight and total fat, suggesting that improved metabolic efficiency may be associated with larger effects of targeted physical activity (Nassis et al., 2005).

The development of sclerotic changes in blood vessels is significantly affected by a high level of cholesterol in the blood. It is particularly pronounced in combination with a high content of glucose and free fatty acids. Systematic exercise and regular physical activity reduce the low density lipoprotein (LDL) and very low density lipoproteins that contain triglycerides, and increase the levels of high density lipoproteins (HDL). The above changes in the lipoprotein content decrease the risk of coronary disease in humans, and thus maintain normal cholesterol content in the blood plasma and the interrelationship of types of lipoproteins that bind cholesterol - HDL (high density lipoprotein) and LDL (low density lipoprotein). The long-term effects of physical activity on blood lipids are well known (Apor, 2003).

The aim of the study was to determine possible differences in the biochemical parameters and parameters of body composition following treatment of experimental aerobic training, as well as the association of some biochemical parameters Body Mass Index, Body Fat Mass and Visceral Fat.

METHOD

The study was longitudinal in character and empirical methods were used, while in accordance with the goal, and according to our knowledge of the problem, laboratory methods of research were also applied. The pre-experimental research draft was used (e.g. one group draft pre-testing - post-testing).

For the purpose of the study, the sample was derived by a random sampling method from the population of working age women (average age 38.3 ± 4.45 years) from Pančevo. The sample was drawn according to the classification of the BMI that was BMI≥25 kg/m2. The measuring of variables for the assessment of body composition was carried out on a sample of 23 subjects in the MIL (a research laboratory), Faculty of Sport and Physical Education, University of Belgrade in 2014. All of the subjects at the time of implementation of the treatment were healthy, and their health had been controlled by a doctor of sports medicine. Prior to the commencement of the research, the subjects were informed about the course and the duration of the study, and given a written consent form to sign in accordance with the ethical principles for biomedical research on humans - Declaration of Helsinki (2013). Only after signing the consent did the initial measuring and application of the eight-week treatment training begin.

As a sample of measuring instruments, the following anthropometric measures were selected: 1) Body height (cm) - measured by anthropometry (Martin) and 2) Body weight (0.1 kg) measured by InBody 230 (Biospace Co., Ltd, Seoul, Korea). Based on the values of body height and weight the BMI (Body Mass Index) was calculated. Reference BMI values were determined by the World Health Organization, (2000b).

Physical composition was assessed by: 1) Body fat mass (0.1 kg) - measured by InBody 230; 2) Skeletal Muscle Mass (0.1 kg) - measured by InBody 230; 3) Percent Body Fat (%) - measured by InBody 230 and 4) Visceral fat (cm2) - measured by InBody 230 (Biospace Co., Ltd., Seoul, Korea). The InBody 230 apparatus based on the bioelectrical impedance (BIA) was used to determine physical composition. The BIA analysis is a fast, noninvasive method for evaluating physical composition. This method evaluates the structure of body composition by releasing a safe quantity of low frequency electrical power (800 micro amperes) through the human body. The electrical power passes through the body without causing muscle resistance, but resistance occurs in the fat tissue. This resistance is named bioelectrical impedance and is measured by instruments that assess physical composition. Compared to DEXA, InBody (Biospace Co., Ltd., Seoul, Korea) proved to be a method which provides more precise results ($r = 0.974$) (Sudarov & Fratrić, 2010).

The biochemical parameters of the initial and final measuring were obtained from the analysis of blood samples in a standard biochemical laboratory in Pančevo Health Center: 1) Blood glucose (mmol / L); 2) HDLD (mmol / L); 3) LDL (mmol / L).

The experimental factor is guided low intensity aerobic training consisting of brisk walking on the treadmill for a period of eight weeks, carried out at the fitness center Fiesta in Pančevo three times per week for 60 minutes. Each session was structured into three phases: induction, which took about 10 minutes and was meant to enhance the activity of the heart and circulatory system, respiratory system, and also to increase the activity of the nervous system, produce an impact on the mobility of muscles and joints, and prepare the body for the upcoming physical strain. The main part of the training lasted for 40 minutes and was carried out by brisk walking on the treadmill at a speed which depended on the Target Heart Rate of each individual subject. During the main part of the training, heart rate was monitored, and the intensity of walking constantly adjusted to maintain the heart rate calculated for the same training zone. The final part was designed for 10 minutes and was based on stretching and relaxation exercises that are aimed at relaxing the body, and verbal communication. This training was designed for subjects at any level of physical fitness, and was based on the individual calculation grounded in determining the Target Heart Rate (THR) recommended by the American College of Sports Medicine (2001), indicating intensity of training in the range of 50% to 80% of maximum physical capacity, i.e. VO2max, which corresponds to 65% to 90% of maximum heart rate. THR was calculated by Heart Rate Reserve Method (HRR) or Karvon's method, which is based on the difference between Maximal Heart Rate MHR and Resting Heart Rate (RHR).

Target Heart Rate Reserve (THRR) = ((MHR-RHR) X% exercise intensity) + RHR

The zone of pulse load was calculated for each subject individually, for each training session by means of Karvon's method. Prior to the agreed training, the subjects recorded the necessary values of Resting Heart Rate (RHR) when they woke in the morning and brought them to the session to enable the on-site calculation of the pulse load which varied. Reference values of heart rate after waking up in the morning and during the treatment were measured by a Polar FT1 Heart Rate Monitor.

Statistical analyses included the computation of descriptive statistics for the measures of central tendency: arithmetic mean (AS); variability measures: the standard deviation (S); measures of distribution: skewness - asymmetry of distribution (Sk), kurtosis - homogeneity of distribution (Kurt). Normality of the data distribution was tested by the Kolmogorov-Smirnov test, and the differences between the average rates during the initial and final measuring were tested using parametric statistical methods for determining differences, the t-test for two dependent groups of subjects (Paired-Samples T Test). The relationships between biochemical and body composition parameters at the initial and final measuring were determined by a set of linear regression analyses.

RESULTS

Table 1 shows the basic descriptive and statistical significance of the Kolmogorov-Smirnov test and the difference of average values between the tested variables at the initial and final measuring.

The measures of distribution forms do not exceed unacceptable coefficients, and for this reason can be considered satisfactory. A certain deviation regarding the skewness values present in the LDL at the final measuring can be explained by the positive asymmetry, i.e. the grouping of results in areas of lower value, which, in any case, explains the improved results during the final measuring of the variables for the estimation of bad cholesterol as it is the inverse metric. The kurtosis values of the variables mentioned during the initial and final measuring have distinct tapered distribution, e.g. most of the results are grouped around the arithmetic mean, which increases the homogeneity of the distribution and makes it leptokurtic. Based on the statistically significant value of KS test, it can be concluded that the distribution does not differ significantly during the initial and final measuring, and that the use of parametric statistical methods is justified.

Table 1 Descriptive statistics and differences between the results the initial and final measuring

Variable	Measuring	Mean	SD	Sk.	Kurt.	p-K-S	t-test*
Body Height (cm.)	Initial	166.760	9.470	0.498	0.080	0.999	0.164
	Final	166.766	9.450	0.497	0.073	0.999	
Body weight (kg.)	Initial	92.110	13.415	0.093	0.168	0.746	3.910*
	Final	88.840	12.915	0.405	0.358	0.969	
Body fat mass (kg.)	Initial	38.500	11.454	0.982	1.648	0.863	6.009*
	Final	34.650	10.266	1.118	2.055	0.860	
Skeletal Muscle Mass	Initial	29.770	6.452	0.881	0.294	0.887	0.671
(kg.)	Final	29.970	6.621	0.717	0.502	0.984	
Body mass index	Initial	33.230	5.188	0.941	1.843	0.292	3.712*
(kg/m^2)	Final	31.440	4.494	0.796	1.824	0.469	
Percent Body Fat (%)	Initial	41.560	9.121	0.015	1.057	0.993	5.453*
	Final	38.850	8.892	0.356	1.013	0.973	
Visceral Fat (cm^2)	Initial	143.170	40.015	0.608	0.808	0.766	6.636*
	Final	123.060	34.391	0.315	1.312	0.926	
Blood glucose	Initial	5.856	0.566	0.267	0.826	0.811	4.719*
(mmol/L)	Final	5.070	0.177	0.176	1.593	0.847	
HDLD	Initial	1.388	0.136	0.984	1.336	0.905	-5.170*
(mmol/L)	Final	1.969	0.312	-0.826	0.867	0.904	
LDL	Initial	4.106	0.621	1.248	2.618	0.714	3.493*
(mmol/L)	Final	3.457	0.763	1.639	2.411	0.504	

Key: Mean – arithmetic mean; SD - the standard deviation ; Sk- measure of distribution symmetry; Kurt- measure of distribution homogeneity; p-K-S - the level of statistical significance of the Kolmogorov - Smirnov test; t-test * the value of the t-test for two dependent groups of subjects and its statistical significance at $p < 0.01$

The values of the t-test indicate that there is a statistically significant difference between the means of the tested variables at the initial and final measuring. The differences were revealed in the following variables: *Body Weight, Body Fat Mass, BMI, PBF, Visceral Fat, Blood Glucose* and in *LDL* variables in favor of the final measuring, given that it is an inverse metric, and that the higher the values of these variables, the poorer are health values. The same can be attributed to the variable *HDLD* whose t- test value has a negative meaning, but in reality the good cholesterol's higher values indicate better results. However, the difference can also be attributed in favor of the final measuring.

The following tables show a linear regression analysis of biochemical parameters with *Index of Body Weight, Body Fat Mass* and *Visceral Fat* at the initial and final measuring, all at the p <0.05 level of statistical significance.

Table 2 Linear regression analysis for BMI

Variable	Initial measuring				Final measuring			
	rpart.	t	Beta	pbeta	rpart.	t	Beta	pbeta
Blood glucose	0.486	1.477	0.511	0.190	0.500	1.664	0.631	0.147
HDLD	0.209	0.721	0.261	0.498	0.126	0.617	0.209	0.560
LDL	0.107	0.077	0.028	0.941	0.055	0.636	0.240	0.548
	R=0.548	R^2=0.300			R=0.573	R^2=0.328		
	F=0.857	P=0.512			F=0.977	P=0.463		

Key: rpart. - partial correlation coefficient; t - value of t -test; Beta - standardized regression coefficients; pbeta - the level of statistical significance of the Beta regression coefficient; R - coefficient of multiple correlation; R2 – the coefficient of determination; F - value of F ratio; P - multiple correlation coefficient of statistical significance.

By analyzing the results of the regression analysis of the *Body Mass Index* in Table 2 at the initial and final measuring, it had been concluded that there is no statistically significant correlation between the system of predictor variables with the criterion variable at the level of inference (P> 0.05). The multiple correlation coefficient at the initial testing was R = 0.548 which explained only 30% of the common variability between the predictor systems and criterion variables. This means that some of the other features and capabilities have a greater impact on the BMI (level of muscle fitness, muscle length, everyday activity, etc.). During the final measuring, that ratio was slightly higher R = 0.573, and the coefficient of determination explained almost 33% of the common variability between the test system variables and biochemical criteria. It can be concluded that in this case some other features have a greater impact on the realized value of the *Body Mass Index.*

The observed increased and positive value of the partial correlation coefficient in the variable Blood Glucose at the initial and final measuring actually represents a negative value (inverse metric). This could be due to the effect of some other factors, because the system as a whole was not statistically significantly associated with the criterion, but in each case the correlation analysis indicated that higher values of sugar in the blood influence the *BMI.*

Table 3. Linear regression analysis of the BODY FAT MASS

Variable	Initial measuring				Final measuring			
	rpart.	t	Beta	pbeta	rpart.	t	Beta	pbeta
Blood glucose	0.448	1.299	0.434	0.242	0.440	1.265	0.491	0.253
HDLD	0.230	0.508	0.178	0.629	0.265	0.925	0.321	0.391
LDL	0.387	0.816	0.286	0.446	0.204	0.091	0.035	0.930
	R=0.589 R2=0.200				R=0.543 R2=0.198			
	F=1.061 P=0.433				F=0.834 P=0.522			

The obtained results in Table 3, between the biochemical parameters and *Body Fat Mass* variable, based on the multiple correlation coefficient and its statistical significance, also point to the lack of a statistically significant correlation with the criterion predictor system at the initial and final measuring. The predictor system at the initial and final measuring explains only about 20% of the common variance with the criterion.

The partial correlation coefficients, if the influence of other variables in the predictor system at the initial and final measuring is ignored, indicate that the greatest mathematical positive or negative logic connections was made by the *Blood Glucose* variable. Regarding cholesterol, it is clear that the partial correlation coefficient decreased at the final measuring, especially for the *LDL* variables. Given that the entire system in this case is also not statistically significantly associated with the criterion, it can be concluded that some other parameters, which were not the subject of this study, had a greater impact on the criterion.

Table 4 Linear regression analysis of the VISCERAL FAT

Variable	Initial measuring				Final measuring			
	rpart.	t	Beta	pbeta	rpart.	t	Beta	pbeta
Blood glucose	0.457	1.331	0.474	0.231	0.426	1.260	0.517	0.254
HDLD	0.185	0.587	0.219	0.579	0.007	0.202	0.074	0.847
LDL	0.139	0.058	0.022	0.956	0.053	0.450	0.184	0.668
	R=0.510 R2=0.160				R=0.460 R2=0.211			
	F=0.703 P=0.584				F=0.536 P=0.674			

After analyzing the results in Table 4, it can also be concluded that there is no statistically significant correlation between the biochemical parameters and *Visceral Fat* variable neither at the initial nor final measuring. The determinant coefficient in this case shows a very small percentage of the common variance of only 16% at the initial, and somewhat more at the final measuring, which was about 21%.

Also, a mathematically positive and logically negative correlation indicates the Blood Glucose variable coefficient which did not significantly change at the final measuring in comparison to the initial. The *HDLD* variable on initial testing indicated a negative correlation, but its relationship to the final measuring had changed. The *LDL* variable acted similarly since its ratios decreased at the final measuring, which can be attributed to an eight-week kinesiology treatment. All of the presented conclusions cannot be accepted without doubt for it must be taken into consideration that the entire system in this case was not statistically significantly associated with the criterion.

DISCUSSION

The program of guided physical activity can be said to have caused positive changes in almost all the tested variables, except for variables for the evaluation of longitudinal dimensionality of the skeleton and variables for the assessment of muscle mass in the body, which was to be expected, given that aerobic training at the test age was not intended and designed for a change in the amount of muscle tissue. The research findings of Campbell & Leidy (2007) suggest that aerobic training in women with different supplementation does not lead to significant changes in muscle tissue, but some changes after supplementation were observed in the bone tissue. Based on the obtained physical parameters measured by bioelectrical impedance (BIA), for which Heinonen, Oja, Sievanen, Pasanen & Vuori (1998) argue that it gives better results than the DEXA method because the results are obtained at the level of the whole body, and the biochemical parameters, it would seem that aerobic training increased the functional adaptation capabilities of the body. Its action can be associated with an increase in the body's resistance to adverse environmental effects. Thanks to the physiological and biochemical effects of adaptation, if aerobic training is conducted over a longer period of time it contributes to the following: an increase in the concentration of high density lipoproteins (HDL) (Motoyama et al., 1995; Ferguson et al., 2003), the reduction in systolic arterial blood pressure (Gerage et al., 2013; Miranda et al., 2013), the decrease in blood cholesterol concentration and the concentration of triglycerides (Schuit et al., 1998). The results indicate that the body mass index decreased significantly compared to the values measured prior to the physical exercise treatment. During the initial measurement it was (BMI 33.2 ± 5.1 kg / m2), and after the eight-week aerobic training it was (BMI 31.4 ± 4.4 kg / m2). Also, the body weight was reduced by about 2.5% compared to the initially measured values. Similar research had been conducted in Taiwan by Lang, Chou, Sheu & Lin (2011). The research was conducted on a sample of men and women whose body mass index was above 25 kg/m2, the results indicated that after an eight-week exercise program, the BMI had significantly reduced, and the body had been reduced by about 3%. The research, conducted in Serbia by Ilić, Ilić, Mrdaković & Filipović (2012) on a sample of obese women over a period of 16 weeks indicates a decrease in body weight during the program by about 10 kg in moderately obese and 20 kg in extremely obese women. The findings from this study are consistent with the research findings of Wieczorek-Baranowska et al., (2011), related to changes in blood glucose and insulin reduction in women attributed to an eight-week aerobic training. The authors state that, among other things, glucose in the body is used as the main sugar in the blood, which is the most important source of energy. However, increased amounts of glucose lead to increased secretion of insulin in order to dissolve the glucose molecules that can only decompose in such a manner to be able to enter cells and release energy. Hence, the increased amount of glucose in the blood can lead to the emergence of diabetes. Therefore, they are of the belief that physical training represents an effective way of reducing it. When other biochemical and physical parameters are assessed, the results can then be compared with the findings obtained in Korea by Han, (2013), who claims that aerobic training over a period of 12 weeks significantly reduced body weight, BMI, waist circumference, visceral fat, subcutaneous adipose tissue and significantly increased VO2max in middle-age women. The author also recommends aerobic training as an effective means of preventing the obesity index, reducing blood fat and insulin resistance.

Research conducted by Stasiulis, Mockienė, Vizbaraite & Mockus, (2010) indicates that physical training in young women over a period of 8 weeks also achieved significant changes in HDLD, values of which are augmented after the eighth week. However, the LDL had not decreased and no statistically significant changes had occurred at the end of the treatment. Body weight and BMI began to change after the second week of aerobic exercise, and in the fourth week there was an increase in VO2max.

The results of the regression analysis of the initial and final state in the research indicate that the system of biochemical parameters; Blood glucose, LDL and HDLD cholesterol in middle-aged women before and after physical training for a period of eight weeks have not been significantly determined by the BMI, Visceral Fat and Body Fat Mass, (from 16% to 30% at the initial testing and 18 % to 32.8% at the final measuring). The biochemical parameters for the most part (32.8%) have been associated to the nutritional status of women at the final measuring, while this percentage was least pronounced in the criteria Visceral Fat at the initial measuring (16%). After the application of the eight-week aerobic training, the proportion of biochemical parameters in a variable Body Fat Mass was reduced, while it increased slightly for the BMI and Visceral Fat. Obesity, defined as an excessive accumulation of body fat, is often associated with low concentrations of high-density lipoprotein cholesterol. However, HDL particles are heterogeneous in their size and composition, and therefore can be variously associated with fatty deposits as indicated by Kouda et al., (2015). Our results suggest the presence of this phenomenon (negatively associated with the emergence of Body Fat Mass). However, it must be taken into account that this was a small sample and the system was not statistically significant. Also, the research results of Gishti et al., (2015) should be mentioned since they indicate that total fat and abdominal fat may be more correlated with the risk factors for the onset of cardiovascular disease than to the body mass index.

Based on the obtained results, it can be assumed that some other features, phenomena and parameters, which had not been used in the analysis, have a greater influence on nutritional status, especially body weight and height, and free fat in the body. Also, attention was not paid to the subjects' everyday lifestyle, intake of certain substances and their mutual influence, nutritional supplements intake in women who exercise regularly or activity and rest ratio (sleep). It should not be forgotten that the state of obesity, percentage and percentage of body fat greatly depend on the financial status of an individual. The latest research by Rodrigues & Silveira (2015) indicates that the financial state of an individual is correlated with their nutritional status. People with higher incomes have a lower risk factor for cardiovascular disease and obesity, because their diet is more varied and has more unsaturated fats, unlike the diet of people with lower income. Due to this finding, further research needs to take into account this fact when forming a sample of individuals to be tested, as it would be interesting to examine the impact of their financial status on biochemical parameters and nutritional status before and after aerobic training.

CONCLUSION

In general it can be concluded that the experimental program has given the expected results in terms of the reduction in body weight of about 2.5% over a period of eight weeks, and that the Body fat mass, BMI, PBF, Visceral fat, Blood glucose and LDL were also reduced. This phenomenon can be linked to the effects of aerobic exercise and its positive impact. The consequence of treatment is also an increase in the HDLD value. Given that Warburton, Nicol & Bredin, (2006) have presented evidence about the positive effects of moderate intensity aerobic training on human health, the authors recommend moderate intensity aerobic exercise as an effective means for improving physical and biochemical parameters, health care and weight-loss. They also believe that the exercise intensity must be increased during the programming process for the next transformation in this sample in order to get even better effects on the reduction of the total fat that would be associated with positive metabolic index changes.

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UTICAJ AEROBNOG TRENINGA NA BIOHEMIJSKE I FIZIČKE PARAMETRE GOJAZNIH ŽENA

Istraživanje je sprovedeno na radno sposobnoj populaciji žena klasifikovanih prema vrednostima indeksa telesne mase (BMI≥25 kg/m2) iz čega je dobijen uzorak od 23 ispitanice prosečne starosti 38, 3±4,45 godina iz Pančeva. Na inicijalnom i finalnom merenju od ispitanica su uzimane analize krvi i merena je kompozicija tela. Eksperimentalni faktor podrazumevao je usmereni aerobni trening niskog intenziteta u trajanju od osam nedelja. Cilj studije bio je utvrditi efekat transformacionog procesa i relacije bihemijskih parametara na inicijalnom i finalnom merenju sa varijablama za procenu kompozicije tela. Rezultati istraživanja dobijeni Paired-Samples T Test ukazuju na postojanje statistički značajnih razlika u sledećim varijablama: Body weight, Body fat mass, BMI, Percent Body Fat, Visceral fat, Blood glucose, LDL i HDLD u korist finalnog merenja. Regresione analize ukazuju da sistem biohemijskih parametara u maloj meri determinišu BMI, Visceral fat i Body fat mass (od 16% do 30% na inicijalnom merenju i od 18% do 32,8% na finalnom merneju) i da sistem prediktora ni u jednom slučaju nije bio statistički značajno povezan. Biohemijski parametri u najvećoj meri su bili povezani sa stanjem uhranjenosti žena na finalnom merenju, dok je taj procenat bio najmanji u kriterijumu Visceral fat na inicijalnom merenju. Na finalnom merenju udeo biohemijskih parametara u stanju Body fat mass se smanjio, dok se kod BMI i Visceral fat blago povećao. Autori preporučuju aerobni trening umerenog intenziteta kao efikasno sredstvo poboljšanja telesnih i biohemijskih parametara u očuvaja zdravlja i smanjenju telesne mase.

Ključne reči: *bioelektrična impedansa, metabolički status, radno sposobne žene, smanjenje telesne mase.*