Gender Differences in Decreasing of Body Mass and the Percentage of Body Fat with Body Building

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Abstract: ***The research was conducted on a sample of 20 recreationalists (10 female and 10 male), between the age of 20 and 30, with the purpose of losing weight and decreasing the percentage of fat mass. Changes in body composition were measured through four variables: weight – body mass (BM), percentage of body fat (%BF), water percentage (%W) and percentage of muscle tissue (%MT). The subjects were measured three times - before the start of the exploration (initial measurement), at the end of the second month (control measurement) and at the end of the forth month (final measurement). Both groups were exercising 1½ hours (90 minutes), five times a week. The differences between all measurements were estimated with T–test of small dependent samples, and the sex differences in variables were determined with T–test of small independent samples. Statistically significant differences existed between female and male participants in all variables, on a level: .00, .01, .02 and .03, in three of the measurements. There are reductions in body mass (BM) and the percentage of body fat (%BF) from initial to final measurements that are statistically significant, in both genders. The only sex difference that can be seen in male subsample, the changes in percentage of body fat (%BF) appear earlier, rather than at control measurements.***

Keywords: recreationalists, female, male, body building, losing weight, decreasing body fat, control measurement, final measurement

1. Introduction

The benefits of regular exercise regimen include improved insulin sensitivity, lower blood pressure, smaller values of cholesterol and reduced risk of death. Moore, J.B., Beets, M.W., Barr-Anderson, D.J., and Evenson, K.R. (2013), proved in their research that negative impact of sedentary time can be overcome by engaging in vigorous activity. Energy expenditure and basal metabolic rate are directly connected with intensity and duration of activity. So if the activity has high intensity and involves large muscle groups, according to Bjorntorp, P. (2001) it can increase the rest metabolic rate for up to 10-15 times_with untrained persons, and 25-30 times with trained. Off course, such an activity can't last very short and its participation in total energy expenditure is low. But, when low-intensity activity is applied, the majority of the participants, even untrained ones, can perform it for a long time, which makes an increase of the total energy expenditure.

Bouchard, C., Depres, J.P., & Tremblay A. (1993), estimated in their research that exercise has an acute effect on resting metabolic rate, but this was not proven for the long-term influences of exercise training, due to suppression of the cessation of training. But, according to Dallal, C. M., Brinton, L.A., Matthews, C.E., Pfeiffer, R.M., Hartman, T.J., Lissowska, J.; Falk, R.T., Garcia-Closas, M., Xu, X., Veenstra, T.D., & Gierach, G.L. (2015) higher activity was associated with accelerated metabolism due to increased estrogens' hydroxylation, while sedentary behaviour slows down the metabolism. Also Katch, F.&McArdle, W. (1993) claims that regular physical activity on a daily basis can speed up the metabolism during the day, due to a bigger energy expenditure and higher percentage of muscle tissue which burns more calories, which is the reason why, according to Milošević, P. (1986), athletes are using 10-20% more energy even when they are not training, probably because in only one game and a warm up, they can spend up to 1800kcal, which equals the 24 hours need for the rest metabolic rate, according to Bjorntorp, P. (2001). The explanation to that is that not only active people spend more energy, but also they are decreasing the cortisol level as a stress hormone, which might be a factor of persistent obesity, not responding to exercise.

According to Bjorntorp, P. (2001) body fat mass increases 2 kg in one year in many individuals, due to energy imbalance of around 150 kJ, which can be depleted with just 10 extra minutes walk a day. Although, some authors like US Department of Health and Human Services (1996) recommend only 30 minutes a day low-intensity activity, others like Ekblom, B. (1994) recommend twice a day walking or cycling for 15 minutes. So, it is very easy to put on weight, with all the choices and availability of food around us and technological revolution which make our life easier. Although little activity is necessary to eliminate the extra energy input and the percentage of fat, still, people are lazy which is the reason why the number and percentage of obese people in the world is so high (according to WHO (2016) 39% of the adults above 18 are overweight, 11% of men and 15% of women are classified as obese, and 42 million children under the age of 5 are overweight or obese) and has even been getting higher on a daily bases (between 1980 and 2014 the prevalence of obesity has doubled, according to WHO (2016) with an increase of 11 million during the last 15 years among children).

2. Material and Methods

a. Participants

The research was conducted in a fitness studio on 20 recreationalists with an age of20 to 30, who wanted to lose weight and decrease the percentage of fat mass, divided into two groups, female and male, each with 10 participants. Body composition was followed by measuring four variables with Tanita BC536: weight – body mass (BM), percentage of body fat (%BF), water percentage (%W) and percentage of muscle tissue (%MT). With bioelectrical impedance analysis (BIA), used in Tanita device, it is very easy to provide information about fat, muscle and water percentage, due to their different responses. Practically, according to Andreacci, J. L., Nagle, T., Fitzgerald, E., Rawson, E. S., and Dixon, C. B. (2013), when a small electrical current is used, different tissues have different resistance to the flow (impedance), which is measured with the analyzer. For example, lean tissues, like muscles, according to Kyle, U., Bosaeus, I., De Lorenzo, A., Deurenberg, P., Elia, M., Gomez, J., Heitmann, B., and Kent-Smith, L. (2004) are highly conductive to the current flow, due to high percentage of water and electrolytes, so they have low impedance. Fat tissue is a poor conductor, which is the reason why it has high impedance. According to Deurenberg, P., Weststrate, J., Paymans, I., and Van der Kooy, K. (1988), measurements are very sensitive to the hydration of the body, so from the exact time of the measurement in comparison to the exercise, according to Heyward, V. H., & Wagner, D. R. (2004) in order for the results to be authentic, they should be measured 12 hours prior to the exercise.

According to some researches, such as those by Jürimäe, T., Sudi, K., Payel, D., Leppik, A., Jürimäe, J., Müller, R., and Tafeit, E. (2003), the results obtained with Tanita have high correlation with the percentage of body fat obtained in clinical methods. The measuring of the other three variables (percentage of muscle tissue, percentage of water in the body and body mass), come as a bonus, because not only do they enable the follow of the changes in body fat, but also in those variables that can give us a complete picture of the changes that appear during weight loss. Some authors, like Jürimäe, T., Jürimäe, J., Wallner, S.J., Lipp, R.W., Schnedl, W.L., Möller, R., and Tafeit, E. (2007), consider this method used in Tanita (BIA - bioelectrical impedance), to be not as stable, because different results can appear in different period of menstrual cycle and can also show gender differences. But, since the usage of this device is very practical, measuring four variables at the same time, and non-invasive, it could be very convenient to use for small researches, like ours. So, we decided to use it in this research, because it provides the measurements of the variables that are very important in weight loss follow up researches.

b. Test protocol

The group had been exercising 1 ½ hours (90 minutes), five times a week, mostly in the morning, with the purpose of speeding up the metabolism. The pulse was measured manually and the criteria was the formula: 220 - years = maximal pulse rate, cited by Medved, R., et all. (1987). After evaluating the maximal pulse rate, the range of 30% of the maximum pulse rate was determined and the subjects were exercising in that range, due to a fact that fat is oxidizing in aerobic conditions. The pulse was measured after every finished round.

Most of the exercises were aerobic and exercises on cardio gadgetry. The applied protocol was: after a short warm up, every subject started the exercise with a stepper or a treadmill for 10-15 minutes (cardio exercises), as a preparation for the next exercises. They had to practice on both devices, but the time spend on each was with individual preference. Also, at the end, the subjects again performed 30 minutes on a stepper or a treadmill, with the same conditions (30% of the max pulse).

After this, they approached to exercises for chest, biceps, back and triceps, for shoulders, legs and lastly for abdomen. For the big muscle groups like: chest, back and legs, 30% of the weight was used in the exercises, and for smaller ones like: biceps, triceps and shoulders, the exercises were performed with 25-30% of the number of max repetitions;

c. Nutrition

Our first intention was also to evaluate the daily energy input using questionnaires with the exact amount and type of products which the subjects would consume on a daily basis, for every subject. But unfortunately the subjects didn't agree to that.

Nevertheless, they were advised to change the daily nutritional habits, in terms of the product choices and the preparation of the food. They were advised to consume water, tea (with no sugar added) and soups, take fresh fruits and vegetables, take integral bread and pasta instead of white ones (because they have more cellulose fibers, which cause satiety), to exclude mayonnaise, sour cream and other products with high percentage of fat (all the types). As a healthy choice of fat fish, seafood, olives, seeds, nuts (but only small amounts), olive oil and grape seed's oil were recommended. They were advised to change the preparation of the food and to consume boiled and roasted food (with minimum oil), instead of fried (especially in deep oil).

Since the subjects didn't cooperate in the measuring of the energy input, information about the participating of the dieting and the food choice in the decreasing of weight are not available.

d. Statistical analysis

Four variables were taken into account in this research: body mass (BM), percentage of body fat (% BF), water percentage (% W) and percentage of muscle tissue (% MT). In order to note the time when the changes appear, the subject were measured 3 times - first before the start of the exploration (initial measurement), at the end of the second month (control measurement) and at the end of the forth month (final measurement).

In order to estimate the differences between initial and control, between control and final, and between initial and final measurement, descriptive statistics were applied and T–test of small dependent samples, and in order to estimate the gender differences in variables, T–test of small independent samples was applied. The results are shown in five tables and one graphic.

e. Purpose of the research

The purpose of the research was to estimate the gender differences in decreasing body mass (BM) and the percentage of body fat (%BF), and at the same time, the increasing in muscle tissue (%MT) and the percentage of water (%W), if any. Also, the time needed to evaluate all the changes in both genders was measured, hoping to estimate the reason why female participants need more time to obtain the same results as male participants.

3. Results

The differences between the two subsamples (female and male) that wanted to reduce weight and the percentage of body fat are shown in tables 1, 2 and 3. The gender differences, from initial to control measurements are shown in table 1, where it can be seen that in all four variables there are statistically significant differences between the two subsamples on a level of: .00.

Table 1: Significance of the differences in arithmetic mean in initial and control measurement between male and female group that want to lose weight (N= 10 female and N= 10 male)

variables	female		male		T-test	df	Sig
	Mean	SD	Mean	SD			
BM	67,84	8,81	89,23	16,74	-3,77	28,00	**,00**
%BF	33,37	9,63	22,74	8,00	3,21	28,00	**,00**
%W	48,46	3,67	54,21	4,90	-3,27	28,00	**,00**
%MT	43,79	2,28	64,29	6,20	-10,05	28,00	**,00**

Table 2: Significance of the differences in arithmetic mean in control and final measurement between male and female group that want to lose weight (N= 10 female and N= 10 male)

variables	female		male		T-test	df	Sig
	Mean	SD	Mean	SD			
BM	65,10	7,78	89,05	15,16	-4,67	28,00	**,00**
%BF	30,29	10,30	21,04	6,84	2,94	28,00	**,01**
%W	50,63	4,00	55,44	5,48	-2,46	28,00	**,02**
%MT	43,64	1,86	65,94	6,20	-11,05	28,00	**,00**

The situation is very similar from control to final measurement (table 2), where the differences between the two subsamples (female and male) are statistically significant in all four variables on a level of: .00 (BM), .01 (%BF), .02 (%W) and .00 (%MT). And also from initial to final measurement (table 3) there are statistically significant differences between the two subsamples in all four variables on a level of: .00 (BM), .03(%BF), .02 (%W) and .00 (%MT). From the values of the significance, value of arithmetic mean and the sign of T-test it can be concluded that male weight more, have bigger percentage of water in body (which is expected since women have 10% more fat in the body and because of the lower amount of water) and bigger percent of muscle tissue (because of the male sex hormone testosterone). Women are “better” in only one variable - have bigger percent of body fat (%BF).

Table 3: Significance of the differences in arithmetic mean in initial and final measurement between male and female group that want to lose weight (N= 10 female and N= 10 male)

variables	female		male		T-test	df	Sig
	Mean	SD	Mean	SD			
BM	62,34	7,48	88,65	13,94	-5,55	28,00	**,00**
%BF	26,58	5,61	21,15	6,46	2,26	28,00	**,03**
%W	50,45	4,45	55,66	5,82	-2,48	28,00	**,02**
%MT	44,37	4,06	65,77	6,19	-9,88	28,00	**,00**

In the tables 4 and 5 are shown significances of the body changes that occur separately in female and in male, from initial through control to final measurements. By observing table 4, where the results of women subsample are shown, it can be concluded that significant changes in body mass (BM) exist in all three measurements (initial, control and final) on a level of .00. There is a statistically significant change in the variable –percent of water (%W), on a level of .00 only at control measurement. At the last (final) measurement, statistically significant change appeared not only in body mass (BM) on a level of .00, but also in variable – percentage of body fat (%BF), on a level of .01. As shown in the same table, the percentage of water (%W) and the percentage of muscle tissue (%MT) didn’t have statistically significant change from initial to final measurement.

Table 4: Significance of the differences in arithmetic mean in initial, control and final measurement in female group that want to lose weight (N= 10)

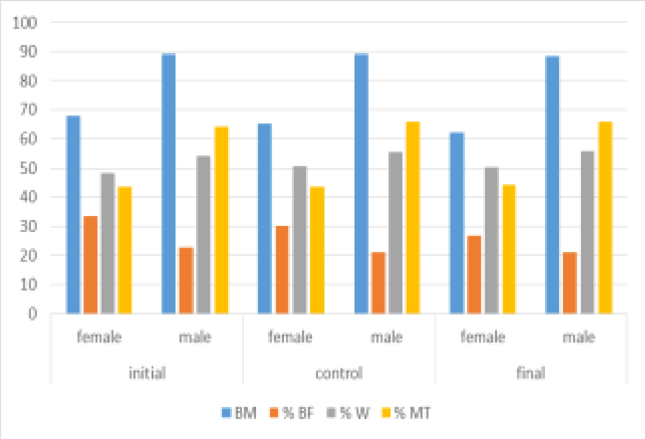
variables	initial to control measurement (significance)	control to final measurement (significance)	initial to final measurement (significance)
BM	**,00**	**,00**	**,00**
%BF	,33	,14	**,01**
%W	**,00**	,87	,16
%MT	,79	,55	,64

Table 5: Significance of the differences in arithmetic mean in initial, control and final measurement in male group that want to lose weight (N= 10) according to Shukova-Stojmanovska, D., Dimeski, F.&Protić-Gava, B. (2014)

variables	initial to control measurement (significance)	control to final measurement (significance)	initial to final measurement (significance)
BM	**,00**	**,00**	**,00**
%BF	,07	**,01**	**,02**
%W	,17	**,02**	,09
%MT	,34	,95	,40

The results of the male subsample are presented in Table 5. It can be concluded that significant changes in body mass (BM) exist in all three measurements (initial, control and final) on a level of .00, which is the same with the female subsample. Statistically significant change occur from initial to final measurement in two variables – body mass (BM)-.00 and percentage of body fat (%BF), on a level of .02, which was similar with female subsample, only in male subsample the statistical significant changes appear earlier, at control measurement (on a level of .01). The percentage of water (%W) shows statistically significant change from control to final measurement on a level of ,02, but no statistically significant change appears in the variable muscle tissue (%MT) from initial to final measurement.

The changes in all four variables are also shown graphycally, in graphic 1, where all the changes can be noticed immidiatelly. On the X–axis, all four variables are shown in the three measurements (initial, control and final), whereby blue colour represents body mass (BM), orange - percentage of body fat (%BF), grey - percentage of water (%W) and yelow - percentage of musscle tissue (%MT). On the Y–axis the values of all four variables are shown and their values in the three measurements (initial, control and final).



Graphic 1: Graphicall display of the results in initial, control and final measurements female and male group that want to lose weight

4. Discussion

Després, J.P., Tremblay, A., Nadeau, A. and Bouchard, C. (1988) almost thirty years ago claimed that there is a sex difference in losing fat during physical activity, because men have better response to exercise which is why they lose more fat. Mobilization of fat also depends a lot on its distribution in the body. According to Petrović, D. (1994) female sex hormones lead to deposition of fat in lower parts of the body (under navel) and we get a pear like obesity, while the male sex hormones lead to decrease of the number and the size of the adipocytes in the lower parts of the body and due to cortisol, storage of fat around the abdomen (upper parts of the body) we get an apple like obesity. The type of obesity is also important, so as was suggested by Bjorntorp, P. (1978) that obese subjects with hyperplastic obesity (large number of fat cells) were more resistant to fat loss in response to negative energy balance then those with hypertrophic obesity (larger fat cells).

But, it is not only about deposition of fat tissue, but also about gender differences in metabolic response of the fat tissue on diet and on physical activity. The same author, Bjorntorp, P. (1978), claims that fat cells in female subjects can deposit triglycerides much easier and at the same time due to decreased lipolysis they can use the fat from the depot as energy much harder. Ostman, J., Arner, P., Engfeldt, P., and Kager, L. (1979), have the same opinion and claim that female adipocytes, in gluteal femoral part of the body, have lower lipolytic response to catecholamine. That is the main reason, according to Despres, J.P., Tremblay, A.& Bouchard, C. (1989), why female can hardly start up the lipolyse of the fat tissue in that section, even as a response to an exercise. Also Despres, J.P., Pouliot, M.C., Moorjani, S., Nadeau, A., Tremblay, A., Lupien, P.J., Theriault, G. and Bouchard, C. (1991) showed in a research, in which subcutaneous fat was measured with computed tomography after applied physical activity for 14 months, that abdominal fat in women is more responsive to exercise then femoral fat. Despres, J.P. (1991) claims that women are more resistant to fat reduction then men, when the distribution is on lower parts of the body. But when the distribution is on upper body parts (abdomen) then there isn't gender difference in fat reduction as a response to physical activity. However, according to the same author, men with upper body fat distribution show a tendency to lose more fat then women in response to endurance exercise. So, men with upper body fat mobilize fat tissue much easier than women during exercise and, as a result, have noticeable fat loss.

Venables, M.C., Achten, J. and Jeukendrup, A.E. (2005) demonstrated in their study that not only women utilize higher absolute rate of lipids, but also lipids participate more in total energy expenditure in different exercise intensities. Similar findings have Melanson, E.L., Sharp, T.A., Seagle, H.M., Horton, T.J., Donahoo, W.T., Grun Wald, G.K., Hamilton J.T., and Hill, J.O. (2002), who investigated the effect of different exercise intensities on energy expenditure over 24 hours and the nutrition oxidation during those days. The results showed that not only women have a little higher fat oxidation during the day (not only during walking, but during active periods of the day, too), but also, their muscle enzymatic profile was favoring fat oxidation, meaning that their muscles were using more fat for energy. They found that the exercise intensity has no effect on 24 hours energy expenditure or nutrition oxidation. Unlike them, according to Horton, T.J., Pagliassotti, M.J., Hobbs, K., and Hill, J.O. (1998), men start to burn fat at lower VO2max and they exhibit an earlier dependency on carbohydrates during exercise, and practically use them as a dominant fuel. The reason for this, according to D'Eon, T.M., Sharoff, C., Chipkin, S.R., Grow, D., Ruby, B.C., and Braun, B. (2002) might be the level of hormones, especially of catecholamines and adrenergic regulation.

This was proven in our research – the decreasing of body mass (BM) started in both genders at control measurement and they maintain to the final and statistically significant changes existed between male and female subsample on a level of .00 (table 1, 2 and 3). But at male subsample, not only that decrease of body mass existed, but significant changes appeared also in the percentage of body fat (%BF) already at control measurement, after two months of exercising, while in female subsample the same changes appear after four months (at final measurement). At the end of the research, statistically significant changes in percentage of fat (%BF) existed between male and female subsample on a level of .00 (table 1), .01 (table 2) and .03 (table 3). So fat reduction in response to exercise appeared also among female subjects, but more time was necessary for the changes to be noticeable (table 4).

On the other hand according to Tremblay, A., Despa, J.P.& Leblanc, C. (1990) the type and intensity of physical activity applied during weight loss program, is also important. So, they claim that subjects involved in vigorous endurance physical activities had lower levels of upper body fat then ones who applied lower intensity activities. Very similar model of training like ours, has been applied by Despres, J. P., et all. (1991), whereas 13 obese premenopausal women, aged average 38.8 years, exercised for 90 min at approximately 55% of maximal aerobic power (VO2 max) four to five times a week for a period of 14 months. Horton, T.J., et all. (1998) in their study determine gender differences in fuel metabolism in response to long-duration exercise, with 40% VO2max. The results showed that women provide 50% of the total energy expenditure from fat oxidation, while men provide 43% from fat oxidation and 57% from carbohydrates. Van Aggel-Leijssen, D.P.C., Saris, W.H.M., Wagenmakers, A.J.M., Senden J.M. and Van Baak, M.A. (2002) tested different intensities, low (40% VO2max) and high (70% VO2max) on fat oxidation at obese man, and concluded that after low intensity training, fat oxidation was increased by 40% (but not in rest), which was on a statistical significant level ($p<.05$), due to increased non-plasma fatty acid oxidation, while high intensity training didn't have such an effect. The reason for that, according to Starritt, E.C., Howlett, R.A., Heigenhauser, G.J., and Spriet, L.L. (2000) might be the reduction in pH (due to accumulation of H ion during high-intensity exercise), which is necessary for the main enzyme for fatty acid transport to be inhibited (carnitine palmitoyl transferase I). This leads to increase in the production of pyruvate and an increase in lactate accumulation, which directly inhibit free fatty acid in adipose tissue to release. Achten, J.&Jeukendrup, A.E. (2004) proved that among trained man, lactate accumulation begins at the same intensity as for maximal fat oxidation. Venables, M.C., Achten, J.&Jeukendrup, A.E. (2005) in their research found that maximal fat oxidation starts in female at 52% VO2max (62% maximal heart rate-HRmax) compared to 45% VO2max in male, which coincides with the lower level of intensity at which man are starting to use carbohydrates as predominant fuel source over fat.

There are differences not only in the opinions about the duration of the program to achieve reduction of weight, but also in the daily and weekly time spent in exercising and in the intensity of exercising. Most authors, like Bouchard, C., Despres J.P.& Tremblay, A. (1993), Institute of Medicine (2002), recommend 60 min/day of moderate intensity physical activity. According to Bjorntorp, P. (2001) the duration of exercise should be 300-360 min/week (approximately 45-50 minutes a day), in order to lose and maintain the weight. On the other hand, some authors like Saris W.H., Blair S.N. &Van Baak M.A. (2003) and Weinsier R.L., Hunter G.R., Desmond R.A., Byrne N.M., Zuckerman P.A., and Darnell, B.E. (2002), think that more exercise is needed to reduce and maintain weight and they recommend 60-90 min/day of brisk walking.

The type of training applied in the research is also playing a role in the success of losing weight. Some authors, Skrypnik, D., Bogdański, P., Mądry, E., Karolkiewicz, J., Ratajczak, M., Kryściak, J., Pupek-Musialik, D.& Walkowiak, J. (2015) found in their research that there weren't any statistical significant differences between groups of obese woman applying different type of training (endurance and endurance strength training). But others, like, Marzolini, S., Oh P.I. &Brooks, D. (2012) and Willis, L.H., Slentz, C.A., Bateman, L.A., Shields, A.T., Piner, L.W., Bales, C.W., Houmard, J.A., Kraus, W.E. (2012) have opposite findings and claim that mixed endurance strength exercise was found to be more effective than endurance exercise in reducing body mass and the percent of body fat.

About the time necessary for the weight loss, different authors recommend different approaches. So, Venables, M.C., Hulston, C.J., Cox H.R., and Jeukendrup, A.E. (2008) recommend four weeks of exercise (exercising three times per week), while Christiansen, T., Paulsen, S.K., Bruun, J.M., Pedersen, S.B., Richelsen, B. (2010) recommend 12 weeks program. In our research the subjects were exercising four months (16 weeks), always in the morning (in order to accelerate the metabolism during the day). But the first results in decreasing weight appear on the control measurement (after two months).

It was explained to all the participants that according to Wilmore, J.H&Costill, D.L. (2004) they need enough water if they want to lose weight efficiently. So from initial to control measurement, increase of the percentage of water (%W) existed only in female sample, and it was statistically signifficant on a level of .00 (table 4), but not from control to final, and from initial to final measurement. In the male sample the differences in the percentage of water existed from control to final measurement on a level of .02 (table 5). But statisticaly significant differences existed between the two subamples (female and male), in water percent in all three measurements, on a level of .00 (table 1), .02 (table 2) and .02 (table 3).

The percentage of muscle tissue (%MT) shows improvements from initial to final measurement (although they aren't statistically signifficant). It can be seen (in table 2) that small decrease in the percentage of muscle tissue appeared in the first two months (on the control measurement). In the second half (final measurement) there is an increase in this variable, but still not statistically significant. According to Chomentowski P., Dubé, J.J., Amati, F., Stefanovic-Racic, M., Zhu, S., Toledo, F.G., and Goodpaster, B.H. (2009) in persons that have restriction in energy intake could easily appear decrease in percentage of muscle tissue, because the body is using it as energy in luck of carbohydrates. Heymsfield, S. B., Thomas, D., Nguyen, A. M., Peng, J. Z., Martin, C., Shen, W., Strauss, B., Bosy-Westphal, A. and Muller, M. J. (2011), found that the loss of fat free mass depends very much on calorie intake, so during low-calorie intake it was 224gr, while it is 576gr during total starvation, even though the rate of weight loss was similar (769gr with low-calorie diet vs. 651gr with total starvation). They also found that during low-calorie diet, rapid depletion of glycogen appear (around 250–300g), due to its catabolisation, followed up with a loss of 350 to 450 g of water, that was related to glycogen.

So, to prevent the depletion of muscle tissue not only strength exercises should be involved, that will lead to increasing of muscular strength, power and endurance, and increasing of muscle mass, according to Weinheimer E.M., Sands L.P., Campbell, W.W. (2010) but also energy intake should be only decreased, and total starvation should be forbidden.

So it can be concluded that in the first half, the limited energy intake was still a shock for the body and the reason for the situation. After a period of four months, the subjects adjust to the energy level and that is the reason why there is an enhancement in that variable (%MT) at the end, although not statistically significant in both subsamples (table 4 and 5). Still, statisticaly significant differences existed in percent of muscle tissue between the two subsamples (female and male), in all three measurements, on a level of .00 (table 1, 2 and 3).

5. Conclusion

The combination of diet and regullar exercise of five times per week, lead to decrease in body mass and the percentage of body fat, both in female and in male.

From the results obtained and presented in this research (table 1), it can be concluded that from initial to control measurement statistically significant differences existed in all four variables: body mass (BM),percentage of body fat (%BF), percentage of water (%W) and percentage of muscle tissue (%MT) on a level of .00.

Between control and final measurement (table 2) statistically significant differences existed in all four variables: body mass (BM),percent of body fat (%BF), percent of water (%W) and percent of muscle tissue (%MT), on a level of .00, .01, 02 and .00.

Between initial and final measurement (table 3) statistically significant differences existed in all four variables: body mass (BM),percentage of body fat (%BF), percentage of water (%W) and percentage of muscle tissue (%MT), on a level of .00, .03, 02 and .00.

The gender changes from initial to final measurement, displayed in table 4 for female and in table 5 for male subsample, show that body mass (BM) has statistically significant differences on a level .00 and percentage of body fat (%BF) has statistically significant differences on a level .00 (female) and .02 (male). But male can use body fat as energy much easier that female. That is also shown in this research: the decrease of percent of body fat (%BF) appears much earlier in men, allready after second month (table 5) and in female after fourth month (table 4).

As a result of a regular physical activity, a decrease in body mass (BM) and in percentage of fat (%F) appear, which was a final goal, and at the same time increase in percentage of water (%W) and in muscle tissue (%MT), although statistically not significant, probably due to better consumption of water and regular strenght training (table 4 and 5).

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