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LOSING WEIGHT AT FEMALE RECREATIONISTS WITH BODY BUILDING

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(Original scientific paper)

Daniela Shukova Stojmanovska[1], Filip Dimeski[2], Jasmina Pluncević Gligorovska[3]
[1]University "Ss. Cyril and Methodius", Faculty of physical education, sport and health, Skopje, R. Macedonia
[2] Student on master study on Faculty of physical education, sport and health, Skopje, R. Macedonia
[3] University "Ss. Cyril and Methodius", Medical faculty, Institute of physiology

Abstract
The research was conducted on a sample consisted of 10 female recreationalists between the age of 20 to 30 years old, who wanted to lose weight and to decrease the percentage of fat mass. In order to track the changes in the body composition, four variables were measured: body mass (BM), percentage of body fat (%BF), water percentage (%W) and percentage of muscle tissue (%MT). In order to see the time when the changes appear, the subject were measured 3 times - first time 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). The group was exercising 1 ½ hours, 5 times a week, mostly in the morning. In order to estimate the differences between initial and control measurements, between control and final measurements, and between initial and final measurements, T – test of small dependent samples was applied. From the obtained results it can be concluded that at the end, the final goal was achieved, a decrease in both, body mass (BM) and percentage of body fat (%BF).

Key words: *recreationists, body building, body mass, percent of fat mass, percent of muscle tissue, water percent.*

Introduction

According to the WHO in 2014, more than 1.9 billion adults, 18 years and older, were overweight, and over 600 million were obese. About 13% of the world's adult population (11% of men and 15% of women) were obese in 2014. In 2014, 39% of adults aged 18 years and over (38% of men and 40% of women) were overweight. The worldwide prevalence of obesity more than doubled between 1980 and 2014 (WHO 2015).

The facts that are well known are that obesity is a consequence of sedentary lifestyle. The genetics, the energy intake, the selection of food, the preparation the food (backing, frying or cooking), the amount of food and the time of eating also have to be taken into consideration. According to Viner, R.M. & Cole, T.J. (2005) every additional hour of TV watching during the weekends among 5 years old children, can increase the risk of adult obesity by 7%. Dietz, W.H. Jr. & Gortmaker, S.L. (1985) described significant association between the time spent in watching TV and the prevalence of obesity. Marshall, S.J., Biddle, S.J., Gorely, T., Cameron, N.& Murdey, I. (2004) don't agree with these statements, because in their analysis, they found that 99% of the variance in body fatness is not explained by media use and physical activity, which might be a little strange. According to Wilmore, J.H. & Costill, D.L. (2004), the inactivity is the major reason for obesity, as important as overeating. Greene (quatation Petrović, J., 1992) claims that decreased physical activity is the number one reason for obesity in 67% of obese people, and the overeating is participating with only 3%.

Physical activity is avaliable to everyone, with no negative health efects (like pills or surgery), it can reduce adipose tissue, and according to Samaras, K., et all. (1999) particulary abdominal fat is suggested to be more responsive to exercise than fat in other parts of the body. Even Samaras, K.&Campbell, L.V. (1997) claim that abdominal fat can be mobilized easier during exercise than peripheral depots. According to McArdle, W.D., Katch, F.I.&Katch, V.L. (2005) physical activity is the only tool that can „normalise" the increased level of the set point, and stabilize the body mass on a lower level. It is also well known that with the reduction of energy intake, it can easily be seen a decrease in muscle tissue, because according to Bernadot, D. (2000) the body is using it as energy in deficiency of carbohydrates. So, Weinheimer, E.M., Sands, L.P. & Campbell, W.W. (2010) and Chomentowski, P., Dubé, J.J., Amati, F., Stefanovic-Racic, M.,

Zhu, S., Toledo, F.G. & Goodpaster, B.H. (2009) claim that if the weight loss is caused only by energy restriction, it also leads to loss of fat-free mass, too.

Method of Work

Subjects

The research took place in a fitness studio in Macedonia, in the period from 1.09.2012 to 30.12.2012. The sample consisted of 10 female recreationists between the age of 20 to 30 years old, who wanted to lose weight and to decrease the percent of fat mass. In order to follow the changes in body composition four variables were measured with Tanita BC536: weight – body mass (BM), percentage of body fat (%BF), water percentage (%W) and percentage of muscle tissue (%MT).

Since this device usage is very practical, measuring four variables at the same time, and non-invasive, it could be very convenient to use for small researches. Different tissues have different resistance to the flow of a small electrical current (impedance). Because muscle and lean tissues have a lot of water, they are not resistant to the current flow, so they have low impedance. Fat tissue has high impedance, which means it is a poor conductor.

Although BIA (bioelectrical impedance) can show different results in different period of menstrual cycles (Dehgan, M.&Merchant, A., 2008) or according to Jürimäe, T., Jürimäe, J., Wallner, S.J., Lipp, R.W., Schnedl, W.L., Möller, R. &Tafeit, E. (2007), can show gender differences, it was decided to use it in the research because at the same time, according to Jebb, S.A., Cole, T.J., Doman, D., Murgatroyd, P.R. & Prentice A.M. (2000) and Jürimäe, T., Sudi, K., Payel, D., Leppik, A., Jürimäe, J., Müller, R. & Tafeit, E. (2003), Tanita devices using bioelectrical impedance have high correlation with the percent of body fat obtained in clinical methods. It also provides the measurements of the variables that are very important in weight loss follow up researches.

Exercise program

The group was exercising 1 ½ hours, 5 times a week, mostly in the morning, in order to speed up the metabolism. The pulse was measured manually and the criterion was the formula: 220 - years = max pulse, cited by Medved, et all. (1987). After evaluating the maximum pulse, the range of 30% of the maximum pulse was determined and the subjects were exercising in that range, because it is well known 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 each subject made individual preference about the time spend on each of them. The subjects performed 30 minutes on a stepper or a treadmill, again at the end, with same conditions (30% of the max pulse).

Afterwards they approached to exercise for chest, biceps, for back and triceps, for shoulders, legs and finally for abdomen. For the big muscle groups like: chest, back and legs, 30% of their weight is 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;

Nutrition

Our first intention was to evaluate the daily energy input too, with questionnaire with the exact amount and type of products that the subjects would consume on a daily basis, for every subject. Unfortunately, the subjects didn't agree to that.

Then they were advised to change the daily nutritional habits, in terms of the product's choice and the preparation of the food. They were suggested to exclude drinking juices during the day and instead to consume water, tea (with no sugar added) and soups, to take fresh fruits and vegetables, integral bread and pasta, not to take saturated fats, to exclude mayonnaise, sour cream and other products with high percent of fat, and instead to take nuts (all types), fish, olives, seeds, olive oil and grape seed's oil and to consume more boiled and roasted food (with minimum oil), instead of fried (specially in deep oil).

Information about the participating of the dieting and the food choice in the decreasing of weight are not available in this research despite of the fact that the major recommendations were followed by the subjects, since they didn't cooperate in the measuring of the energy input.

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 see the time when the changes appear, the subject were measured 3 times - first time 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 measurements, between control and final measurements, and between initial and final measurement**s**, descriptive statistics was applied and T – test of small dependent samples. The results are shown in tables and graphic.

Purpose of the research

The purpose of the research was to see if the applied exercise program at female recreationists can lead to a decrease of body mass (BM) and the percentage of body fat (%BF), and at the same time, increase in muscle tissue (%MT) and the percentage of water (%W). No less important is the time needed to see that changes in body composition that we wanted to evaluate.

Results

The results in the research are shown in three tables and one graphic. It can be concluded that there are continous decreasing of weight and the percentage of body fat, and anincrease in water percentage and percentage of muscle mass. But T –test of small dependent samples was applied to see if those changes are statistically significant and when exactly the changes appear. In table 1 we have a T –test between initial and control measurements, in table 2 between control and final measurements and between initial and final measurement**s** in table 3.

Table 1. Significance of the differences in arithmetic mean in initial and control measurement**s** at female group that want to lose weight (N= 10)

	Variables	initial		control		R	T-test	sig
		X	SD	X	SD			
1	BM	67,84	8,81	65,10	7,78	0,99	5,81	**,00**
2	% BF	33,37	9,63	30,29	10,30	0,54	1,02	,33
3	% W	48,46	3,67	50,63	4,00	0,95	-5,31	**,00**
4	% MT	43,79	2,28	43,64	1,86	0,66	0,27	,79

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

	Variables	control		Final		R	T-test	sig
		X	SD	X	SD			
1	BM	65,10	7,78	62,34	7,48	0,98	5,85	**,00**
2	% BF	30,29	10,30	26,58	5,61	0,73	1,60	,14
3	% W	50,63	4,00	50,45	4,45	0,71	0,17	,87
4	% MT	43,64	1,86	44,37	4,06	0,40	-0,62	,55

From the obtained results it can be concluded that in the period from the initial to control measurements (table 1), changes in body mass (BM) and in water percentage (%W) appear on a significant level of .00. So, the average level of body mass has decreased from 67,84kg to 65,10kg and the average level of of water percentage has increased from 48,46% to 50,63%.

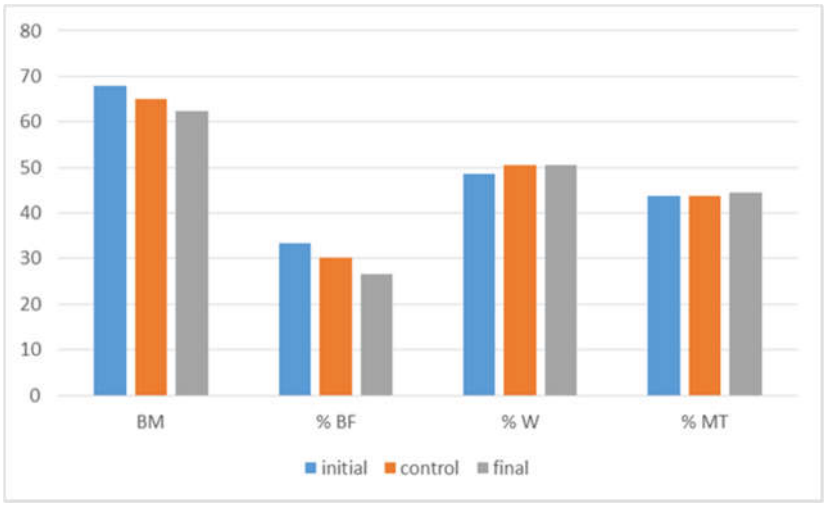
In table 2 the significance of the differences in the arithmetic method in the control and final measurement are shown. From the obtained results it can be concluded that there are significant differences on a level of ,00 only in one variable – body mass (BM). Positive changes occur in two more variables (decrease of the percent of body fat – %BF and increase of the percent of muscule tissue - %M), but they are not significant.

The significance of the differences in the arithmetic method in the initial and final measurement are showen in table 3. From the results we can tell that there are signifficant differences only in two variables: body mass (BM) and percentage of fat tissue (% BF) on the level of ,00 and ,01. On the other two variables there are improvements (increase in the percent of water - %W and percentage of muscule tissue- % MT), but they are not statistically significant.

Table 3. Significance of the differences in the arithmetic method in the initial and final measurement among the members of the female group who wanted to lose weight

	Variables	initial		Final		R	T-test	sig
		X	SD	X	SD			
1	BM	67,84	8,81	62,34	7,48	0,97	6,96	**,00**
2	% BF	33,37	9,63	26,58	5,61	0,72	3,15	**,01**
3	% W	48,46	3,67	50,45	4,45	0,50	-1,53	,16
4	% MT	43,79	2,28	44,37	4,06	0,39	-0,48	,64

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 and in the three measurements (initial, control and final). On the Y – axis the values of all four variables are shown and also the values in the three measurements (initial, control and final).



Graphic 1. Graphicall display of the results in initial, control and finalmeasuements at the group of female that want to lose weight

Discussion

In order to follow the changes in body composition, in this research, four variables were measured with Tanita BC536: weight – body mass (BM), percentage of body fat (%BF), water percentage (%W) and percentage of muscle tissue (%MT). One may ask why is Tanita used in this research. First of all, the usage of the device is very practical, measuring four variables at the same time, it is non-invasive and it provides the measurements of the variables that are very important in weight loss follow up researches. Although BIA (bioelectrical impedance) can show different results in different periods of menstrual cycles (Dehgan, M. & Merchant, A., 2008) or according to Jürimäe, T., et all. (2007), can show gender differences, it was decided to be used in the research because at the same time, according to Jebb, S.A., Cole, T.J., Doman, D., Murgatroyd, P.R. & Prentice A.M. (2000), Tanita devices using bioelectrical impedance have high correlation with body fat obtained in clinical methods.

From the results of this research, it can be concluded that after four months of exercising, statistically significant differences appear only in two variables: body mass (BM) and the percentage of body fat (%BF) on a level of .00 and .01 from initial to final measurements. In the other two variables (percentage of water - %W and percentage of muscle tissue - %MT), there are improvements, but they are not on a statistically significant level.

In our research the subjects were exercising 4 months, always in the morning (in order to accelerate the metabolism during the day). The first results in decreasing weight appear on the control measurement (after 2 months). According to Venables, M.C., Hulston, C.J., Cox, H.R. & Jeukendrup, A.E. (2008) for the fat oxidation (and insulin sensitivity) to be improved, four weeks of exercise has to be provided (exercising three times per week), at an intensity that equalled their individual fat-max, or zone in which their fat oxidation is on maximum. Christiansen, T., Paulsen, S.K., Bruun, J.M., Pedersen, S.B., and Richelsen, B. (2010) recommend a 12 week program.

There are differences not only in the opinions about the duration of the program to achieve losing weight, but also in the daily and weekly time spent in exercising and in the intensity of exercising. Institute of Medicine (2002) recommend 60 min/day of moderate intensity physical activity. But separately 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. & Darnell, B.E. (2002) claimed that, the time spent in exercise should be 60-90 min/day of brisk walking in order to achieve long term weight loss and maintains of body weight. Bouchard, C., Despres J.P.& Trembluy, A. (1993), claim that in order to lose weight efficiently, one should exercise almost every day, at least 1 hour. So the subjects in our research, practiced 1 ½ hours, 5 times a week and they applied mostly, aerobic exercises and exercises on cardio gadgetry, because fat are metabolized in aerobic conditions. Periodically they made exercises on gadgetry with small weights (30% of their weight) and more repetitions, because "fat is burning on the fire of carbohydrates".

With applying physical activity while losing weight, according to Petrović, J. (1994), not only that the fat cells become more sensitive to the lipolitic stimulus, so it is much easier to mobilize the fatty acids from the fat reserves, but also the level of insulin is reducing, so its effect on the lipogenesis is eliminated. Katch, F.I. & McArdle, W.D. (1993) measured the diameter of the fat cells and realized that after running 5 times a week in a period of 6 months, it decreased for 18% in comparison with the sedentary period. As expected, the longer the exercise – the bigger effect and higher fat oxidation. Schutz, Y., Tuan Nguyena,, D.M., Byrne, N.M. & Hills, A.P. (2014) proved that the energy expenditure increased significantly with an increase in duration of walking prescription ($p < 0.01$). On average, the walking prescription increased total energy expenditure by 3% (30-min prescription), by 6% (60-min prescription) and by 9% (90-min prescription). In a group of trained individuals Achten, J. & Jeukendrup, A. E. (2003) found that exercise at moderate intensity (62-63% of VO2max or 70-75% of HRmax) was the optimal intensity for fat oxidation, whereas according to Jeukendrup, A.E. & Wallis, G.A. (2005) it was around 50% of VO2max for less trained individuals.

Skrypnik, D., Bogdański, P., Mądry, E., Karolkiewicz, J., Ratajczak, M., Kryściak, J., Pupek-Musialik, D. & Walkowiak, J. (2015) claim that there weren't any statistically significant differences in body composition between two groups of obese women that were practicing different type of training (endurance and endurance strength training). These findings are opposite to earlier studies of Marzolini, S., Oh PI &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) in which mixed endurance strength exercises were found to be more effective than endurance exercises in percentage of body fat and body mass.

So, from initial through control to final measurement there is a constant decreasing of body mass (BM), which is statistically significant on a level .00, .00 and .00. In the variable percentage of body fat (%BF) there is also a constant decreasing, but it becomes statistically significant even on final measurement (after 4 months) on a level of .01. At male pattern, according to Shukova-Stojmanovska, D., Dimeski, F. & Protić-Gava, B. (2014), the changes in the percent of body fat appear earlier, at the control measurement (after 2 months). Christiansen, T., et all. (2010) think that there aren't any sex specific differences in losing weight, while the conclusion of Petrović J. (1994) is that female can mobilise fat tissue for energy much harder, which was proven in our research. Some authors like Venables, M.C., Achten, J. & Jeukendrup, A.E. (2005) indicate that a higher rate of fat oxidation exist in women in different rates of intensity and, what is more surprising, it occurs in higher intesity compared with men (because at that intensity male are starting to use carbohydrates as energy). The energy provided from fat oxidation in the day energy expendure is a little higher in female then in men, as well.

Carmichael, H.E., Swinburn, B.A. & Wilson, M.R. (1998) adviced obese women who wanted to lose weight to decrease the fat intake in daily input for the period of 3 months and to increase the physical activity during the same period. So the percentage of fat intake decreased from 36% to 22%, which led to a decrease of body mass. But the women who lost most body mass, during the 3 months research, were those that decreased fat intake on 40 grams per day.

All the participants were explained 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, and it was statistically signifficant on a level of .00 (table 2). After the second month there is a plateau and the values from control to final measurement are close and statistically signifficance didn't existed at that point.

The percentage of muscle tissue (%MT) showes improvements from initial to final measurement (although they aren't statistically signifficant). It can be seen (in table 2) that a 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 stataistically significant. According to Chomentowski, P., et all. (2009), among persons who have restriction in energy intake a decrease in percentage of muscle tissue could easily appear, because the body is using it as energy in lack of carbohydrates. To prevent the depletion of muscle tissue, Weinheimer, E.M., et all. (2010) recommend to involve some strength exercises because that is the way of increasing muscular strength, power and endurance, and at the end it also increases the muscle mass (which was proven in this research). 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 4 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.

Conclusion

Exercise apllied regullary 5 times per week lead to decrese in body mass and the percentage of body fat.

From the results obtained and preseneted in this research (table 1), it can be concluded that from initial to control measurement statistically significant decrease existed in body mass (BM) on a level of .00 and increase of percentage of water (%W) on a level of .00.

Between control and final measurements (table 2) only body mass (BM) has decreased statistically significant (.00) and between initial and final measurements (table 3) both body mass (BM) and the percent of body fat (%BF) decreased on a statistically significant level of .00 and .01 (table 4).

Due to adequate energy intake, the percent of muscle tissue remained the same or show even a little increase (because of the regular activity).

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Coresponding author:
Daniela Shukova Stojmanovska
Vladimir Komarov 29/1-15, Skopje, R. Macedonia
tel.: +38922461532/mobil: +38971224993
mail: daniela.shukova-stojmanovska@ffk.ukim.edu.mk