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THE EFFECTS OF 8-WEEK STEP-AEROBIC EXERCISE ON THE BODY COMPOSITION AND HEMATOLOGIC PARAMETERS IN THE OBESE AND OVERWEIGHT FEMALES

EVRİM ÇAKMAKÇI[1] AHMET SANİOGLU[1] HÜSAMETTİN VATANSEV[2] KAMİLE MARAKOGLU[3]
[1]Selçuk University, Higher School of Physical Education and Sports, Konya/TURKEY
[2]Selçuk University. Selcuklu Medical Faculty Depeartmen of Biochemistry, Konya/TURKEY
[2]Selçuk University. Selcuklu Medical Faculty Depeartmen of, Familiy medicine, Konya/TURKEY

ABSTRACT

Objective: In this research, the exemination of the effect of aerobic exercise on the body composition and hematologic parameters in the obese and overweight, sedentary women has been aimed.

Material: 29 obese people whose avarage age is 41.55 ± 6.72 year, avarage height is 159,21 ± 7.18 cm, avarage weight is 85.97 ± 9.60 kg, 29 overweight people whose avarage age is 35.10 ± 9.11 year, avarage height is 160.59 ± 5.20 cm, avarage weight is 68.55 ± 6.72 kg, in total, 58 people have been accepted to this research. These groups have been arranged according to the body mass index.

Method: In this research, 8 weekly period- aerobic exercise in 3 days of the week have been applied to people. Before and after the exercise protocol, the body fat percentage, the rate of the waist to the hip, elasticity, some hemotologic parameters (WBC, RBC, MCV, HGB, HCT, PLT) ,sistolic and disostolic blood pressure have been measured.

Result: When the group inside findings have been examined. While the important decrease in the level of BW, BMI, BFP and WHR in the obese group, the important increase in E and DBP have been seen. There are understandable decrease in the level of BW, BMI, WHR, BVF SBP and DBP ($p<0.05$) , understandable increase in E ($p< 0.05$), there is also no difference in WHR.

After and before the exercise of the obese and overweight groups, the understandable increase in the level of RBC, HGB, HCT ($p<0.05$) and understandable decrease in the level of MCV ($p<0.05$) have been seen. As different from the overweight group, understandable increase in WBC ($p<0.05$)has been seen. The important difference in PLT in the both groups hasn't been seen. When differences between two groups have been examined, after the exercise, the level of RBC in the obese group is higher than those in the overweight group.($p<0.05$)

Discussion and conclusion: In conclusion, it can be said that in the obese and overweight women, the applied exercise protocol have an important effect on the antropometric and hemotologic levels, regular aerobic exercises will reduce the body fat percentage without the loss of the muscle.

Key Words: Step-aerobic exercise, Antropometric Measurements, Obesity, Hemotologic Parameters.

INTRODUCTIONS

Saving the adequate liquid volume is an indispensable stipulation to maintain normal activities of cardiovascular system. This balance in the body is provided with the interaction among many numbers of organs involving hormonal and neural messages. The factors such as physical stress, which can change this balance potentially into chronic or acute state, trigger different hemostatic mechanisms (R. Murray et al., 1991).

During the exercise, certain amount of liquid enters into the tissues leaving the veins and the density of erythrocyte, hemoglobin and plasma proteins increases (K. Karacabey et al., 2004, F.Özdengül, 1998). It has been stressed that decreases may occur in the level of erythrocyte when the vein volume hemostasis is reobtained as a result of relaxation and intake of liquid and electrolyte after exercise (R. Morgan et all 2004).

When blood flow increases and is accelerated with exercise, the leucocytes clinging to vein wall mingles with the flow and the amount of leucocytes in the blood increases. In addition, hormonal changes can also cause this increase (D.N.Khansari et al., 1990, M. Waern, C.Fossum, 1993, N. Akgün, 1994). The higher stress is accompanied by exercise, the greater the leucocytes increase. This increase is especially significant in the strenuous exercises. The principal reason of this increase is the blood pressure (especially systolic blood pressure) and liquid filtration from capillaries into the tissues by arteries. Another reason is that osmotic pressure rises as a result of metabolism products augmenting in the liquid among the tissues caused by increased metabolism and consequently water recedes (K. Karacabey et al., 2004, F. Özdengül, 1998). Changes in the hemotologic parameters occur according to the type, stress and duration of the exercise. Presumably, these changes are caused by such factors as the methods used in experiments, experiment times, the type of exercises applied, the age, sex and training condition of the subjects (S. Shephard et al., 1994). However, there is no complete consensus in the literature how exercise affects on blood concept. While some researchers express that exercise increase blood volume (M.Günay et al., 2006), others state that it does not change (N. Akgün, 1994).

It has been explained in the literature that the increase in the hematocrit is caused by hemoconcentration connected with exercise, more considerably the release of high hematocrit blood from splenic to circular circulation (W.Ganong, 1996, B.Yılmaz, 1999, M.Guyton, 1996), and it has become more significant with the entering of leucocytes in the margination pool into the circulation as a result of the increase in the leucocytes due to accelerated circulation (D.N.Khansari et al., 1990).

Obesity, the suffering of this century, develops after puberty in many cases. The prevalence of obesity occurrence in both sexes is high due to the deceleration of metabolism in the early years of adulthood. Furthermore, pregnancy establishes the base of obesity in females. Sedentary living is the most common cause of obesity in adult age group (D.J .Wilson 1988). Obesity, risk factor for many diseases, threatens life quality. In order to prevent obesity, it is essential that sedentary living should be abandoned and exercise be included into daily life. We aimed to investigate the effects of exercise and obesity on hematologic parameters in this study.

MATERIAL

The choice of subjects:

29 obese (O) subjects whose mean age was 41.55 ± 6.72 years, mean height: 159,21 ± 7.18 cm, average body weight (BW) : 85.97 ± 9.60 kg, and 29 overweight (OW) subjects whose mean age was: 35.10 ± 9.11 years, mean height: 160,59 ± 5.20 cm and average body weight (BW) was : 68.55 ± 6.72 kg, total 58 individuals taking part in the step aerobic exercise program run by KOMEK (Konya Vocational Course) were included in the study.

They were classified according to their body mass index (BMI). In classification, the subjects with 25.0 – 29.9 BMI were regarded as overweight (OW) and with 30.0 – 39.9 as obese (O).(WHO,1999) The subjects were informed about the parameters and their written consents were obtained and then examined physically. The completely healthy individuals who had no diabetic, cardiac and chronic systemic and metabolism diseases and the diseases affecting immune functions in their clinical examinations and history were included in the study. The subjects were asked to follow their usual normal nutrition habits and to avoid excessive physical activities during the study.

Metod

Exercise program and its severity:

We had the subjects do warm-up exercises for 10 minutes, active step aerobic exercises for 45 min. and finally stretching cooling exercises for 10 min. at the 60-70% severity of their target pulse rate three days a week for 8 weeks, and the rates before and after the exercises were recorded. The severity of the aerobic exercise was determined according to Karvonen protocol.

Pulse Rate (PR)= 60-70% PR(PR max-PR min)+PR

Maximal PR=220- age (K.Özer, 2006).

Measuring/measurement means:

Before the subjects started training, the initial tests and at the end of the training after 8 weeks the final tests of height(H), body weight(BW), systolic blood pressure (SBP), diastolic blood pressure (DBP), body fat percentage (BFP), waist and hip rate (WHR), elasticity (E) and body mass index(BMI) were obtained and recorded.

Anthropometric Measurements:

The body weights of the individuals included in the study were measured in kilogram (kg) with NAN scale in their casual home clothes with bare feet before the exercises began. Their heights were measured in meters with studio meter and recorded. Body mass index (BMI) was calculated with Weight / height² (kg/m^2) formula. The contour of the body was measured in cm. with a fiberglass tape measure which is 0.6cm wide, rigid but flexible. The steps taken during the measurements were mentioned below.

Waist circumference was measured horizontally from the narrowest point of the distance between ksifoid prominence and umbilicus, and hip circumference was measured from the trochanters horizontally as the widest diameter while the legs were 20-30cm apart. Moreover, the values of waist and hip circumferences were divided to each other and waist/hip rat was obtained. The thickness of skin pleat was measured from triceps, biceps, subscapular and suprailiac zones using Holtain T/W Skinfold Caliper. In order to measure the thickness of the skin pleat, the fold between thumb and index finger was separated from the muscular tissue removing the skin with its hypodermic fat tissues and slightly compressing it between the ends of caliper and the values on the dial was read and recorded.

Total Body Fat Percentage:

Body density was calculated using Durnin-Womersley formula with triceps, biceps, subscapular and suprailiac SF Total body fat percentage was calculated applying Siri equation to this body density.

Durnin-Womersley Formulas:

Female=1, 1581- (0,0720x (LOG S (triceps, biceps, subscapular and suprailiac SF) (J.V.Durnin and J. Womersley, 1974)

Siri equation:

Total Body Fat Percentage= (4.95/body density - 4.50) x 100 Siri (Siri, 1956)

Blood Pressures: the SBP and DBP of the subjects were taken in mmHg with stethoscope and sphygmomanometer (B.N.Roohi, 2008).

Sit and Reach Test was used to measure the elasticity of the individuals. The test was repeated twice and the highest score was recorded (K.Tamer, 2000).

Blood parameters: White blood cell (WBC), Red Blood Cell Count (RBC), Mean Corpuscular Volume (MCV), Hemoglobin (HGB), Hematocrit (HCT9, Platelets (PLT) were measured from the fasting blood samples. Laboratory tests were carried out using standard measurements techniques.

Statistic Analyzes: The arithmetic means and standard deviations of all statistical data in the study were calculated with SPSS 15.0 packet program. The comparison of test assessments of the subjects with each other before the training and after 8-week training was performed with Paired Samples t-test.

RESULTS

Table 1: Body composition, blood pressure, elasticity and in-group comparison of measurement values obese and overweight individuals before and after 8-week regular exercise scheme.

	Overweight group (N:29)				Obese group (N:29)			
	Mean	Std. Deviation	T	P	Mean	Std. Deviation	T	P
Age (year)	35.10	9.11			41.55	6.72		
Height(cm)	160.59	5.20			159.21	7.18		
BW(kğ)1	68.55	6.727	7.376	.000*	85.97	9.601	4.687	.000*
BW 2	66.00	6.164			83.31	10.160		
BMI 1 (kg/m2)	26.57	2.257	7.502	.000*	33.99	3.888	4.506	.000*
BMI 2 (kg/m2)	25.58	2.027			32.92	3.960		
WHR 1(%)	,7919	,05723	2,092	,046*	,8411	,05645	1,047	,304
WHR2 (%)	,7744	,04781			,8316	,05206		
BFP1 (%)	36.12	2.739	5.448	.000*	39.31	2.644	3.435	.002*
BFP 2 (%)	33.41	3.772			37.56	2.492		
Elasticity (cm)1	28.90	5.492	-2.727	.011*	27.62	6.925	-3.225	.003*
Elasticity(cm2	30.07	5.675			30.45	6.231		
Sistolik (mmHG)1	11,66	,974	-,226	,823	12,31	1,491	2,637	,013*
Sistolik(mmHG)2	11,69	,541			11,79	,675		
Diastolik(mmHG)1	7,21	,861	-2,117	,043*	7,72	,701	2,774	,010*
Diastolik(mmHG)2	7,48	,574			7,37	,561		

In Table 1, according to the values of first and last tests of the subjects, there was significant difference in the parameters of BW, BMI, BFP, WHR, E, SBP, DBP respectively in favor of the last tests(Table: 1 P<0.05*)

Table2: In-group comparison of hematologic parameters before and after exercise.

	Overweight group (N:29)				Obese group (N:29)			
	Mean	Std. Deviation	T	p	Mean	Std. Deviation	T	P
WBC1(x10^9/)	5.7660	0.8986	2.895	.007	6.352	1.4614	2.005	.055
WBC2(x10^9/)	6.4186	1.4164			6.761	1.6582		
RBC1(x10^{12}/)	4.3979	0.2563	9.207	.000	4.5562	0.4223	8.270	.000
RBC2(x10^{12}/)	4.7014	0.3013			4.8897	0.3767		
HGB1(g/dl)	12.034	1.1191	8.573	.000	12.169	1.0840	9.405	.000
HGB2(g/dl)	13.266	1.4884			13.476	1.4664		
HCT1(1/1)	37.790	2.974	5.110	.000	38.390	3.434	3.288	.003
HCT2(1/1)	39.369	3.378			40.049	3.622		
MCV1(fl)	86.052	7.0386	-5.187	.000	84.841	6.2558	-6.622	.000
MCV2(fl)	83.686	6.3494			82.066	7.0578		
PLT1(K/u)	274.90	60.904	.590	.560	297.76	68.408	.152	.880
PLT2(K/u)	279.17	59.772			299.34	76.562		

In Table 2, according to the values of first and last tests of the subjects, while there was significant difference in favor of initial and final tests in the parameters of RBC, HGB, HCT, MCH, MCHC respectively in group K and O, MCV diminished considerably ($p<0,000$). PLT was high significantly. While WBC was higher in group K, it was not significant in group O ($p<0.05$).

DISCUSSION

Physical exercises done regularly have effects on obesity, cardiovascular system, blood pressure, physical goodness, body fat rate and healthy life in middle-aged people (D.E.Laaksonen et al, 2002; A.S.Ryan et al, 1996; I.S.Ockene et al. 2004, G.Charach et al. 2004)

M.Egana and B.Done (2004) applied stepper exercise program on 24 females for 12 weeks and were given tests before and after the exercises and there were significant difference in favor of last tests of BFP and BW. Özcan et al. (2004) found statistically significance in the values of BFP, SBP, DBP and E in the sedentary males exposed to 6-week aerobic exercises.

F.F.Çolakoğlu and S. Karacan (2006) applied 30min. walking-running training 3 days a week for 12 weeks and found significant difference in favor of last tests of BMI and BW before and 12 weeks after training while they determined no significant difference between the tests of SBP and DBP. Ü. Erbaş (2007) investigated the effects of regular aerobic exercise on 54 middle-aged sedentary females for 6 months. He gave total 3 tests; an initial test before training, a middle test 3 months later and a final test 6 months later. After the exercise protocol, it was determined that the middle test values of SBP, DBP, BW, BFP, BMI and E were significantly different from those of initial test, and the values of final test were significantly different from both initial and middle test. J.M. Saavedra et al. (2007) applied water aerobic on middle-aged females 2 days a week for 8 months and established that there was significant difference in favor of final tests between the values of BW and BFP before and at the end of 8-month exercise.

M.E. Kafkas et al. (2009) concluded that 12-week regular aerobic and resistance exercises had positive effects on BW, BMI, BFP and blood pressure. L. Perussa et al.(1997) established in their study on 97 sedentary male-female subjects that regular aerobic exercises had positive effects on BMI and BFP. E. Zorba et al. (2000) found in their study that there was significant increase in E values after 45-minute exercise 3 days a week for 8 weeks. In our study there was significant difference in the values of BW, BMI, BFP, E and DBP between the initial and final tests of 8-week aerobic-step exercise in favor of final tests and there was also difference between the values of SBP ($p<0,05$).

We observed significant increase in the parameters of HGB, HCT, MCH, MCHC in favor of last tests in our study ($p<0,05$). There are various studies indicating that exercise have effects on the hemoglobin values (M. Günay et al., 2006,S.L.Nieman et al., 1999,G. Büyükyazı et al., 2000, B. Freund et al., 1991, G.Ersöz et al., 1995, E.Wade et al., 1987). G.Buyukyazi and F.Turgay found in their study on male sportsmen that hemoglobin levels increased significantly after interval trainings (G. Buyukyazı et al.2000)

B. Ferund et al. determined increase in the levels of hemoglobin after the exercise at 60-80%with MaxVO2. However, it has been reported that generally the significant increase in the hematocrit level just after the exercise retuned to basal level within 24-48 hours (M.Ünal, 1998, G.Ersöz et al., 1995, E.Wade et al., 1987). Since the blood samples were taken 24 hours after the exercise in our study, HGB and HCT values are not acute answers. We found considerable difference in MCV. We think that this is related to iron deficiency anemia caused by inadequate respond of iron depot to increased hemoglobin production. Consequently, additional iron must be taken with exercise.

Significant increase occurred in the parameters of WBC in this study. It is possible to regard this increase in WBC as acute phase respond (W. Weight et al.1991). Many studies have stated that especially intensive exercise increases WBC concentration (P.A. Deuster et al., 1989, M. Kappel et al., 1998) and in addition to intensity of the exercise, the condition of the individual is determinant in this increase (S.İbiş et al, 2010). The significant increase in leucocytes is caused by the entrance of leucocytes in the margination pool into the circulation system with the accelerated circulation (D.N.Khansari et al., 1990). Moreover, we suggest that the increase of hematocrit density also affects leucocyte level.

While some studies report that exercise increases the number of thrombocytes (F. Özdengül, 1998, Younesian, 2004), others state that exercise have no effects (M.Ünal, 1998, S. Patlar et al., 2007). Insignificant increase in the number of thrombocytes was observed in O-K group in our study. Although the increase can be explained as the hemoconcentration related to exercise, it can also be defined as the activation of neural system caused by the factors such as compelling body and stress and the increased number of blood platelets (M. Günay, 2006).

The effects of regular exercise on middle aged females can be seen in literature and research samples. Deformation in the body composition and increased blood pressure caused by overweight and age can be observed in middle-aged individuals. It has been proved that the negative effects of sedentary living on individuals can be lowered with exercise. According to literature, sports activities promote life quality, and general physical performance completely affects positively the functional capacity of the systems.

In conclusion, we can deduce that intensive and exhausting exercises affect the hematologic values more than normal and moderate exercises, and reasonable exercise like aerobic exercise make significant changes in the hematologic parameters. It can be considered that exercise affects hematologic values, and these are caused

by hematocrit increase related to the decrease in the blood plasma during and after exercise.

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