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Original Research Paper

The Regular Pilates Exercise Program Reduces the Risk of Cardiovascular Diseases or Other Diseases at Sedentary Obese and Overweight Women

Biochemistry

KEYWORDS: : Physical activity, Ischemia-modified albumin, obesity, weight, and BMI.

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ABSTRACT

Aim: The aim of this study was to investigate the effects of Pilates exercise program on ischemia-modified albumin levels and blood lipids in sedentary overweight and obese Turkish women.

Methods: Fifty-six sedentary woman divided into two groups including overweight (n=29) and obese groups (n=27) according to their Body Mass Index. They underwent a 2-month the Pilates regular exercise in 2013.The serum albumin concentrations, the blood lipids and the IMA levels of the groups determined at baseline and two months later.

Results: The average IMA and Ox-LDL levels decreased, and the albumin levels increased in both groups after the Pilates regular exercise. While there were significant differences in the IMA, Ox-LDL levels, total cholesterol, LDL- cholesterol, VLDL-cholesterol and Triglyceride levels of an obese woman, the HDL, and serum albumin levels were significant differences in both obese and overweight woman ($p<0,05$).

Conclusions: These findings showed that regular exercise was the beneficial effect on the IMA, the Blood Lipids, and the Ox-LDL levels which were closely related to cardiovascular diseases in Turkish sedentary obese and overweight women.

INTRODUCTION

Ischemia-modified albumin (IMA) regarded as one of the biochemical markers for determination of myocardial ischemia (1), (2). On the contrary, cardiac enzymes are released as creatine kinase-myocardial bands and troponin in the case of cardiac necrosis (2).IMA has not been previously correlated directly with oxidative stress in obesity (3). But it is related with the overproduction of free radicals that may modify the N-terminal region of human serum albumin (HSA) generating an ischemia-modified albumin (IMA), a sensitive marker of ischemia, and it tends to increase in diseases related to obesity, such as hypercholesterolemia(4), metabolic syndrome(3), and higher amounts of free fatty acids (FFA) in the body(5), (6).

Oxidative stress associated with obesity and a large body of evidence indicates that it implicated in many of the processes that are involved in the excess visceral adiposity (7). Falkensammer et al. have reported that IMA is to be a biomarker in non-cardiac clinical conditions such as exercise-induced ischemia (8).Researchers have demonstrated that acute exercise; a transient decrease (9), (11) and increase (8), in IMA levels have observed.

Besides, Apple et al. say that there were temporary reductions in the IMA concentrations immediately after the exercise in their studies which assessed the effect of skeletal muscle ischemia on circulating IMA levels in healthy individuals (9). Also, Middleton et al. report that a significant reduction is in the IMA in healthy individuals after the marathon (10). Zapico et al. evaluate the IMA in healthy subjects following hand grip, and find ischemia decreases significantly in forearm according to the past (12).

As shown in studies, the effects of short-term exercise were investigated on the Ischemia-modified albumin (IMA) in healthy individuals. As a result of the research, there were not any studies about the effects of a long-term exercise, such as an eight-week Pilates exercise program.

Therefore, the aim of this article is to investigate the levels of IMA and other blood lipids from the risk of cardiovascular diseases in healthy sedentary women with obesity and overweight as well as its association with BMI before and after the eight-week Pilates exercise program.

Materials and Methods

Subjects

In this study designed as a cross-sectional. A total of 147 healthy sedentary Turkish women participated who had no previous experience of any sport/exercise and registered for the first time from the fitness center in the province Konya of Turkey. The BMI categorized according to the recommendations of the World Health Organization: below-normal weight (<18.5 kg/m^2), normal weight (18.5–24.9 kg/m^2), overweight (25.0–29.9 kg/m^2), obesity (30.0–39.9

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kg/m^2), and extreme obesity (40 kg/m^2).The women divided into two groups including overweight and obese groups according to their BMI (calculated as weight in kilograms divided by height in meter squares): %20 overweight group and %18 obese group and women excluded for small (n=29,%20) and normal weight (n=39,%26). In this study were included the subjects who completed an all of the 8-week Pilates exercise programs. The case excluded from this study that came at Pilates training program one or two days per week (n=23, %16).

The Ethics Committee approved all procedures of this study of the Faculty of Medicine of Selcuk University in Konya/Turkey. The individuals were informed about the survey, and all of the subjects gave the written informed consentsubjects. The measurements were taken twice, before and after the pilates exercise program and were recorded at the baseline and immediately after the study.

Data Collection

Height was measured to the nearest 0.1 cm on a body height scalewhen the subjects were shoeless. Body weight was measured to the nearest 0.1 kg using a pre-calibrated Tanita (model TBF-305; Tanita, Arlington Heights, IL) electronic scale. BMI was calculated and categorized according to the recommendations of the World Health Organization (13).

Laboratory Analysis

The venipuncture technique drew blood samples into Vacutainer® (BD Diagnostics, Plymouth, UK) tubes with sodium fluoride (gray top tubes), EDTA (purple top tubes) or no anticoagulant (red top tubes). Blood specimens in red top tubes were allowed to clot for 20-40 min. Blood specimens were routinely centrifuged for 15 min at 1500g, and aliquots of serum samples were stored at –40 °C for a maximum of 2 weeks before the measurement of IMA levels. The plasma was used to measure the levels of fasting glucose while the fresh serum was used to assess the levels of total cholesterol, HDL-cholesterol, LDL-cholesterol, and triglycerides. All analyses were performed by the clinical chemistry analyzer of Synchron LX20 Clinical Systems (Beckman Coulter, Ireland) using standard methods. The LDL-cholesterol was estimated by the usage of Fried Ewald equation (6). The serum IMA was measured by the colorimetric cobalt-albumin binding test described previously (4).

Pilates Exercise Program

Each subject completed aan 8-week series of one-hour Pilates exercise program for three days per week. Pilates exercise targets 60-70% of maximal heart rate for the age. Exercises were performed on a mat and with balls (65 cm blue colors of balls) (15),(16). The Pilates exercise program conducted in two separate sections. For the first four weeks, each session consisted of 10 minutes of warming up, 40 minutes of Pilates mat exercise program and 10 minutes of cooling down. For the other four weeks, 45 minutes of Pilates mat and ball training program were performed while the warming up and cooling down times remained the same and the pilates coach gave verbally and tactile clues for them.

Statistics

The SPSS statistical program (version 15.0) was used for data analysis. The standard statistical methods were used for the calculation of means and SD. The Categorical data were classified, and the Kolmogorov-Smirnov test was used to determine the dependent variables that were normally distributed or were not. The data showed normal distribution and then the comparisons between the overweight and obese group performed with the independent sample "t" test.The paired sample t-test performed for comparisons within the groups at before and after the Pilates exercise program. For all analyses, the criterion for significance was set at an alpha level of $p< 0.05$.

Results

Table 1. Descriptive statistics for the experimental group and control group

Variables	Overweight Group (N= 29) M ± SD	Obese Group (N=27) M ± SD
Age (year)	35,11 ± 9,12	41,70 ± 6,95
Body height (cm)	160,59 ± 5,22	158,78 ± 7,25

The average age and height of the subjects were 35.11 ± 9.12 years and 160.59 ± 5.22 cm (n=29) for the overweight group and 41.70 ± 6.95 years and 158.78 ± 7.25 (n=27) for the obese group.

Table 2. Comparison of the overweight group and obese groups on pretest and posttest for experimental parameters

Variables	Groups	N	Pre-test		Post-test	
WEIGHT	Overweight Group	29	68,55 ± 6,73	0.001 *	66 ± 6,16	0.001 *
	Obese Group	27	84,59 ± 7,67		81,85 ± 8,25	
BMI	Overweight Group	29	26,58 ± 2,26	0.001 *	25,59 ± 2,03	0.001 *
	Obese Group	27	33,66 ± 3,50		32,55 ± 3,55	
IMA	Overweight Group	29	0,61 ± 0,19	0,65	0,51 ± 0,18	0,96
	Obese Group	27	0,61 ± 0,28		0,49 ± 0,17	
LDL	Overweight Group	29	133,37 ± 21,69	0.78	132,13 ± 28,28	0.17
	Obese Group	27	125,64 ±23,68		134,54 ± 26,63	
Ox-LDL	Overweight Group	29	205,39 ± 73,46	0,83	174,61 ± 59,92	0,09
	Obese Group	27	208,67 ± 87,91		146,24 ±103,66	
HDL	Overweight Group	29	40,33 ± 11,78	0.36	46,08 ± 13,10	0.31
	Obese Group	27	36,78 ± 10,34		42,67 ± 11,29	
TRIGLYCERIDE	Overweight Group	29	88,86 ± 39,32	0.14	83,34 ± 46,53	0.047 *
	Obese Group	27	123,30 ± 8,43		98,96 ± 45,20	
VLDL	Overweight Group	29	17,87 ± 8,46	0.007 *	16,60 ± 9,31	0.007 *
	Obese Group	27	25,99 ± 12,43		20,28 ± 8,43	
TOTAL CHOLESTEROL	Overweight Group	29	193,72 ± 27,74	0.71	189,41 ± 36,79	0.33
	Obese Group	27	186,33 ± 30,59		194,44 ± 36,05	

Weight means, BMI, Triglyceride and VLDL were respectively 68.55 ± 6.73 kg, 26.58 ± 2.26 kg/m^2, 88.86 ± 39.32 and 17.87 ± 8.46 mg/dl before exercise; 66.00 ± 6.16 kg, 25.59 ± 2.03 kg/m^2, 83.34 ± 46.53 and 16.60 ± 9.31 mg/dl after exercise in the overweightgroup; 84.59 ± 7.67 kg, 33.66 ± 3.50 kg/m^2, 123.30 ± 8.43, and 25.99 ± 12.43 mg/dl before exercise; 81.85 ± 8.25 kg, 32.55 ± 3.55 kg/m^2, 98.96 ± 45.20 and 20.28 ± 8.43 mg/dl after exercise in the obese group, respectively. These differences were statistically significant ($p<0.005$). At the end of the statistical analysis, there were no significant differences in between the pre and post-test values of HDL-cholesterol and Total cholesterol ($p>0.05$). But, the means of HDL-cholesterol levels were different in the post-test. While the obese group had increases in the total cholesterol levels, there were decreases in the total cholesterol levels for the overweight group in the post-test (Table 2). Interestingly, while the IMA and Ox-LDL levels decreased for the overweight and obese group, the albumin levels increased for both groups. But after

Variables	Groups	Pre-test		Post-test	
		N	Mean±SD	p	Mean ± SD	p
ALT	Overweight Group	29	21,45 ± 4,31	0.86	21,66 ± 5,07	0.77
	Obese Group	27	21,63 ± 3,94		21,55 ± 4,88	
AST	Overweight Group	29	20,41 ± 9,36	0.82	20,07 ± 6,50	0.17
	Obese Group	27	21,71 ± 7,31		20,48 ± 8,23	
UREA	Overweight Group	29	17,83 ± 5,26	0,011*	17,28 ± 6,83	0,010*
	Obese Group	27	21,41 ± 6,11		20,75 ± 6,60	
CREATININE	Overweight Group	29	0,73 ± 0,09	0,74	0,7 ± 0,09	0.99
	Obese Group	27	0,73 ± 0,09		0,7 ± 0,09	
ALBUMIN	Overweight Group	29	4,34 ± 0,18	0.90	4,43 ± 0,25	0.07
	Obese Group	27	4,26 ± 0,18		4,43 ± 0,19	
TOTAL PROTEIN	Overweight Group	29	7.66 ± 0.39	0.71	7.52 ± 0.45	0.26
	Obese Group	27	7.61 ± 0.45		7.38 ± 0.36	
GLUCOSE	Overweight Group	29	95,28 ± 9,38	0,54	96,21 ± 9,72	0,15
	Obese Group	27	99,82 ± 9,59		98,78 ± 10,46	

Besides, the glucose valueswere normalinboth groups before and after the pilates exercise program (Table 3). As shown in Table 3, we did not find significant differences between the pretest and posttest regarding Alanine transaminase (ALT), aspartate aminotransferase (AST), Creatinine and Total protein levels for both the overweight and obese groups (p>0.05). Besides, after the exercise, the means of serum albumin levels significantly increased in both groups when compared to the previous practice. However, there was not statistically a significant difference (p>0.05). But we found major differences between the pretest and the posttest regarding Urea (p<0.05), and the means of urea levels decreased.

Table 4. Percentage change of IMA, Ox-LDL, and LDL(post-pre test)

Variables	Groups	N	Mean ± SD	p
IMA (% change)	Overweight Group	29	4,94 ± 61,13	0,86
	Obese Group	27	7,59 ± 53,35	
Ox-LDL(% change)	Overweight Group	27	12,00 ± 34,79	0,04*
	Obese Group	29	30,49 ± 26,31	
LDL(% change)	Overweight Group	29	0,50 ± 16,94	0,08
	Obese Group	27	8,30 ± 19,41	

There was asignificant change in the percent of Ox-LDL and LDL levels in both groups after the exercise program (p<0.05) (Table 4).

Discussion

To our knowledge, the present study was the first survey for the Pilates exercise program, but it was not the first research for the aerobic exercise program. Because of that, we examined an effect of Pilates training program on the plasma IMA levels, BMI, weight and blood lipids. The significant finding of this study was that Pilates exercise program resulted in favorable changes in BMI, weight, triglyceride, VLDL-cholesterol and HDL-cholesterol levels of the healthy sedentary obese and overweight women only in 8 weeks. There were only a few studies of exercise-associated alterations on IMA from cardiac biomarkers .

Elosua et al. investigated the effects of a 16 week- aerobic PA (Physical Activity) training on blood lipids in the seventeen sedentary, healthy, young men and women. They found that the regular PA increased the LDL-cholesterol resistance to oxidation, and decreased the oxidized LDL concentration . This study revealed a decline for both groups regarding the weight, BMI, triglyceride and VLDL-cholesterol levels of after the pilates exercise program, and this decrease was observed to be statistically significant (p <0.005). Besides, these results were shown in the same direction as in the studies by Furukawa et al. (20). An inactive, sedentary lifestyle leads to adverse changes in the body composition and the blood lipid profile. It reported that the regular exercise reduced the level of LDL- cholesterol, facilitated the formation of arteriosclerosis and increased to prevent atherosclerosis with the HDL-cholesterol levels (21). Many studies indicate that the regular practice of moderate, aerobic exercise related to a normal plasma lipid profile (22). Besides, Leon and Sanchez notice that aerobic exercise increased the plasma levels of HDL-cholesterol and reduced the triglycerides and the LDL-cholesterol levels (23).

According to the other findings of this study were significant decreases the IMA and Ox-LDL levels of both groups in between the means of the pre- and post-tests and these differences were statistically significant (p < 0.005) only for the obese group in the post-test. Also, it was ameaningful change as a percentage of the Ox-LDL. Piva et al. notice that IMA was a marker of the oxidative stress in obesity and it was associated with BMI (24). According to the post-test results, the BMI and the IMA decreased in this study. Many studies report that the IMA levels decreased with exercise (10), (12). In a study performed on the marathon runners by Apple and his colleagues, they found a reduction in the IMA concentrations after the exercise and this was followed by a delayed increase after 24–48 h (9). The other study informs that the immediate decrease in the IMA concentration after the physical exercise may be attributable to the IMA measurement with the lactate production during skeletal muscle ischemia (9), (12).

The other studies stated the effects of anaerobic exercise on the oxidative stress and IMA appears to be a sign of the oxidative stress (25), (27). The acute physical exercise results in the oxidative stress, but a regular training program could regulate the antioxidant status (28). Lippi et al. stated that aerobic physical activity might influence the generation of IMA, which might be increased in the medium term following high-workload endurance training (29).This study observed a decrease in the means of the IMAand Ox-LDL levels and there wasa significantchange as a percentage of the IMA and Ox-LDL concentrations in both groups after the Pilates exercise program. But, this decrease was statically significant only obese group in between pre and posttests (p<0.05). It was thought that the Pilates exercise program was implemented as a regular exercise and it continued for an eight week. Vincent et al. notice that the exercise routine training decreases the oxidative stress, and the strenuous acute physical exercise can cause the oxidative stress (30). There was also a preferred fuel source during the prolonged exercise (18). In the present study, the continued Pilates exercise program might cause increases in the serum albumin levels.

This study had some limitations. In this study totally participated 56 women who were found to be statistically sufficient. But the comparisons were conducted with a lower number of subjects regarding overweight and obese groups. The results of this study could be supported with more subjects, and The Pilates exercise program long term applicable and effect may examine in the other studies.

Limitations

This study had some limitations.In this study of the effects of Pilates exercise program; The total number of participants were 56, which was found to be statistically sufficient. But the comparisons were

conducted with a lower number of subjects regarding overweight and obese groups. The many studies may support the results of this study that included more participants, and the effect of the Pilates exercise program could be seen better in there. Another limitation of this study was Pilates exercise program which was applied an eight-week, one-hour for three days per week. The Pilates exercise program long term applicable and effect may be examined in the other studies.

Conclusion

The effects of Pilates exercise program on the IMA and the blood lipids have never been investigated in the sedentary Turkish women before. These results were especially important, as the IMA, Ox-LDL, HDL-cholesterol and LDL-cholesterol levels were shown to be closely related to cardiovascular diseases, but only the obese group was statically significant after the Pilates exercise program. In conclusion, the prolonged exercise might cause a decrease on the IMA, which was a sign of the oxidative stress.Hence, the present study reveals the fact that Pilates training program had a beneficial effect on the IMA, the Blood Lipids and the Ox-LDL levels in the sedentary obese and overweight women, and the risk of cardiovascular diseases or the regular physical activities may prevent other diseases

References

1. Anwaruddin S, Januzzi JL Jr, Baggish AL, Lewandrowski EL, Lewandrowski KB Ischemia-modified albumin improves the usefulness of standard cardiac biomarkers for the diagnosis of myocardial ischemia in the emergency department setting. Am J Clin Pathol 2005, 123(1): 140-145.
2. Wu AH The ischemia-modified albumin biomarker for myocardial ischemia. MLO Med Lab Obs 2003, 35(6):36-40.
3. Valle Gottlieb MG, da Cruz IB, Duarte MM, Moresco RN, Wiehe M, Schwanke CH, Bodanese LC Associations among metabolic syndrome, ischemia, inflammatory, oxidatives, and lipids biomarkers. J Clin Endocrinol Metab 2010, 95(2):586-91.
4. Duarte MM, Rocha JB, Moresco RN, Duarte T, Da Cruz IB, Loro VL, Schetinger MR (2009) Association between ischemia-modified albumin, lipids and inflammation biomarkers in patients with hypercholesterolemia. Clin Biochem 2009, 42(7-8):666-671.
5. Bhagavan, N.V., et al., Utility of serum fatty acid concentrations as a marker for acute myocardial infarction and their potential role in the formation of ischemia-modified albumin: a pilot study. Clinical chemistry, 2009, 55(8): p. 1588-1590.
6. Vincent, H.K. and A.G. Taylor, Biomarkers and potential mechanisms of obesity-induced oxidant stress in humans. Int J Obes (Lond). 2006, 30(3): p. 400-18.
7. Vassalle, C., et al., An oxidative stress score as a combined measure of the pro-oxidant and anti-oxidant counterparts in patients with coronary artery disease. Clin Biochem, 2008; 41(14-15): p. 1162-7.
8. Falkensammer, J., et al., Serum levels of ischemia-modified albumin in healthy volunteers after exercise-induced calf-muscle ischemia. Clin Chem Lab Med 2007, 45(4): p. 535-40.
9. Apple, F.S., et al., Release characteristics of cardiac biomarkers and ischemia-modified albumin as measured by the albumin cobalt-binding test after a marathon race. Clin Chem 2002, 48(7): p. 1097-100.
10. Middleton, N., et al., Novel application of flow propagation velocity and ischaemia modified albumin in the analysis of postexercise cardiac function in man. Experimental physiology, 2006, 91(3): p. 511-519.
11. Roy, D., et al., Ischemia-modified albumin concentrations in patients with peripheral vascular disease and exercise-induced skeletal muscle ischemia. Clinical chemistry 2004, 50(9): p. 1656-1660.
12. Zapico-Muniz, E., et al., Ischemia-modified albumin during skeletal muscle ischemia. Clin Chem 2004, 50(6): p. 1063-5.
13. World Health Organization, Obesity: preventing and managing the global epidemic. 2000: World Health Organization.
14. Bar-Or, D., E. Lau, and J.V. Winkler, A novel assay for cobalt-albumin binding and its potential as a marker for myocardial ischemia-a preliminary report. J Emerg Med 2000, 19(4): p. 311-5.
15. Culligan, P.J., et al., A randomized clinical trial comparing pelvic floor muscle training to a Pilates exercise program for improving pelvic muscle strength. International urogynecology journal, 2010; 21(4): p. 401-408.
16. Gillies, E., 101 Ways to Work out On the Ball. 2004, USA: Fair Winds Press.
17. Neilan, T.G., et al., Myocardial injury and ventricular dysfunction related to training levels among nonelite participants in the Boston marathon. Circulation 2006, 114(22): p. 2325-33.
18. Shave, R., K. George, and D. Gaze, The influence of exercise upon cardiac biomarkers: a practical guide for clinicians and scientists. Curr Med Chem 2007, 14(13): p. 1427-36.
19. Elosua, R., et al., Response of oxidative stress biomarkers to a 16-week aerobic physical activity program, and to acute physical activity, in healthy young men and women. Atherosclerosis 2003, 167(2): p. 327-334.
20. Furukawa, F., et al., Effects of an off-site walking program on energy expenditure, serum lipids, and glucose metabolism in middle-aged women. Biol Res Nurs 2003, 4(3): p. 181-92.
21. Williams, P.T., Health effects resulting from exercise versus those from body fat loss. Med Sci Sports Exerc 2001, 33(6 Suppl): p. S611-21; discussion S640-1.
22. Durstine, J.L., et al., Blood lipid and lipoprotein adaptations to exercise: a quantitative analysis. Sports Med 2001, 31(15): p. 1033-62.
23. Leon, A.S. and O.A. Sanchez, Response of blood lipids to exercise training alone or combined with dietary intervention. Med Sci Sports Exerc, 2001; 33(6 Suppl): p. S502-15; discussion S528-9.
24. Piva, S.J., et al., Ischemia-modified albumin as an oxidative stress biomarker in obesity. Clin Biochem, 2011 44(4): p. 345-7.
25. Bailey, D.M., et al., Regulation of free radical outflow from a separate muscle bed in exercising humans. Am J Physiol Heart Circ Physiol, 2004, 287(4): p. H1689-99.
26. Collinson, P.O. and D.C. Gaze, Ischaemia-modified albumin: clinical utility and pitfalls in measurement. J Clin Pathol 2008, 61(9): p. 1025-8.
27. Fisher-Wellman, K. and R.J. Bloomer, Acute exercise and oxidative stress: a 30-year history. Dyn Med, 2009, 8: p. 1.
28. Gougoura, S., et al., Increased oxidative stress indices in the blood of child swimmers. Eur J Appl Physiol 2007, 100(2): p. 235-9.
29. Lippi, G., et al., High-workload endurance training may increase serum ischemia-modified albumin concentrations. Clin Chem Lab Med 2005, 43(7): p. 741-4.
30. Vincent, H.K., J.W. Morgan, and K.R. Vincent, Obesity exacerbates oxidative stress levels after acute exercise. Med Sci Sports Exerc 2004, 36(5): p. 772-9.