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The Effect of 8 Week Plates Exercise on Body Composition in Obese Women

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A B S T R A C T

The objective of this study was to explore the effects of 8-weeks modern pilates mat and ball exercise program on body mass, waist circumference and waist to hip ratio on sedentary obese women total of 58 health sedentary obese women volunteered to participate in this study. They were divided randomly into 1 of 2 groups: pilates training group (PTG; N=34) and control group (CG; N=27). A pilates training program was applied to the subjects one hour per day four days per week during 8 weeks. The subjects in the control group did not participate in the training and participated only in the pre and post test measurements. BMI, waist circumference, Waist-hip ratio, 4-site skinfold thickness (Biceps, Triceps, Supscapula and Iliac), fat percentage, resting metabolic rate, Lean body mass and flexibility were assessed before and after the pilates training program. The SPSS statistical program (version 16.0) was used for data analysis. Analyses of covariance (ANCOVAs) were run on each of the dependent variables. For all analyses, the criterion for significance was set at an alpha level of $p<0.05$. 8 weeks of pilates training program has been found to be effective on weight, Body mass index, Lean body mass, waist-hip ratio, biceps, triceps, fat percentage, basal metabolic rate, and flexibility in PTG ($p<0.05$). The control group showed no significant differences in the same measures post-intervention. As a result there was a positive effect of Modern Pilates mat and ball exercises of reducing obesity, body composition parameters and flexibility at sedentary obese women.

Key words: *pilates, obesity, body composition*

Introduction

Obesity is a widespread situation in many societies that steadily increasing rate[16]. Obesity is associated with many chronic health conditions as diabetes, hypertension, heart disease, sleep apnea and mortality rates rise with increasing body mass[4,20]. Obesity is described as an excess of body fat and body fat is difficult to measure. However, increase of body fat is usually associated with an increase in total body mass, thus indices of relative weight are commonly used to diagnose obesity[16,1]. The body mass index is that one of the most generally used indices of relative weight[13].

Body mass index (BMI; in kg/m^2) is an estimator of the morbidity and mortality that numerous chronic diseases are embracing as type 2 diabetes, cardiovascular disease (CVD), and stroke and it has long been known[26,18]. Additionally, abdominal obesity evaluated whereby waist circumference (WC) and predicts obesity-related health risk[26,28]. The weighted evidence shows that WC with BMI predicts health risk better than does BMI alone[2,11].

The treatment of obesity has developed effectively throughout the past[10] 20 yy. Most of these treatments involve exercise as part of the treatment, however, until recently, these recommendations are generally made on the possible beliefs that exercise would be of value rather than on scientific evidence. The evidence relating to intensity of exercise and type of exercise as well as exercise[3,9]. In the studies point out to be quite dramatically different the amount of weight loss with exercise in only intervention group and they have boasted the greatest changes in weight as a result of exercise alone [15,23].

While using the whole body during a training session, Pilates is a form of exercise that targets the core of the body (the abdomen, hips, and back, i.e.). Pilates also enhance flexibility and improve posture. The exercises are typically done that strengthen the abdominal muscles, hips, and back by lying down on a mat and include a series of controlled movements of the arms and legs. Pilates also can be done on special Pilates equipment[24].

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Pilates is popular among women[5]. A few studies have been related with Pilates in aging and its effects and it has positive effects on their body mass, waist circumference[18,20]. Therefore, the purpose of this study was to explore the effects of 8-weeks modern pilates mat and ball exercise program on body mass, waist circumference and waist to hip ratio on sedentary obese women.

Materials and Methods

Subjects

In this study participated total 58 health sedentary obese women as volunteers from KOMEK (Vocational Training Course in Konya). The age and height averages of the subjects of female experimental and control group were respectively 36.15±9.59 years for age, 1.56±4.13 cm. for height, 82.71±9.48 for weight (N=34) and 38.96±10.02 years for age, 1.60±6.82 cm. for height, 83.74±10.25 for weight (N=27).

Individuals were informed about study and written informed consent was obtained for all participants. The measurements were taken twice as before and after pilates training program being applied a 8-week series of one hour Pilates training four days *per* week. The control group did not participate in any activity Pilates training during the eight-week period. All measurements were recorded at baseline and immediately after the study. All study procedures were approved by the Ethics Committee at the Faculty of Selcuklu Medical Sciences, Selcuk University in Konya.

Measures

Height was measured to the nearest 0.1 cm on a stadiometer with the participants shoeless. Body weight was measured to the nearest 0.1 kg using a pre-calibrated tanita digital electronic scale.

Body composition

BMI was calculated as weight in kilograms divided by the square of the height in meters. The BMI was then categorized according to the recommendations of the World Health Organization[27]: 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 kg/m^2), and extreme obesity (40 kg/m^2).

While the subjects were minimally respiration, waist circumference was measured from the nearest 0.1 cm at the iliac crest[25].When viewed from the side, hip circumference was evaluated at the level of maximum extension of the thigh and WSR was calculated as WC (cm)/height (m).

Skinfold thickness was defined that a total of four skinfolds measured by using the Holtain skinfold caliper. Skinfolds involved that biceps (anterior surface of the biceps midway between the anterior auxiliary fold and the antecubital fossa), triceps (vertical fold on the posterior midline of the upper arm, halfway between the acromion and olecranon process), subscapular (fold on the diagonal line coming from the vertebral border to between 1 and 2 cm from the inferior angle of the scapulae) and suprailiac (diagonal fold above the iliac crest even with the anterior auxiliary line).

Pilates training

Pilates training target for a heart rate of 60–70 % of maximal heart rate for the age. The intensity of pilates training was determined by Carvonen Method[6].

The Carvonen Method:

Max. Heart Rate=220–Age

Heart Rate Reserve=HR max–HR Rest (Resting Heart Rate)

%60 Target Heart Rate=(0.60 × HRR)+HR rest

The pilates training program consisted of 8-week series of one hour Pilates exercise four days *per* week. Exercises were performed on a mat and balls. Besides, we used 55 cm (red), 65 cm (blue), colors ball[8,17].

Each exercise session lasted for about 60 min and was led by a certified pilates coach. For all participants train-

TABLE 1
THE PILATES TRAINING PROGRAM

	Exercises	Equipments	Repetitions
Warm up	Breathing	No equipments	–
	Imprint and release	No equipments	–
	Spinal rotation	No equipments	–
	Cat stretch	No equipments	–
	Hip rolls	No equipments	–
	Scapula isolation	No equipments	–
	Arm circles	No equipments	–
Exercises	The hundred	Mat	8
	The shoulder bridge	Mat	8
	Single leg circle	Mat	8
	One leg stretch	Mat	8
	Double leg stretch	Mat	8
	Rolling like a ball	Mat	8
	Leg pull down	Mat	8
	Leg pull up	Mat	8
	Pelvic curl	Mat	8
	Side bend	Mat	8
	Side kick front	Mat	8
	Side kick back	Mat	8
	The saw	Mat and with ball	8
	Roll-up	Mat and with ball	8
	Spine stretch and spine Stretch forward	Mat and with ball	8
	Push-up	Mat and with ball	8
	Bent-knee bride	With ball	8
	Single leg stretch	With ball	8
	Lie back stretch	With ball	8
	Knee stretch	With ball	8

ing was provided by the same coach verbal and tactile clues were given during each Pilates exercise. At the beginning of the program, while the intensity of exercise was 40%, it was gradually increased to 60% in the eighth week. The pilates training program was seen in Table 1.

Statistical analysis

The SPSS statistical program (version 16.0) was used for data analysis. Standard statistical methods were used for the calculation of means and SD. The Kolmogorov-Smirnov test was used to determine if dependent variables were normally distributed. The Levene test was used to determine if there was homogeneity of variance. Analyses of covariance (ANCOVAs) was run on each of the dependent variables. For all analyses, the criterion for significance was set at an alpha level of $p<0.05$.

TABLE 2
DATA SUMMARY FOR THE EXPERIMENTAL GROUP AND CONTROL GROUP

Variables	Experimental group (n=34) Mean±SD	Control group (n=27) Mean±SD
Age (year)	36.15±9.59	38.96±10.02
Body height (m)	1.56±4.13	1.60±6.82
Weight (kg)	82.71±9.48	83.74±10.25

Results

As shown in Table 2, the mean (SD) age is 36.147± 9.586 (years), body height is 1.56±4.135 (m), weight is 82.709±9.481 (kg) for the experimental group, the mean (SD) age is 38.963±10.017 (years), body height is 1.60± 6.822 (m), weight is 83.741±10.253 (kg) for the control group.

TABLE 3
COMPARISON OF THE EXPERIMENTAL GROUP AND CONTROL GROUPS WITH RESPECT TO PRETEST AND POSTTEST

Variables	Groups	N	Pre-test $\overline{X}$±SD	T	p	Post-test $\overline{X}$±SD	T	p
Weight (kg)	Experimental group	34	82.71±9.48	–0.407	0.685	80.07±9.89	–1.557	0.125
	Control group	27	83.74±10.25			84.18±10.69		
Body mass index	Experimental group	34	33.76±3.69	1.625	0.110	32.69±3.89	0.067	0.946
	Control group	27	32.46±2.14			32.63±2.33		
Waist circumference	Experimental group	34	95.50±12.43	0.114	0.909	91.85±12.79	–1.183	0.242
	Control group	27	95.18±7.89			95.11±7.18		
Waist-hip ratio	Experimental group	34	0.82±0.08	–17.262	0.000*	0.83±0.08	–18.236	0.000*
	Control group	27	1.22±0.09			1.22±0.09		
Biceps	Experimental group	34	17.88±5.67	–3.141	0.003*	14.35±4.26	–5.948	0.000*
	Control group	27	23.11±7.34			23.26±7.32		
Triceps	Experimental group	34	24.50±5.27	–3.623	0.001*	21.00±5.13	–6.033	0.000*
	Control group	27	30.04±6.67			30.18±6.77		
Supscapula	Experimental group	34	24.85±6.63	–1.497	0.140	20.94±4.81	–4.521	0.000*
	Control group	27	27.33±6.16			27.41±6.36		
Iliac	Experimental group	34	26.35±7.14	0.154	0.879	23.09±6.08	–1.826	0.073
	Control group	27	26.07±6.93			26.15±6.99		
Fat percentage	Experimental group	34	35.65±3.31	–3.777	0.000*	33.26±3.08	–6.980	0.000*
	Control group	27	38.83±3.18			38.89±3.19		
Basal metabolic rate	Experimental group	34	1279.53±101.14	–9.741	0.000*	1254.33±101.65	–10.543	0.000*
	Control group	27	1569.93±131.78			1574.23±135.35		
Lean body mass	Experimental group	34	49.36±3.25	0.082	0.935	48.47±3.47	–0.973	0.335
	Control group	27	49.27±3.62			49.38±3.73		
Metabolic	Experimental group	34	1585.93±71.48	0.082	0.935	1566.733±76.38	–0.973	0.335
	Control group	27	1584.33±79.69			1586.53±82.04		
Flexibility	Experimental group	34	24.41±5.68	3.748	0.000*	29.79±5.68	6.866	0.000*
	Control group	27	18.93±5.68			20.07±5.25		

*$p<0.0$

As shown in Table 3, we find significant differences between experimental and control group for Waist-hip ratio, biceps, triceps, supscapula, fat percentage, basal metabolic rate, and flexibility in the pretest and posttest ($p<0.05$). Also, we did not find significant differences between experimental and control group for weight, body mass index, waist circumference, iliac, lean body mass, and metabolic in the pretest and posttest ($p>0.05$).

As shown in Table 4, we find significant differences between pretest and posttest for weight, body mass index, waist circumference, supscapula, iliac, lean body mass, and metabolic in the experimental group ($p<0.05$). Also, we did not find significant differences between pretest and posttest for weight, body mass index, waist circumference, supscapula, iliac, lean body mass, and metabolic in the control group ($p>0.05$).

As shown in Table 5, it indicates descriptive statistics of posttest values according to experimental and control groups

As shown in Table 6, covariance analyses detected significant differences in effect of pilates training for waist--hip ratio, biceps, triceps, fat percentage, basal metabolic rate, and flexibility in the experimental and control groups ($p<0.05$). Therefore, it was shown that effect of pilates training method on waist-hip ratio, biceps, triceps, fat percentage, basal metabolic rate, and flexibility ($p<0.05$).

TABLE 5
DESCRIPTIVE STATISTICS OF THE POSTTEST POINTS WITH RESPECT TO EXPERIMENTAL GROUP AND CONTROL GROUPS

	Variables	$\overline{X}$±SD (s)	Estimate Marginal Means (s)
Experimental Group	Waist-hip ratio	0.82±0.08	0.98
	Biceps	14.35±4.25	16.23
	Triceps	21.00±5.13	23.29
	Fat percentage	33.26±3.07	34.51
	Basal metabolic rate	1254.33±101.65	1384.33
	Flexibility	29.79±5.68	28.00
Control Group	Waist-hip ratio	1.22±0.09	1.03
	Biceps	23.26±7.32	20.89
	Triceps	30.18±6.76	27.30
	Fat percentage	38.87±3.19	37.31
	Basal metabolic rate	1574.23±135.35	1411.33
	Flexibility	20.07±5.25	22.33

Discussion

The Pilates method has itself influenced many forms of dance, movement education and therapy, as well as rehabilitation methods, and different types of body work. It has given physiotherapy a new direction, and influenced exercise prescription in many bodywork fields, including sports medicine[14]. The present study investigated the effects of 8-weeks modern pilates mat and ball exercise program on body mass index, body composition parameters and RMR at sedentary obese women.

Difference in the means of the pre- and post-tests of waist-hip ratio, biceps, triceps, supscapula, fat percentage, basal metabolic rate, and flexibility of the exercise group proved to be higher compared to the control group. Besides, there was a significant difference between pre- and post-measurements in exercise and control groups ($p<0.05$).

TABLE 4
COMPARISON OF THE PRETEST AND POSTTEST RELATIVE PHYSICAL WITH RESPECT TO EXPERIMENTAL GROUP AND CONTROL GROUPS

Groups	Variables	Pretest $\overline{X}$±SD	Posttest $\overline{X}$±SD	T	p
Experimental Group (N=34)	Weight	82.71±9.48	80.07±9.89	8.174	0.000*
	Body mass index	33.76±3.69	32.68±3.89	8.171	0.000*
	Waist circumference	95.00±12.43	91.85±12.79	5.411	0.000*
	Supscapula	24.85±6.63	20.94±4.81	5.764	0.000*
	Iliac	26.35±7.14	23.08±6.08	5.464	0.000*
	Lean body mass	49.36±3.25	48.47±3.47	7.228	0.000*
	Metabolic	1585.90±71.48	1566.70±76.38	7.228	0.000*
Control Group (N=27)	Weight	83.74±10.25	84.185±10.69	1.265	0.217
	Body mass index	32.46±2.14	32.63±2.33	1.214	0.236
	Waist circumference	95.18±7.89	95.11±7.18	0.311	0.758
	Supscapula	27.33±6.16	27.41±6.36	0.811	0.425
	Iliac	26.07±6.93	26.15±6.99	1.442	0.161
	Lean body mass	49.29±3.62	49.38±3.73	0.994	0.330
	Metabolic	1584.33±79.69	1586.53±82.04	0.994	0.330

*$p<0.05$

TABLE 6
ANCOVA RESULTS OF THE POSTTEST POINTS CORRECTED IN PRETEST ACCORDING TO EXPERIMENTAL GROUP AND CONTROL GROUPS

Variables	Source of variance	Type III Sum of Squares	Mean Square	F	p
Waist-hip ratio	Covariate	0.37	0.37	415.66	0.000
	Effect of Experiment	0.005	0.005	5.66	0.021*
Biceps	Covariate	1622.04	1622.04	255.02	0.000
	Effect of Experiment	280.06	280.06	44.03	0.000*
Triceps	Covariate	1807.31	1807.31	418.01	0.000
	Effect of Experiment	198.51	198.51	45.91	0.000*
Fat percentage	Covariate	500.14	500.14	374.54	0.000
	Effect of Experiment	94.69	94.69	70.91	0.000*
Basal metabolic rate	Covariate	798748.02	798748.02	2494.33	0.000
	Effect of Experiment	4427.82	4427.82	13.83	0.000*
Flexibility	Covariate	1037.87	1037.87	81.18	0.000
	Effect of Experiment	390.46	390.46	30.54	0.000*

*$p<0.05$

Segal et al. (2004) examined that the effect of pilates exercise on flexibility and body composition. In this study participated 31 female and 1 male adults and pilates exercise was performed one hour *per* week for 6 months. After 2, 4 and 6 months the test to was performed three times. They found a significant increase after six months with initial results in flexibility but didn't find a significant change in body composition[21]. In our study has been determined that eight-week pilates exercise to be effective in both flexibility and body composition parameters. Body composition values did not show results a similar with the results of Segal et al. Study. It is thought that a result of the frequency and intensity of the training program is low (one hour a week pilates exercise).

A second important finding of this study was that 4 independent measures of central obesity (abdominal and suprailiac skinfolds and minimal waist and abdominal circumferences) demonstrated a strong response to effect of pilates training program and the improvements in these measures. We find significant differences between pretest and posttest for weight, body mass index, waist circumference, supscapula, iliac, lean body mass, and basal metabolic rate in the experimental group ($p<0.05$). Also, we did not find significant differences between pretest and posttest for weight, body mass index, waist circumference, supscapula, iliac, lean body mass, and metabolic in the control group ($p>0.05$).

Sekendiz et al. (2007) investigated to the effect of pilates exercises on abdominal and lumbar region, muscular endurance, strength, the posterior trunk flexibility and body composition. As a result of this research observed pilates exercises to increase strength of the abdominal and lumbar region and flexibility was developed on sedentary women. There have been no significant changes in body weight and fat percentage[22]. The results were not similar changes with results in body weight and fat percentage at Sekendiz et al. Because, in our studies is thought that due to the implementation of both the mat and ball exercises together at 8 weeks and 4 days a week a significant change in body composition values, weight loss and fat percentage.

Gilliat et al. (2001) researched to the effect of physical activity on body composition and RMR. This study participated between the ages of 35 and 50 into two groups experimental and to be sedentary women and experimental groups performed physical activity an average of 9 hours *per* week. As a result they detected that experimental group was less body fat weight, fat percentage and lean body weight than the control group and RMR was higher than the control group[7]. Ryan et al. (1996), found that although body mass, percent body fat and BMI were significantly higher in sedentary women compared to active controls[19]. We found significant differences for waist-hip ratio, biceps, triceps, fat percentage, RMR, lean body mass, and flexibility in the experimental and control groups ($p<0.05$). These results were similar to Gilliat et al. (2001). There was shown that effect of pilates training method on waist-hip ratio, biceps, triceps, fat percentage, RMR, lean body mass, and flexibility.

Kate and Gibson (2006) researched to the effect of an 8-week mat Pilates training program on body composition, flexibility, and muscular endurance. This study participated 22 (16 Caucasian; 6 Hispanic) of the original 28 adults from the University of Miami. Nine novice students (8 women) enrolled in the mat Pilates class were the treatment group (P), and 13 University community members (12 women) were the control group (C). They found that significant improvements in body composition, flexibility, and muscular endurance were noted following 8-wk of traditional mat Pilates class comprised primarily of beginner and intermediate level exercises[12].

These results supported to in our research and were similar to Kate and Gibson (2006).

As results, the major finding of the present study was that there was a clear response to effect of eight weeks modern Pilates mat and ball exercises on body composition values, body mass index and amount of weight change, lean body mass, flexibility and metabolic rate at sedentary obese females. Besides in this study indicated that pilates training had a positive effect on all measurements at sedentary obese women.

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UTJECAJ OSMOTJEDNOG VJEŽBANJA PILATESA NA TJELESNU KOMPOZICIJU U PRETILIH ŽENA

SAŽETAK

Cilj ove studije bio je istražiti utjecaje osmotjednog vježbanja programa suvremenog pilatesa na prostirki i na lopti na tjelesne masu, širinu struka te omjeru struk-kuk kod neaktivnih pretilih žena. U studiji je volonterski sudjelovalo sveukupno 58 zdravih neaktivnih pretilih žena. Podijeljene su slučajnim odabirom u dvije skupine: skupina koja vježba pilates (PTG; N=34) i kontrolna skupina (CG; N=27). Program vježbanja pilatesa provodio se jedan sat dnevno, četiri dana u tjednu, osam tjedana za redom. Ispitanice u kontrolnoj skupini nisu sudjelovale u vježbanju, nego samo u mjerenju prije i poslije istraživanja. Indeks tjelesne mase, širina struka, omjer struk-kuk, četiri kožna nabora (biceps, triceps, subskapularni, suprailijačni), postotak masnog tkiva, potrošnja energije u mirovanju, tjelesna masa bez masnog tkiva i fleksibilnost mjereni su prije i nakon programa. Statistički program SPSS (inačica 16.0) koristio se za analizu. Analiza kovarijance (ANCOVAs) koristila se za svaku zavisnu varijablu. Za sve analize, kriterij značajnosti postavljen je na alfa razinu $p<0,05$. Program vježbanja pilatesa tijekom osam tjedana pokazao se kao efektivan na težinu, indeks tjelesne mase, tjelesnu masu bez masnog tkiva, na omjer struk-kuk, biceps, triceps, postotak masnog tkiva, na potrošnju energije u mirovanju i fleksibilnost tijekom programa ($p<0,05$). Kontrolna skupina nije pokazala značajnu razliku u istim mjerama nakon ponovnog mjerenja. Rezltat istraživanja je pozitivni utjecaj suvremenog pilatesa na prostirki i lopti na smanjenje pretilosti, na parametre tjelesne kompozicije i fleksibilnost neaktivnih pretilih žena.