

EVALUATION OF THE EFFECTS OF PILATES MAT EXERCISE PROGRAM ON SOME FITNESS PARAMETERS AND WEIGHT LOSS OF MIDDLE AGED PERIMENOPAUSAL SEDENTARY WOMEN⁵

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ABSTRACT

Menopause starts when menstruation permanently cuts off. Perimenopause was defined as irregular bleeding (6 weeks to 4 months) and/or vasomotor symptoms such as sweating and hot flushes (3). Therefore, the purpose of this study was to examine the effects of intermittent exercise on body composition, fat distribution and vasomotor symptoms in perimenopausal sedentary women.

In this study participated that total 66 middle-aged with the phenomenon of hot flushes overweight sedentary women as volunteers. Body weight, Body composition (via skinfolds caliper), waist hip ratio, waist circumference and body fat percentage were obtained from sedentary women. Besides subjects were asked menopausal bleeding patterns (including vasomotor symptoms) states with information form. The measurements were taken twice as before and after Pilates mat training program being applied a 6-week series of one hour exercise three days per week. The control group did not participate in any activity exercise program during the six-week period. There were significant differences between pretest and posttest for weight, body mass index, waist circumference, waist hip ratio, fat percentage and body composition parameters in exercise group ($p<0,05$). Also, there were not significant differences between pretest and posttest for same measurements in control group. According to subjects' answers to was found that pilates mat exercise had significantly effective on hot flushes from vasomotor symptoms at sedentary women.

As a result, the findings support of pilates mat exercises effects on weight loss and body composition parameters. Pilates mat exercises can have long-term benefits for women undergoing the menopausal transition.

Key Words: Pilates, Perimenopause, Body Composition, Hot Flushes

ORTA YA LI PER MENOPOZAL SEDANTER BAYANLARDA P LATES MAT EGZERS Z PROGRAMININ K LO KAYBI VE F Z KSEL UYGUNLUK PARAMETRELER ÜZER NE ETK LER N N DE ERLEND R LMES

ÖZET

Menopoz, adet kanamasının kalıcı olarak kesildi i zamandır. Perimenopoz düzensiz kanama (6 hafta- 4 ay) veya terleme, sıcak basması gibi vasomotor semptomlar olarak tanımlanır. Bu çalı maya sıcak basması olgusuna sahip toplam 66 orta ya lı, kilolu sedanter bayan gönüllü olarak katıldı. Sedanter kadınlardan vücut a rlı ı, vücut kompozisyonu (skinfold kaliper aracılı ı ile), bel-kalça oranı, bel çevresi ve vücut ya yüzdesi verileri elde edildi.ayrıca deneklere bilgi formu aracılı ı ile menapoz kanama düzenleri, (vasomotor semptomlar dahil) dereceleri, soruldu. Ölçümler 6 hafta, haftada 3 gün 1 saat uygulanan pilates mat antrenman program öncesinde ve sonrasında alındı. Kontrol grubu 6 hafta boyunca her hangi bir egzersiz programına katılmadı. Egzersiz grubunda kilo, BMI, bel çevresi, bel-kalça oranı, ya yüzdesi ve vücut kompozisyonu parametrelerinde öntest ve sontest arasında önemli farklılıklar bulundu. Aynı zamanda, kontrol grubunda aynı ölçümlerde öntest ve son test arasında önemli farklılıklar yoktu. Deneklerin cevaplarına göre pilates mat egzersizi vasomotor semptomlardan sıcak basması üzerine önemli derecede etkili oldu u tespit edildi.

Sonuç olarak bu çalı manın bulguları pilates mat egzersiz programının kilo kaybı ve vücut kompozisyonu üzerine etkilerini desteklemektedir. Pilates mat egzersizleri, menapoz geçi e maruz kalan bayanlar için uzun süre faydalı olabilir.

Anahtar Kelimeler: Pilates, Perimenopoz, Vücut kompozisyonu, Sıcak basması.

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INTRODUCTION

The prevalence of obesity increases with age and this situation is mostly observed among middle-aged and elderly women (28). Additionally, after menopause, a sectional change in the body fat distribution occurs, where the body fat change its place from gluteofemoral to abdominal section of the body (23). This excessive fat tissue in the abdomen, which especially surrounds visceral organs, increases metabolic risk of cardiovascular disease (9,15). In fact, National Institutes of Health Clinical Guidelines recommends that the management of obesity promote the use of waist circumference as a measure of abdominal obesity for predicting risk of disease in overweight and obese persons [body mass index (BMI; in kg/m^2): 25.0–34.9](27). A few research mentions that a hypocaloric diet and regular aerobic exercise is very effective in the treatment of abdominal obesity (19, 22). The amount of fat and fat-free mass (FFM) changes with the increase in age, as a function of various factors, such as physical activity, menopausal status, nutrition and disease in adults. At the same time, body composition can be used in the assessment of functional status to predict disability and mortality. Heymsfield et al. (1994) reported that the menopause has been shown to be associated with major changes in body composition, weight and fat distribution (18). The women health and welfare may be affected by symptoms of menopausal status (31). Hot flushes are among the most important symptoms of perimenopause. The impact and

emergence time of hot flushes is different for every woman (4). It is mentioned that hot flushes is more common in women whose BMI are above $27 \text{ kg}/\text{m}^2$ and who are overweight and obese, and aged between 40-55 years (13). It is said that women who rarely participate in exercise and who are less active experience higher hot flushes than the ones who are active and who regularly exercise. Despite the complaint of hot flushes reveal the heavy exercise sometimes to women, the moderate intensity exercises reduces hot flushes and night sweat (8). Because of regular exercise is strongly recommended for hot flushes from vasomotor symptoms in women (25). In most of the studies and reviews it has been reported that physical activity and exercise have positive effects on the other menopause-related symptoms and health outcomes such as cognitive functioning, depression, fatigue, weight maintenance and cardiovascular diseases (7,10,20). Hammer et al.(1990) have shown that even being in the same menopausal status, women have lower hot flushes who are members of a local gymnastics club and participating in physical exercise regularly than the women who do not participate an exercise program (16).

Therefore the primary aim of the study was to examine the effect of Pilates mat training on BMI, body composition, waist circumference, waist–hip ratio and hot flushes which emerge as one of the vasomotor symptoms in middle aged sedentary perimenopausal women.

MATERIAL AND METHODS

Subjects

In this study totally 66 healthy sedentary women participated as volunteers from fitness center sports club in Konya. The age and height averages of the subjects of female experimental and control group were respectively 44.11 ± 2.81 years for age, 1.59 ± 6.83 cm for height, 79.32 ± 10.34 for weight (n=42) and 43.33 ± 2.84 years for age, 1.60 ± 5.12 cm for height, 73.25 ± 12.21 for weight (n=24).

Individuals were informed about study and the consent form was obtained from all participants. Basic demographic and health history information was collected from all participants prior to study participation and menopausal status was determined by asking participants a series of questions related to their menstrual bleeding patterns by face to face interviews. And then women who had hot flushes from vasomotor symptoms in perimenopause were selected as the subject group of the study.

The measurements were taken before and after Pilates mat training program which was conducted for one hour per day and three days per week for 6 weeks. The control group did not participate in any physical activity. Pilates mat training program during the six-week period. All study procedures were approved by the Ethics Committee of the Faculty of Selçuklu Medical, Selçuk University in Konya in Turkey.

Measures

Height was measured to the nearest 0.1 cm on a stadiometer. During the height measurements participants were shoeless. Body weight was measured to the nearest

0.1 kg using a pre-calibrated tanita digital electronic scale.

Body composition

BMI was calculated by dividing weight in kilograms with the square of the height in meters. Then the BMI was categorized according to the recommendations of the World Health Organization (33): below-normal weight (<18.5 kg/m²), normal weight (18.5–24.9 kg/m²), overweight (25.0–29.9 kg/m²), and obesity (30.0–39.9 kg/m²), and extreme obesity (40 kg/m²). The waist circumferences of the subjects were taken during minimal respiration from the nearest 0.1 cm at the iliac crest (32). 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 estimation was calculated by skinfold measure of four body sections using the Holtain skinfold calliper. The body section involved in skinfold measure were 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 Mat Exercise Program

Carvonen method was used for intensity of pilates mat exercise program (American College of Sports Medicine [ACSM], 1990). Initially, According to Carvonen's formula

60-70 % of maximal heart rate was set for Pilates mat exercise program(1). The Pilates mat exercise program consisted of one hour per day and three days per week for 6 weeks exercise (2,17,24). Exercises were performed on a mat. Each exercise session lasted for about 60 min and was led by a certified Pilates coach. For all participants training was provided by the same coach. The beginning of the program included supine exercises of segmental movements involving trunk muscle recruitment to maintain neutral posture and leg and standing exercises were gradually added.

Besides, each session consisted of 10 minutes of warming up, 40 minutes of

Pilates mat exercise program followed by 10 minutes to cool down for the first three weeks. And then, while the warming up and cooling down times remained the same, the Pilates mat exercises gradually increased and the focus was maintained on keeping a neutral posture in different gravity orientations. Verbal and tactile clues were given during each Pilates mat exercises. No specific exercises were defined for completion between weekly sessions. At the beginning of the program, while the intensity of exercise was 40%, it was gradually increased to 60% in the six week. The Pilates training program is given in Table. 1.

Table 1: The Pilates Mat Exercise 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	-
	The Hundred	Mat	8
	The Shoulder Bridge	Mat	8
	Single Leg Circle	Mat	8
Exercises	Swimming	Mat	8
	One Leg Stretch	Mat	8
	Double Leg Stretch	Mat	8
	Single leg stretch with obliques	Mat	8
	Rolling Like a Ball	Mat	8
	The Saw	Mat	8
	Roll Up	Mat	8
	Spine Stretch	Mat	8
	Abdominal prep	Mat	8
	Breast stroke preps	Mat	8
	Leg Pull Down	Mat	8
	Leg Pull Up	Mat	8
	Push Up	Mat	8
	Pelvic Curl	Mat	8
	Side Bend	Mat	8
	Side Kick Front	Mat	8
	Side Kick Back	Mat	8
	Leg pull front	Mat	8

Statistical Analysis

The SPSS statistical program (version 15.0) 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. Differences between

pre-tests and post-tests were tested via Paired t-tests in experimental and control group. Independent t-tests were used to test difference in variables between the experimental and control group. For all analyses, the criterion for significance was set as $p < 0.05$.

RESULTS

Table 2. Summary of the Data of the experimental and control groups

Variables	Experimental group (n =42) M ± SD	Control group (n =24) M ± SD
Age (year)	44.11±2.81	43.33±2.84
Body height (cm)	1.59±6.83	1.60±5.12
Body weight (kg)	79.32±10.34	73.25±12.21

The means and comparisons of pre-exercise and post-exercise are presented in table 3. We find significant differences between experimental and control group for body weight, body mass index, waist circumference, waist-hip ratio in the pre-test ($p < 0.05$). Also, there was no significant differences found between experimental and control group according to body weight, body mass index, waist circumference, biceps, triceps, supscapula, iliac and fat percentage in the post-test

($P > 0.05$), but we found a significant difference in waist-hip ratio between experimental and control group in the post test ($P < 0.05$). But body weight, body mass index, waist circumference, waist-hip ratio, skinfold thickness and fat percentage means was significantly lower than pre-exercise values. In fact, there was a significant difference in waist-hip ratio between pre-test and post-test scores of experimental group ($p < 0.05$).

Table 3. Comparison of the experimental and control groups with respect to their pre-test and post-test scores

Variables			Pre-test			Post-test		
Groups		N	Mean±SD	t	p	Mean±SD	t	p
Body weight (kg)	Experimental group	42	79.32±10.34	2.147	0.036*	77.68±10.03	1.236	0.221
	Control group	24	73.25±12.21					
Body mass index (kg/m ²)	Experimental group	42	31.40±4.17	2.601	0.012*	30.74±3.98	1.670	0.100
	Control group	24	28.65±4.06					
Waist circumference (cm)	Experimental group	42	93.57±9.15	2.255	0.028*	89.26±8.16	0.646	0.520
	Control group	24	87.83±11.22					
Waist-hip ratio	Experimental group	42	0.80±.044	-25.432	0.000*	0.93±.31	-4.743	0.000*
	Control group	24	1.25±0.10					
Biceps (cm)	Experimental group	42	18.24±6.45	-0.409	0.684	16.12±6.12	-1.567	0.122
	Control group	24	19.04±9.47					
Triceps (cm)	Experimental group	42	28.40±6.03	0.845	0.401	24.40±6.32	-1.673	0.099
	Control group	24	27.04±6.77					
Sup scapula (cm)	Experimental group	42	26.48±7.09	1.095	0.278	21.81±6.20	-1.684	0.097
	Control group	24	24.54±6.57					
Iliac (cm)	Experimental group	42	21.93±5.36	0.056	0.955	21.19±4.82	-0.474	0.637
	Control group	24	21.83±8.46					
Body fat percentage (%)	Experimental group	42	37.07±3.10	1.316	0.193	35.09±3.29	-1.871	0.066
	Control group	24	35.85±4.38					

*p < 0.01

As shown in Table 4, we find significant differences between pre-test and post-test values of body weight, body mass index, waist circumference, waist-hip ratio, biceps, triceps, supscapula, iliac and fat percentage in the experimental group (p < 0.05). But, there were no significant differences seen between pre-test and post-test values of waist circumference, waist-hip ratio, biceps, triceps, subscapula,

iliac and fat percentage in the control group (P>0.05). We find significant differences between pre-test and post-test for body weight and body mass index in the control group (p < 0.05).

Table 4. Intragroup comparison of the pre-test and post-test values for both experimental and control groups.

Groups	Variables	Pre-test Mean±SD	Post-test Mean±SD	t	p
Experimental Group (N=42)	Body weight (kg)	79.32±10.34	77.68±10.03	5.993	0.000*
	Body mass index	31.40±4.17	30.74±3.98	5.694	0.000*
	Waist circumference	93.57±9.15	89.26±8.16	5.830	0.000*
	Waist-hip ratio	0.80±0.044	0.93±0.31	-2.508	0.016*
	Biceps	18.24±6.45	16.12±6.12	3.295	0.002*
	Triceps	28.40±6.03	24.40±6.32	5.408	0.000*
	Subscapula	26.48±7.09	21.81±6.20	5.488	0.000*
	Iliac	21.93±5.36	21.19±4.82	2.064	0.045*
	Body fat percentage	37.07±3.10	35.09±3.29	6.017	0.000*
Control Group (N=24)	Body weight (kg)	73.25±12.21	74.25±12.16	-2.261	0.034*
	Body mass index	28.65±4.06	29.04±3.99	-2.267	0.033*
	Waist circumference	87.83±11.22	87.75±10.67	0.371	0.714
	Waist-hip ratio	1.25±0.10	1.24±0.10	0.785	0.440
	Biceps	19.04±9.47	19.13±9.47	-1.446	0.162
	Triceps	27.04±6.77	27.21±6.95	-1.813	0.083
	Subscapula	24.54±6.57	24.54±6.57	0.000	1.000
	Iliac	21.83±8.46	21.96±8.37	-1.366	0.185
	Body fat percentage	35.85±4.38	36.88±4.42	-1.539	0.137

*p < 0.05

DISCUSSION

A few research mentions that physical activity has been commonly used and studied as a health-related factor (5) and it is mentioned that regular physical activity of moderate intensity has significant influence on health (29). Besides, Pilates is popular among women (6), it also has given a new direction to physiotherapy, and influence exercise prescription in many bodywork fields including sports medicine (21). The present study investigated the effect of Pilates mat training on BMI, body composition, waist circumference, waist-hip rate and emergence of hot flushes as vasomotor symptoms at middle aged sedentary perimenopausal women.

There were no differences among groups for body weight, body mass index, waist circumference, skin-fold thickness and fat percentage between the pre-test and post-test (p >0.05) but there was differences between experimental and control group for waist-hip ratio between the pretest and posttest (p < 0.05).

In this study, the means of the pre and post-tests means were different for body weight, body mass index, waist circumference, waist-hip ratio, skin-fold thickness and fat percentage after the Pilates exercise program, although those proved to be higher in experimental group than the control group before Pilates exercise program. Besides, there was statistically significant difference between pre- and post-measurements for body weight, body mass index, waist circumference, waist-hip ratio, skin-fold thickness and fat percentage in Pilates mat training group (p<0.05). In our study it is also demonstrated that the 6 week Pilates mat training program enhanced weight loss, body mass index, waist circumference, body composition parameters and fat percentage when compared with the control group. Morey and Zhu (2003) mentioned that exercise program could reduce symptoms, especially the reported developments in functional or physical parameters such as fitness or body composition in their studies

(26). Ryan et al. (1996) found that body mass, body fat percentage and BMI were significantly higher in sedentary women compared to active controls (30). In another study, the effect of Pilates exercise on body composition in sedentary women was examined. They had not found statistically significant differences between exercise group and control group after the Pilates exercise implemented for 12 weeks 2 days per week and 60 min in day (11). It was thought that the frequency and intensity may cause of the Pilates mat training program (two hour a week Pilates exercise). However, their study demonstrated that the exposure of women to Pilates mat exercise program improved body composition during 12 weeks, for two 60-minutes sessions per week, besides increased lean mass and decreases fat mass and the percentage fat mass at upper and lower limbs level at the end of exercise program and they suggested that The Pilates mat exercise program may be useful to body composition control (11).

Also in this study, in the control groups intragroup comparison there was a significant difference between pre- and post-measurements for body weight, body mass index ($p < 0.05$). In our study, it was thought that there was a significant difference between pre- and post-measurements for body weight, body mass index due to an increase in weight after the experiments.

Additionally in this study, some of the women who participated in the pilates mat training program stated that much reduced cases of hot flushes ($n=23$) and some of the women said that it was partially reduced ($n=11$) and the other women reported that they did not see any changes in cases of hot flushes ($n=8$) at the end of training program. As a result of those women who improved their fitness across the training program

exhibited decreases in hot flushes symptom over time. Daley et al. (2007) stated that positive effects of exercise was shown on hot flushes in cross-sectional studies while prospective studies indicated small or no effect (13) and Freedman and Krell (1999) reported that most studies have relied on self-report measures of both physical activity and hot flushes or did not test different exercise modalities or consider fitness as an outcome (12). But, In contrast there are researches which reported that physical activity did not influence vasomotor symptoms (Guthrie et al., 1994; Wilbur et al., 1990). However, in this study decreased and improved of hot flushes from vasomotor symptoms for women who participated in pilates mat training program and the same for inactive women (14).

CONCLUSION

It is also known that regular physical activity is beneficial in reducing a number of physical and mental symptoms. Due to, physical activity can impact on symptoms associated with perimenopause.

In summary, six weeks pilates mat training program had major effects on weight management, fat percentage, body mass index and body composition *parameters in middle aged sedentary overweight women*. Most of the women reported that hot flushes decreased at the end of pilates mat training program. Therefore, in this study supported to the use of pilates mat training program to relieve hot flushes during perimenopause.

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