

Effects of 8-week Pilates exercise program on menopausal symptoms and lumbar strength and flexibility in postmenopausal women

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The aim of this study was to investigate the effects of an 8-week Pilates exercise program on menopausal symptoms and lumbar strength and flexibility in postmenopausal women. In total, 74 postmenopausal women were recruited and randomly allocated to a Pilates exercise group (n=45) and a control group (n=29). Menopausal symptoms were measured through a questionnaire, while lumbar strength was measured through a lumbar extension machine, and lumbar flexibility was measured through sit-and-reach and trunk lift tests performed before and after the Pilates exercise program, respectively. The Pilates exercises consisted of 7–10 min for warm-up, 35–40 min for the main program modified from Pilates Academy International, and 5–7 min for the cool-

down, and were performed 3 times a week for 8 weeks. The results showed a significant decrease in menopausal symptoms except urogenital symptoms. Also, the results presented a significant increase in lumbar strength and flexibility after 8 weeks of the Pilates exercise program. We concluded that an 8-week Pilates exercise program is effective in decreasing menopausal symptoms and increasing lumbar strength and flexibility.


Keywords: Menopausal symptoms, Pilates, Postmenopausal women, Lumbar strength, Lumbar flexibility

INTRODUCTION

Menopause is defined as the permanent cessation of menstruation due to loss of ovarian follicular function. As a result, a decline in estrogen production has been observed throughout the perimenopausal period, while a very low level of circulating estrogen is seen in postmenopausal women (Gruber et al., 2002). This results in clinical symptoms such as vasomotor, psychological, physical, and urogenital symptoms (Palacios et al., 2010; Rymer and Morris, 2000). Using the Menopause Rating Scale questionnaire, Chedraui et al. (2007) reported that 65.6% of postmenopausal women suffer from hot flushes, 77% from muscle and joint problems, 74.6% from depressive moods, and 69.6% from sexual problems, and these rates are higher compared to those of premenopausal women (Chedraui et al., 2007). These symptoms have a negative impact on quality of life in postmenopausal women.

Also, menopausal women experience a number of physical changes such as loss of muscle strength and flexibility, which is considered to be a major contributor to musculoskeletal disorders (Sutton-Tyrrel et al., 2005). Yamamoto et al. (2009) identified flexibility as a determinant of arterial stiffness, which is known to be an independent risk factor for cardiovascular disorders, target organ damage (Coutinho et al., 2011), and increased mortality risk (Vlachopoulos et al., 2010).

A Pilates intervention has been proven to increase muscle strength and flexibility and is believed to minimize the harmful effects of menopause on function (Montero-Fernández and Serra-Rexach, 2013). The method is relatively safer than other exercises because of the fact that there is no physical contact, thereby decreasing the risk of injury to the musculoskeletal system (Wells et al., 2012). It also increases core muscle (Lee et al., 2014), flexibility and muscular strength (Kao et al., 2015), and dynamic pos-

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tural balance (Kloubec, 2010), and improves quality of life (Küçük and Livanelioglu, 2015).

Although previous research has proven the effectiveness of Pilates, studies about exercise in postmenopausal women are still insufficient. Therefore, the purpose of this study was to comparatively analyze the effects of an 8-week Pilates exercise program on menopausal symptoms and lumbar strength and flexibility in postmenopausal women.

MATERIALS AND METHODS

Subjects

The subjects were recruited using an advertisement posted on the Mom's cafe website of S City. Subjects included 74 women aged 45–60 yr who were in the menopausal stage for ≥ 1 yr. The subjects were randomly categorized into a Pilates exercise group ($n=45$) and a control group ($n=29$). The subjects had not participated in any formal exercise programs and had not received medication for menopausal symptoms within the past 6 months. Additionally, the subjects had no medical history of diseases such as musculoskeletal disorders, cardiovascular disease, or metabolic disorders. The subjects were asked to sign a letter of consent for participating in the study (Table 1).

Menopausal symptoms questionnaire

The questionnaire used for measuring menopausal symptoms was developed by Choi (2001) using Chronbach alpha 0.92. The questionnaire included a total of 44 items measuring vasomotor (7), genitourinary (5), psychological (21), and physical symptoms (11), and answers ranged from “no symptoms” (0 points) to “symptoms are very severe” (6 points). Higher points indicated the severity of menopausal symptoms. Pre- and posttests were administered for all measurements.

Lumbar strength test

Lumbar strength was measured using a lumbar extension ma-

chine (Apsun Inc., Hamburg, Germany). The subjects were instructed to sit in the machine wherein the pelvis was secured. Then the subjects were required to extend their backs against the upper back pad by gradually increasing the tension for 2- to 3-sec periods. Upon reaching the maximum tension, the subjects were told to hold the contraction for another 10 sec. Lumbar strength was measured according to the University of Florida Protocol at a 72° fixed position. The procedure was performed twice, and the subjects were given a 15-sec rest between procedures. The higher score was recorded (Pollock et al., 1989).

Sit-and-reach and trunk lift tests

Lumbar flexibility was measured using the sit-and-reach and trunk lift tests. The sit-and-reach test was conducted according to YMCA (Young Men's Christian Association) standards, wherein the participants gradually reach forward while sitting with legs extended and feet 5 cm apart. The measurement was taken twice, and the higher score was recorded in centimeters (cm) (Golding et al., 1989).

The trunk lift test was conducted with the subjects lying in a prone position. The subjects were instructed to lift their upper bodies gradually off the floor to a maximum height. The distance between the floor and the inferior aspect of the chin was measured. The measurement was taken twice, and the higher score was recorded in centimeters (cm) (Patterson et al., 1997).

Pilates exercise program

The program was adopted from Pilates Academy International (PAI, New York, NY, USA) and was modified in accordance with the participants' capabilities. Relaxing music was played during the program. The exercise program consisted of 7–10 min for the warm-up, 35–40 min for the main program, and 5–7 min for the cool-down. The main program consisted of exercises that emphasize the 6 principles of Pilates such as the Hundred, Roll Up, Leg Stretch (single and double), Leg Circles (single and double), Rolling like a Ball, Spin Stretch Forward, Saw, Teaser, Swan Dive, Crisscross, Coccyx Curl, Curl Up, and Swimming. Each exercise was repeated 10–15 times for 2–5 sets, with a 10-sec rest per repetition and 60 sec between sets. The rating of perceived exertion (RPE) was used to gradually increase the program intensity. The program was divided into 3 phases: phase 1 (RPE, 9–11), phase 2 (RPE, 9–13), and phase 3 (RPE, 9–11).

Statistical analysis

IBM SPSS ver. 18.0 (IBM Co., Armonk, NY, USA) was used to

Table 1. Physical characteristics of the subjects

Variable	PEG (n=45)	CG (n=29)
Age (yr)	53.00 \pm 3.62	55.31 \pm 3.16
Height (cm)	159.51 \pm 4.40	156.52 \pm 4.27
Weight (kg)	61.85 \pm 9.24	60.99 \pm 7.44
Body fat (%)	33.59 \pm 5.22	33.03 \pm 5.77
Body mass index (kg/m ²)	24.56 \pm 3.43	25.03 \pm 3.12

Values are presented as mean \pm standard deviation.
PEG, Pilates exercise group; CG, control group.

calculate the mean and standard deviation for each variable earned from the experiment. A two-way repeated measures analysis of variance was performed to investigate the difference between the two groups. All statistical significance levels were $P < 0.05$.

RESULTS

Changes in postmenopausal symptoms by the application of Pilates exercise

Significant differences were shown between the groups and for time and interaction of vasomotor, mental, and physical symptoms ($P = 0.001$). However, changes in urogenital symptoms showed significant differences between the groups and interaction ($P = 0.001$), but did not show any significant difference for the time (Table 2).

Changes in lumbar muscle strength by the application of Pilates exercise

The results for lumbar strength showed significant differences between the groups ($P = 0.000$), time ($P = 0.000$) and interaction

($P = 0.001$) (Table 3).

Changes in flexibility by the application of Pilates exercise

Significant differences between the groups ($P = 0.001$), time ($P = 0.001$) and interaction ($P = 0.001$) were found for sit-and-reach test. Similarly, the trunk lift test also showed significant differences between the groups ($P = 0.001$), time ($P = 0.042$) and interaction ($P = 0.001$) (Table 4).

DISCUSSION

Several studies have shown that postmenopausal women are more prone to sedentary habits and loss of fitness (Sowers et al., 2007), which is clearly associated with deterioration in health and lower quality of life (Martin et al., 2009). Therefore, it is important for postmenopausal women to change their sedentary lifestyles by performing physical activities like Pilates exercises.

This study investigated the effects of an 8-week Pilates exercise program on menopausal symptoms in postmenopausal women and found that it decreased vasomotor, psychological, and physical

Table 2. Changes in menopausal symptoms

Item	Group	Pretest	Posttest	F	P-value
Vasomotor	PEG	19.47 ± 8.58	8.86 ± 5.97	G: 376.685	0.000***
	CG	13.62 ± 8.82	17.74 ± 11.47	T: 5.724	0.019*
				G × T: 29.489	0.000***
Mental/Psychological	PEG	66.86 ± 23.34	31.60 ± 19.42	G: 791.739	0.000***
	CG	51.76 ± 20.64	59.72 ± 30.59	T: 10.907	0.001**
				G × T: 27.357	0.000***
Physical	PEG	35.53 ± 10.84	18.77 ± 8.54	G: 1,010.453	0.000***
	CG	32.29 ± 12.34	33.21 ± 14.24	T: 17.149	0.000***
				G × T: 21.331	0.000***
Urogenital	PEG	14.19 ± 5.72	7.96 ± 6.45	G: 411.824	0.000***
	CG	11.50 ± 5.53	14.91 ± 8.20	T: 2.131	0.149
				G × T: 24.950	0.000***

Values are presented as mean ± standard deviation.

PEG, Pilates exercise group; CG, control group; G, group; T, time.

* $P < 0.05$. ** $P < 0.01$. *** $P < 0.001$.

Table 3. Changes in lumbar strength

Item	Group	Pretest	Posttest	F	P-value
Lumbar Strength	PEG	502.31 ± 209.63	754.36 ± 296.31	G: 487.213	0.000***
	CG	453.90 ± 215.91	469.83 ± 228.87	T: 19.204	0.000***
				G × T: 14.909	0.000***

Values are presented as mean ± standard deviation.

PEG, Pilates exercise group; CG, control group; G, group; T, time.

* $P < 0.05$. ** $P < 0.01$. *** $P < 0.001$.

Table 4. Changes in sit and reach test and trunk lift test

Item	Group	Pretest	Posttest	F	P-value
Sit and reach test	PEG	11.77±9.14	18.19±6.64	G: 250.365	0.000***
				T: 14.629	0.000***
				G×T: 23.414	0.000***
	CG	12.56±7.99	11.81±7.26	G: 250.365	0.000***
				T: 14.629	0.000***
				G×T: 23.414	0.000***
Trunk lift test	PEG	27.37±6.83	31.14±6.50	G: 1,119.715	0.000***
				T: 12.791	0.001**
				G×T: 4.273	0.042*
	CG	24.57±8.73	25.58±8.00	G: 1,119.715	0.000***
				T: 12.791	0.001**
				G×T: 4.273	0.042*

Values are presented as mean ± standard deviation.

PEG, Pilates exercise group; CG, control group; G, group; T, time.

* $P < 0.05$. ** $P < 0.01$. *** $P < 0.001$.

symptoms. However, the urogenital symptoms showed significant differences between the two groups and for interaction but no significant changes on pre- and posttests. These results correspond to the study of Chang and Lai (2013) which stated that exercises such as weight training (Conceição et al., 2013) and aerobics (Ağıl et al., 2010) can ameliorate menopausal symptoms. This study found that only a relatively short period (8 weeks) of Pilates exercise can effectively decrease menopausal symptoms.

This study also found significant differences between groups and for time and interaction in muscle strength and flexibility after the Pilates exercise program. The main Pilates movements used in the study improve muscle strength and flexibility by gradually reinforcing the muscles, cartilage, and conjunctive tissue of the trunk segment. This is similar to the study by Menacho et al. (2010), which stated that Pilates exercise helps to stabilize and strengthen the lumbar muscles by focusing on the powerhouse. Campos de Oliveira et al. (2015) compared static stretching exercises to Pilates, which could significantly improve lower limb strength, posture, balance, and health-related quality of life in older adults.

Thus, Pilates is a good intervention for menopausal women because it helps improve not only physical fitness like balance and flexibility but also mental fitness. In this study, a Pilates exercise program increased the subjects' flexibility and strength by breath control, which causes the muscles to relax.

Therefore, this study shows that an 8-week Pilates exercise program has positive effects on menopausal symptoms and lumbar strength and flexibility in postmenopausal women. Thus, contin-

uous participation of women in a Pilates exercise program may help to enhance their health and ability to live independently after menopause.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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