

The Ameliorating Impact of Pilates Training on Anxiety and Body Mass Index in Menopausal Symptoms

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Abstract

Background: Menopausal symptoms severely affect a woman's lifestyle and health. Lifestyle, including physical activity, is known to be an effective factor on the menopausal-associated symptoms. We conducted the present study to evaluate the effects of an eight-week Pilates training on menopausal-related symptoms, including somatic, psychological and sexual symptoms, body mass index (BMI), and anxiety as possible effective factors on menopausal symptoms.

Methods: This was an experimental study conducted in the summer of 2020. The participants in this study were 27 postmenopausal women (aged 60-65, BMI: 24-30) who participated in the study voluntarily. They were randomly divided into two groups of control (n=12) and exercise (n=15). The subjects in the training group participated in Pilates training for eight weeks, three sessions per week and each session lasted 75 minutes with progressive intensity. BMI was measured and the participants completed anxiety and depression questionnaires (HADS) and menopausal symptoms rating scale (MRS) before and after the exercises. We utilized paired t-test and analysis of co-variance (ANCOVA) to analyze the data.

Results: BMI (P=0.023), anxiety (P<0.001), physical score (P<0.001), psychological score (P=0.001), and the total (P<0.001) score of menopausal symptoms reduced significantly following Pilates training compared to the control group. No significant changes were observed in the sexual symptoms of menopause following Pilates training compared to the control group (P=0.60).

Conclusion: An eight-week Pilates training reduced most of the postmenopausal symptoms (somatic, psychological, and total) as well as potentially aggravating menopausal symptoms, including anxiety and BMI.

Keywords: Exercise, Menopause, Body Mass Index, Anxiety, Postmenopause

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1. Introduction

Menopause is defined as the last period of menstruation, which follows one year of amenorrhea. Accordingly, menopause is the period following the final menstruation (1). It is a natural process that occurs with normal aging (2). Women spend over a third of their lives in menopause, and due to the effects of menopause on the body's systems, preventative measures are of great importance in reducing the incidence of menopausal symptoms (3). Menopausal age in women depends on their lifestyle and medical history. During this process, middle-aged women between the ages of 40 and 60 experience a variety of menopausal symptoms, including physical symptoms such as night sweats, vaginal dryness, hot flashes, joint pain, and psychological symptoms such as forgetfulness, insomnia, anxiety, and headaches. It strongly affects women's lifestyle and health (4). Several factors are involved in the development and exacerbation of menopausal symptoms, including body composition, menopausal stage, age, and lifestyle (5).

Lifestyle, including physical activity, is known to be an effective factor in the onset of menopausal symptoms. Physical activity is divided into exercise and daily physical activity (6). Regular exercise prevents weight gain, improves body composition, develops strength, and increases the body functional capacity. A review study demonstrated that exercise in postmenopausal women causes optimal changes in their body composition, decreases adipocyte, and increases lean mass (7). Regular exercise in various forms, brisk walking for instance, can reduce weight and body fat, and considering the effect of body composition and obesity on menopausal symptoms, it could reduce menopausal symptoms (8). Walking for four months in postmenopausal women has been observed to reduce anxiety and ultimately, menopausal symptoms (9). However, moderate-intensity aerobic exercises for 12 weeks did not reduce vasomotor symptoms, yet improved quality of sleep, insomnia, and anxiety in middle-aged women with sedentary lifestyle (3). Meanwhile, following 12 weeks of exercise all the indicators of quality of life in postmenopausal women

improved (10). Exercise might improve menopausal symptoms by improving physical and functional parameters, such as body composition or fitness (11). It has been suggested that exercises improving cardiovascular fitness can decrease hot flashes or other menopausal symptoms (12). A type of exercise suggested for the reduction of the harmful effects of menopause on physical function is Pilates (13). Pilates includes easy exercises which increase strength, muscular endurance, and flexibility and improve cognitive function. This sport is safer than other types of exercises, and can be considered as a suitable kind of exercise for elder people (14). A study has shown that eight weeks of Pilates exercises reduced vasomotor, mental disorders, and physical symptoms in postmenopausal women (15). Nevertheless, certain indicators such as body composition and anxiety affect menopausal symptoms, which has not been controlled in most of previous studies. In addition, considering the wide variety of Pilates training (in terms of intensity and method of execution), it is not clear which kind affects menopausal symptoms. Moreover, environmental factors such as lifestyle, including nutrition and daily physical activity, which are various in different countries, could be effective on the reducing impact of Pilates on these indicators. Therefore, this study aimed to examine the impact of Mat Pilates training with increasing intensity on the menopause-associated symptoms.

2. Methods

In order to examine the impact of Pilates training on menopausal symptoms and clarify the possible effect of BMI and anxiety on these symptoms, we conducted the present work on postmenopausal women. This research is an applied and experimental study performed by pretest-posttest method with two groups of Pilates training and control. It was conducted in the summer of 2020. The statistical population was postmenopausal women in Isfahan. The statistical samples of the project were purposefully selected based on a call among women aged 60 to 65 years. Initially, the call to participate in the research was distributed in various centers, including the Retirement Center and welfare centers in Isfahan. The exclusion criteria was as the following: history of cardiovascular disease, diabetes, smoking, mental illness including depression, use of antidepressants, getting psychotherapy, use of hormonal drugs (estrogen and progesterone), not participating in the research program including exercises and tests, any unpredicted illness that could affect the hormones or variables, any acute psychological stress or movement problems, and the

unwillingness of the subject to continue collaboration was with the researcher. The inclusion criteria included subjects with menopausal history of at least five years and the ability to perform the exercises.

We calculated the sample size using the following formula (16):

$$n_A = \kappa n_B \text{ and } n_B = \left(1 + \frac{1}{\kappa}\right) \left(\frac{\sigma}{\mu_A - \mu_B} \left(z_{1-\alpha/2} + z_{1-\beta}\right)\right)^2$$

$$1 - \beta = \Phi(z - z_{1-\alpha/2}) + \Phi(-z - z_{1-\alpha/2}) \quad , \quad z = \frac{\mu_A - \mu_B}{\sigma \sqrt{\frac{1}{n_A} + \frac{1}{n_B}}}$$

$\kappa = n_A/n_B$ is the matching ratio;

σ is the standard deviation;

Φ is the standard Normal distribution function;

Φ^{-1} is the standard Normal quantile function;

α is Type I error;

β is Type II error, meaning $1 - \beta$ is power.

According to Chow and colleagues (17), the vasomotor symptoms of the exercise and control groups were predicted as 8.86 ± 5.97 and 17.74 ± 11.47 , respectively, and the sample size was estimated to be 13 subjects in each group. Out of 61 volunteers, 35 were selected according to the inclusion criteria. Five women were excluded for different reasons, such as sudden stress or illness, possibly affecting the results of the study. 30 women were randomly divided into the control ($n=15$) and the exercise ($n=15$) groups through blocked randomization method. 3 women of the control group were excluded due to not participating in the post tests. Therefore, the final participants considered for the data analysis included 27 people, among which 15 were in the training group and 12 in the control group.

Ahead of the exercises, we measured the participants' height and weight parameters to measure BMI. The participants also completed two questionnaires of anxiety and depression (HADS) (17) and menopause rating scale (MRS) (18) so that we could assess the related symptoms. The method of completing the questionnaires was fully explained to the participants. For controlling the acute effect of the exercises, we remeasured the participants' height and weight 72 hours following the training course and both questionnaires were completed by the participants again.

Training and testing: The training protocol consisted of 8 weeks of Pilates training, with about 60 minutes each session (19). In order to observe the principle of overload in sports training, the intensity of exercise increased gradually with the increase in the number of repetitions. The sets and the type of exercises were controlled with Borg scale (Borg, 1998) and heart rate was measured with smart wristbands. The intensity of these exercises increased gradually during the training period according to the ability of the participants. In the first week, the intensity of exercises was moderate meaning that it was 3- 4 (RPE) according to the Borg scale or 96 beat/min based on the heart rate). In the second to fourth week, the intensity was 4- 6 (RPE) based on the Borg scale or average heart rate 110 beat/min. From the fifth to eighth week, the intensity was 6-7 (RPE) based on the Borg scale or average heart rate of 125 beat/min. To obtain the principle of individualization of the training, we increased the intensity of the training based on the ability of each person individually.

The exercises were designed according to Pilates (2001) acetate instructions. The warm-up included 5 minutes of gentle kinetic and tensile movements of various joints. The main exercises were divided into two parts. The initial part (4 weeks) of Mat exercises and the second part (second 4 weeks) of resistance exercises were added. Before starting the main exercises, we performed two training sessions in order to adapt and familiarize our subjects with the Pilates exercises. (20). Each session was performed with one to three sets and with 8-12 repetitions per set, and the number of repetitions increased progressively. The training intensity increased by changing the type of exercises and the number of repetitions and sets.

The Hospital Anxiety and Depression Scale (HADS): Surveying the tension and melancholy in patients with physical and mental issues is an exceptionally suitable and useful self-report apparatus. This questionnaire incorporates 14 inquiries and comprises two sections, 7 of which measure the anxiety, and the other 7 measure the depression. Each of the questions has four options and is scored 0 to 3 (17). The Persian version of the questionnaire was validated by Montazeri and colleagues, whose validity and reliability was approved (21).

The MRS questionnaire: The MRS questionnaire is globally valuable and is employed for assessing menopausal symptoms. It includes 11 menopause-associated inquiries in three areas: physical (4 questions),

mental (4 inquiries), and urogenital (3 inquiries). Physical problems assess symptoms of hot flashes and night sweats, sleeping disorders, heart problems, and muscle and joint pain; psychological inquiries examine depression, nervousness, anxiety, poor memory, and lack of concentration; urogenital inquiries are related to urinary problems and dryness, the decreased sexual desire and satisfaction, and vaginal burning. These inquiries are measured on a 5-point Likert scale. In the research by Heinman and colleagues the content and face validity of this questionnaire was assessed and confirmed, Cronbach's alpha was used for calculating its reliability that was obtained to be above 0.65 for all the dimensions (22). Darsareh and colleagues. approved the validity and reliability of its Persian version (23). Lower scores of each domain or the total score is indicative of less severe symptoms of menopause (18). We utilized SPSS software (version 20) to analyze the data. Due to the normality of the data, paired t-test was used to examine within-group changes. The analysis of covariance was applied for examining the differences between the groups. The significance level throughout the present study was considered at 95% or alpha 0.05.

The participants signed the informed consent prior to their contribution to the study. Primarily, the study was approved by the Local Ethic and Graduate Committee of Shiraz University (no: 993/48/1481) and also Ethic Committee of School of Rehabilitation Science in Shiraz University of Medical Sciences (no: IR.SUMS.REHAB.REC.1399.033).

3. Results

Table 1 represents the demographic information of our subjects. The comparison of the two groups using independent t-test indicated no significant differences between the exercise and control groups before the intervention in terms of BMI ($t=0.31$, $P=0.75$), menopausal age ($t=0.25$, $P=0.80$), and menopausal history ($t=1.25$, $P=0.22$). Therefore, the two groups were considered homogeneous in the above-mentioned variables.

For evaluating the effects of Pilates training on menopausal symptoms and the related factors of BMI and anxiety, we employed paired t-test in order to compare the changes in the groups, and ANCOVA test for inter-group comparisons. According to the results of t test in Table 2, following the exercise in the Pilates training group, we observed a significant decrease in BMI ($P=0.016$), anxiety ($P=0.002$), and physical ($P=0.047$), psychological ($P=0.01$), and the total ($P=0.004$) symptoms of menopause; meanwhile,

Table 1: Comparison of Demographic characteristics of the participants in the two groups of exercise (n=15) and control (n=12)

| | Group | Mean±SD | T | P |
|--------------------------|----------|------------|------|-------|
| Age | Exercise | 61.47±1.55 | 4.5 | 0.01* |
| | Control | 62±1.44 | | |
| BMI (kg/m ²) | Exercise | 28±4.00 | 0.31 | 0.75 |
| | Control | 26.5±2.75 | | |
| Age of menopause | Exercise | 49.5±6.10 | 0.25 | 0.80 |
| | Control | 50±1.70 | | |
| History of menopause | Exercise | 11.9±6.50 | 1.25 | 0.22 |

BMI: Body mass index, significant, *P<0.05

Table 2: Comparison of the study variables within and between exercise and control groups

| Variables | Group | Pre-experiment | Post-experiment | Within group | | Between groups | | | |
|-------------------------------|--------------------------|----------------|-----------------|--------------|--------|----------------|--------|------------|------|
| | | | | t | P | F | P | Eta square | |
| Symptoms of menopause (score) | Physical | Exercise | 6.33±2.49 | 5.06±2.28 | 2.1 | 0.047* | 18.09 | <0.001* | 0.43 |
| | | Control | 6.58±2.46 | 7.08±2.15 | 1.31 | 0.214 | | | |
| | Psychological | Exercise | 6.33±3.47 | 6.40±2.79 | 2.71 | 0.015* | 16.06 | 0.001* | 0.40 |
| | | Control | 8.16±1.11 | 8.75±0.86 | 2.54 | 0.027* | | | |
| | Sexual | Exercise | 3.93±2.63 | 3.86±2.53 | 0.43 | 0.670 | 0.27 | 0.60 | 0.11 |
| | | Control | 4.66±1.30 | 4.91±1.37 | 1.91 | 0.082 | | | |
| | Total | Exercise | 16.40±6.99 | 13.40±5.92 | 3.49 | 0.004* | 28.01 | <0.001* | 0.53 |
| | | Control | 20.75±2.80 | 19.41±2.90 | 3.21 | 0.008* | | | |
| | BMI (kg/m ²) | Exercise | 28.11±3.99 | 27.70±3.89 | 2.75 | 0.016* | 5.86 | 0.023* | 0.19 |
| | | Control | 27.60±4.31 | 27.61±3.30 | 02.34 | 0.039* | | | |
| Anxiety (point) | Exercise | 9.93±3.53 | 6.06±3.15 | 3.68 | 0.002* | 27.90 | <0.001 | 0.54 | |
| | Control | 10.66±0.98 | 11.25±1.13 | 3.02 | 0.12 | | | | |

BMI: Body mass index, significant, *P<0.05

no significant differences were found between post-test and pre-test in concerning sexual symptoms (P=0.67) in the exercise group. In the control group, no significant changes were observed in anxiety (P=0.002) and menopausal symptoms, including physical (P=0.214) and sexual symptoms (P=0.082) whereas BMI (P=0.039) and psychological symptoms (P=0.027) increased significantly.

Table 2 represents the results of ANCOVA test regarding the comparison of variables between the two groups. These results revealed that after controlling the effects of pre-test as covariate, significant differences were found between the two groups considering BMI (F=5.86, P=0.023), anxiety (F=27.90, P=0.021), and menopausal symptoms, including physical (F=18.09, P<0.001), psychological (F=16.06, P=0.001) and the total symptoms (F=28.01, P<0.001) after the intervention. However, no significant differences were seen between the two groups concerning sexual symptoms following the intervention (F=0.027, P=0.60).

4. Discussion

The present study implied that an eight-week

Pilates training in postmenopausal women resulted in decreased BMI and anxiety, and moderated symptoms of menopause, including physical, psychological and the total symptoms. Yet, we did not observe any significant effects on sexual symptoms in comparison with the control group. Herein, the participants were homogeneous regarding BMI, menopausal age, and menopausal history, which are the effective factors on menopausal indices.

Previous studies have approved the effects of exercise on reducing cardiovascular disease in postmenopausal women and health problems that occur during menopause (24). The present research illustrated that eight weeks of Pilates reduced BMI in older women. The type of breathing in this sport is such that it effectively promotes oxygen transfer, thereby increasing energy and insulin sensitivity; consequently, fat oxidation increases (25), which could reduce the total weight. Coinciding with this research, Moradpour and colleagues (10) reported that physical activity and exercise energy expenditures are associated with the body composition and increased cardiovascular fitness and could reduce menopausal symptoms. In another study, Conceição (26)

suggested that 16 weeks of weight training improved menopausal symptoms reducing metabolic syndrome, lowering blood glucose, improving body composition and muscle strength in postmenopausal women. In another study on 2399 women aged 46-55, those who had regular physical activity had higher quality of life scores compared to inactive ones. Furthermore, it has been found that women with normal BMI had lower physical symptoms of menopause than inactive women (27). In another study, on 225 middle-aged women, all the three subscales of menopausal symptoms were higher in women with BMI higher than normal score compared to those with normal BMI (26). BMI classification, specifically provided for the Asian populations than international classification was more closely correlated with the menopausal symptoms (28). Inconsistent with the present study, one study showed that weight reduction in obese women could not diminish hot flashes as one of menopausal symptoms (29) while the findings of another research exhibited that higher BMI or higher fat mass might be associated with different effects on menopausal symptoms at different stages of menopause (30). However, given that body composition is a risk factor for the development of menopausal symptoms, a decrease in BMI can be pivotal in reducing the severity of these symptoms. The expansion of the adipose tissues stimulates secretion of inflammatory factors, such as tumor necrosis factor α and interleukin 6, and diminishes adiponectin, disposing to a pro-inflammatory state and oxidative stress. The expanded amount of interleukin 6 stimulates secretion of C-reactive protein (31). Moreover, adipocyte hypertrophy, through physical reasons triggers the rupture of the cells which induce an inflammatory reaction (32). Additionally, there is a relationship between inflammation and hot flashes (33). Therefore, reducing obesity could reduce menopausal symptoms mediating by inflammation reduction.

The present study indicated that eight weeks of Pilates training resulted in a significant reduction in anxiety and menopausal symptoms in older women. Previous findings have shown that women without a history of depression and anxiety are at a higher risk of depression and anxiety during menopause and post menopause than premenopausal stage (34). A strong predictive association has been found between somatic anxiety and the risk of menopausal hot flashes; thus, anxiety treatment has been proposed as a potential target in clinical management of premenopausal women (35). Therefore, another effective factor for reducing the impact of Pilates on menopausal symptoms might be reducing anxiety. Physical activity

is one of the best and most effective ways to reduce the rate of cognitive and physical decline and all the malignancies in postmenopausal women due to its multiple health benefits (36). Among various exercises, Pilates improves physical and mental performance, particularly in older women. This type of exercise has been found to be suitable and beneficial for all ages regardless of their abilities (12). Consistent with the present study, a study showed that eight weeks of Pilates exercises improved depression and anxiety, sleeping quality, and fatigue severity in older women aged 60 to 70 (37). Another study examined the effect of 12 weeks of Pilates exercises on people aged 60 to 70. A health chart was used to measure the health, which indicated an improvement in physical, social, mental, and emotional health following the exercise program (38). Another study demonstrated that both aerobic and weight training exercise improved menopausal symptoms in postmenopausal women. Meanwhile, in the group of resistance exercises, no significant changes were observed in the sexual subscale in the post-test, which was consistent with the results of the present study. However, in the group of aerobic exercises, all the subscales indicated a significant decrease (39). The intensity and other characteristics of exercise might be effective on its impact on menopausal symptoms. Dąbrowska and colleagues (40) reported that the severity symptoms of menopause is lower in women with high and moderate levels of physical activity compared to that in inactive women. However, in women with low physical activity, physical and sexual symptoms of menopause were higher than those in women with high or moderate physical activity. Considering that in the present study, the intensity of Pilates training increased progressively, its intensity could be sufficient to induce the ameliorating effects on menopausal symptoms.

The limitations of this study included the small sample size, individual differences (including hormonal differences), physical and psychological conditions before the test, which may affect the test results. Sleeping quality and memory loss are other psychological symptoms of menopause that are suggested to be evaluated further in future researches. Moreover, considering the effect of cardiovascular fitness on menopausal symptoms (10), we suggest that in future researches, the effect of Pilates exercises on cardiovascular fitness and menopausal symptoms be investigated.

5. Conclusion

Eight weeks of Pilates exercises moderated

menopausal symptoms and reduced BMI and anxiety in postmenopausal women. Since obesity and anxiety are among the factors contributing to the severity of menopausal symptoms, in the present paper, Pilates exercises might have reduced menopausal symptoms by affecting these two variables. Due to the hormonal effects on anxiety and stress, future studies are recommended for further clarifications.

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