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# Effect of Pilates exercises on fatigue in post-menopausal women

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## Abstract

**Background** A lot of changes occur in women's post-menopausal period: one of these symptoms is fatigue or a lack of energy which is a potential symptom of menopause, and it can be one of the most difficult symptoms to manage. Few studies are concerned with post-menopausal fatigue treatment. Pilates is a mind-body exercise focusing on muscle strength, core stability, endurance, muscle control, posture, and respiration which seems to improve both the physical and psychological components in post-menopausal women. The purpose was to determine the effect of Pilates exercises on fatigue in post-menopausal women.

**Methods** Fifty-two post-menopausal women are suffering from fatigue, their ages ranged from 50 to 55 years, their body mass index (BMI) is below 30 kg/m<sup>2</sup>, and they all became menopause at least 1 year ago. The patients were selected randomly from the out clinic of El Kasr EL-Aini Hospital and randomly divided into two equal groups: group A composed of twenty-six patients who received Pilates exercises and medical standard care for fatigue, and group B is composed of twenty-six patients who received medical standard care for fatigue only. It was a randomized controlled trial for 8 weeks, and the outcome measures were fatigue assessment scale (FAS) and interleukin-6 test (IL-6).

**Results** There was a significant decrease in FAS ( $P < 0.00001$ ) and IL-6 ( $P < 0.00001$ ) after treatment for group A while there was no significant reduction for group B.

**Conclusions** Pilates exercises are considered an effective modality to reduce fatigue in post-menopausal women.

**Keywords** Fatigue, Pilates, Post-menopause, Interleukin-6

## Introduction

In the transition phase of menopause, there will be significant changes in the gonadal hormones. Many women develop somatic and psychological symptoms cluster called post-menopausal syndrome [1].

The signs and symptoms of menopause are characterized by the onset of irregular menses, hot flashes, and night sweats. Menopause is known to be associated with changes in bio-psychosocial changes, e.g., mood swings,

anxiety, sexual dysfunction, stress, forgetfulness, sleep disturbances, and fatigue. During menopause, estrogen levels decline, leading to sleep impairment, depressive disorders, cognitive decline, and various physical ailments like osteoporosis, vaginal atrophy, and sexual dysfunction [2].

Menopausal symptoms, such as hot flashes, may ease gradually for many women. However, some women continue to experience menopausal symptoms for a decade or longer after the menopause transition, unless they receive the proper intervention [3].

Post-menopausal fatigue exacerbates menopausal symptoms such as anxiety, poor concentration, and a lack of confidence [4]. The main cause of menopausal fatigue is the change in hormone levels estrogen, progesterone, thyroid, and adrenal hormones are all involved in regulating cellular energy in the body which when compromised

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can lead to fatigue [5]. Fatigue has a negative impact on the quality of life of post-menopausal women. It can be an overwhelming experience impacting the physical, emotional, and social aspects of them. It can prevent them from carrying out their usual activities of daily living [6]. Menopause-related fatigue is often compounded by symptoms, mainly vasomotor symptoms which are experienced by up to 80% of women and include hot flashes and night sweats that can disrupt post-menopausal women's sleep [7]. Several psychotropic pharmaceuticals may be prescribed to rapidly and successfully improve the vasomotor symptoms that contribute to sleeplessness and fatigue. These include selective serotonin reuptake inhibitors (SSRIs) and serotonin-norepinephrine reuptake inhibitors (SNRIs), both of which are commonly used as antidepressants, but have potential side effects as associated with appetite, constipation, and nausea [8].

Hormone replacement therapy (HRT) (estrogens and progestogens) is used to treat symptoms associated with post-menopausal women [9], but with a long run use, it promotes endometrial thickening and can increase the risk of cancer as well as having several side effects such as headache, upset stomach, stomach cramps or bloating, diarrhea, appetite, and weight changes, black patches on the skin, acne, swelling of hands, and legs due to fluid retention [10]. Regular exercise in post-menopausal women has the benefits of increased cardio-respiratory fitness, increased muscle strength and endurance, reduced body fatigue, improved morale, and increased ability to perform daily tasks with greater force. Thus, the main objective of regular exercise is the prevention of physical deterioration and optimizing functional capacity to improve overall post-menopausal women's quality of life [11]. Pilates is a system of exercises using special apparatus designed to improve physical strength, flexibility, dynamic postural balance, and enhance mental awareness as well as improve the quality of life in post-menopausal women [12]. In the Egyptian population, post-menopausal fatigue did not have much interest; thus, the aim of the present study is to assess the effect of a set of Pilates exercises on the general physical and mental fatigue of post-menopausal women.

## Materials and methods

### Study design

It was a randomized controlled trial. Ethical approval was obtained by the Research Ethics Committee of the Faculty of Physical Therapy, Cairo University (No: P.T.REC/012/003239).

### Participants

Fifty-two post-menopausal women who suffered from fatigue who participated in this study were selected from

the outpatient clinic of El Kasr EL-Aini Hospital, Faculty of Medicine, Cairo, Egypt. All of them were post-menopause at least for 1 year, their age was between 50 and 55 years old, and their body mass index (BMI) did not exceed 30 kg/m<sup>2</sup>. The exclusion criteria were uncontrolled hypertension, thyroid gland disorders, and history of syncope or arrhythmia induced by physical exercises; any mental, neurological, vestibular, and cardiovascular disorders or metabolic disease, visual or hearing impairment that does not allow the possibility of intervention; any hormonal replacement therapy (HRT); or any drug known to affect their physical activity, autoimmune disease, and other problems that make it impossible to perform physical exercises were excluded from the study. Group A (study group) included 26 post-menopausal women who received Pilates exercises 3 sessions per week for 8 weeks, medical standard care for fatigue, and a pamphlet of advice to deal with fatigue, while group B (control group) received medical standard care for fatigue as well as a pamphlet of advice to deal with fatigue. All females were instructed with a full explanation of the study protocol with signing a consent form before participating in the study, they were randomly and equally distributed into two groups A and B.

### Measurement procedures

#### *Weight–height scale*

It was used to measure the weight and height of each post-menopausal woman in both groups A and B before the treatment program to assure that all post-menopausal women's BMI did not exceed 30 kg/ m<sup>2</sup>.

#### *Fatigue assessment scale (FAS)*

The FAS has proven to be a valid questionnaire to assess fatigue for post-menopausal women, and it is quick, easy, and not time-consuming [13]. The FAS is a 10-item general fatigue questionnaire to assess post-menopausal fatigue, five questions reflected physical fatigue and 5 questions (questions 3 and 6–9) reflected mental fatigue; an answer to every question had to be given on the Likert scale as never, sometimes, regularly, often, or always. The total FAS score was calculated by summing the scores on all questions (recoded scores for questions 4 and 10), the total score ranged from 10 to 50, a total FAS score < 22 indicated no fatigue, while a score ≥ 22 indicated fatigue [14]. It was done on all post-menopausal women in both groups A and B before starting the study and after the end of the treatment (8 weeks).

#### *Interleukin-6 test (IL-6)*

A 5-ml blood sample was drawn to assess the level of IL-6 for each post-menopausal woman in both groups A and B before starting the study and after the end of the

treatment (8 weeks). The blood analysis took place at the central Labs of El Kaser El Aini University Hospital. Its normal range is 0–16.4 pg/ml, and values higher than 16.4 indicated fatigue [15].

**Treatment procedures**

*Pilates exercises* All females in group A received Pilates exercises consisting of a set of 10 movements: bridging, the saw, roll up, one leg circle (both ways), single straight leg stretch, single leg kick, side kick up and down, side kick circle, spine stretch forward, and curling [16]. Participants were instructed to perform 30 min per session, 3 sessions per week, for 8 weeks. In the beginning, warm up for 7–10 min as a walk brisk, 30 min for the main program, with 3–5 repetitions of each 10 movements at the start, 10-s rest per repetition, 2 sets, with a 60-s rest between sets, and a 5–7 min for the cool-down in form of stretching. Adding two more repetitions for each movement every week until the end of the intervention [17]. The rating of perceived exertion (RPE) was used to gradually increase the program intensity; the modified RPE scale has a range from 0 to 10 (with 0 being no exertion and 10 being maximum effort). This scale corresponds more with a feeling of breathlessness [18]. If any woman complained of the following: chest pain, breathing difficulties, excessive sweat, feeling dizzy, numbness, or tingling, the exercise session is stopped immediately.

*Medical standard care for fatigue* All females in groups A and B received the medical standard care for fatigue which was instructed to them in the shape of dietary supplements and vitamins.

*Advice* Each post-menopausal woman in both groups A and B received a pamphlet with lifestyle advice to fight fatigue as follows: drink plenty of water; get rid of caffeine; make sure to have breakfast; do not skip meals; eat a healthy diet; increase the amount of fruit, vegetables, wholegrain foods, low-fat dairy products, and lean meats; reduce the amount of high fat, high sugar, and high salt foods; do not eat so much, instead of eating three big meals per day, try eating six mini-meals to spread the kilojoule intake more evenly; eat iron-rich foods; and avoid sleeping pills.

**Statistical analysis**

Statistical analysis was conducted using IBM SPSS statistics. The current test involved two independent variables. The first one was the (tested group); between subject factors which had two levels (group A received Pilates exercises 3 sessions per week for 8 weeks, medical

standard care for fatigue, and a pamphlet of advice to deal with fatigue, while group B (control group) received medical standard care for fatigue as well as a pamphlet of advice to deal with fatigue). The second one was the measuring periods within the subject factor which had two levels (pre-treatment, post-treatment). In addition, this test involved two tested dependent variables (FAS, and IL-6). Prior to the final analysis, data were screened for normality assumption, homogeneity of variance, and presence of extreme scores. This exploration was done as a pre-requisite for parametric calculations of the analysis of differences. FAS and IL-6 were normally distributed, as assessed by Shapiro–Wilk’s test ( $P > 0.05$ ). There was homogeneity of variances, as assessed by Levene’s ( $P > 0.05$ ) for almost dependent variables. There was a linear relationship between the dependent variables, as assessed by scatterplot, and no evidence of multicollinearity, as assessed by Pearson correlation ( $|r| < 0.9$ ). There were no univariate outliers in the data, as assessed by inspection of a boxplot, and no multivariate outliers in the data, as assessed by Mahalanobis distance, accordingly,  $2 \times 2$  mixed MANOVA test was used to compare the tested variables of interest at different measuring periods at both groups. With the initial alpha level set at 0.05.

**Results**

**General characteristics**

The current study was conducted on 52 participants. They were assigned randomly into two groups of twenty-six patients each. As indicated by the independent  $t$  test, there were no significant differences ( $P > 0.05$ ) in the mean values of age, body mass, height, BMI, and last menstruation between both tested groups A and B as shown in Table 1.

**Overall effect**

Statistical analysis using  $2 \times 2$  mixed design MANOVA (Table 2) indicated that there were significant effects of

**Table 1** Physical characteristics of participants in both groups A and B

Items	Group A	Group B	Comparison		S
	Mean $\pm$ SD	Mean $\pm$ SD	t value	P value	
Age (years)	52.4 $\pm$ 1.8	53.23 $\pm$ 1.6	-0.18	0.428	NS
Body mass (kg)	74.42 $\pm$ 3.7	75.46 $\pm$ 4.12	0	0.5	NS
Height (cm)	165.2 $\pm$ 5.06	164 $\pm$ 4.07	-0.14	0.444	NS
BMI (kg/m <sup>2</sup> )	27.3 $\pm$ 1.89	28 $\pm$ 1.11	0.17	0.43	NS
Last mens. (years)	3.96 $\pm$ 1.1	4.23 $\pm$ 1.2	-0.83	0.204	NS

SD Standard deviation, P Probability, S Significance, NS Non-significant

**Table 2** 2 × 2 mixed design MANOVA

Source of variation	F value	P value
Groups	12.29	0.00001*

\*p-value < 0.05 is significant

**Table 3** Mean ± SD and P values of FAS pre- and post-treatment in both groups

FAS	Pre-treatment Mean ± SD	Post-treatment Mean ± SD	MD	% of change	P value
Group A	29.31 ± 3.33	15.8 ± 2.26	13.51	-46	<.00001*
Group B	30.58 ± 2.436	29.7 ± 7	0.88	-2.9	0.273
MD	-1.27	-13.9			
P value	0.062	<.00001*			

SD Standard deviation, MD Mean difference, P value Probability value

\* Significant level is set at alpha level < 0.05

the tested group on all tested dependent variables; FAS and IL-6 ( $F = 12.29$ ,  $P = 0.00001^*$ ).

**FAS**

**Within groups**

As presented in Table 3 within the group’s comparison the mean ± SD values of the fatigue assessment scale (FAS) in the “pre-” and “post-treatment” were 29.31 ± 3.33 and 15.8 ± 2.26, respectively, in group A. There was a significant reduction of FAS at post-treatment in comparison to pre-treatment ( $P$  value < 0.00001\*), while the mean ± SD values of FAS in the pre- and post-treatment were 30.58 ± 2.436 and 29.7 ± 7, respectively, for group B. There was no significant reduction of FAS at post-treatment in comparison to pre-treatment ( $P$  value = 0.273).

**Between groups**

Considering the effect of the tested group on FAS, the pre-treatment between both groups showed no significant differences with  $P = 0.062$ , while there was a significant difference in the mean values of the post-treatment

between both groups with ( $P < 0.00001^*$ ) and this significant reduction in favor to group A.

**IL-6**

**Within groups**

As presented in Table 4, within the group’s comparison, the mean ± SD values of IL-6 in the pre- and post-treatment were 62.73 ± 31 and 10.58 ± 4.99, respectively, in group A, while there was a significant reduction of IL-6 at post-treatment in comparison to pre-treatment ( $P$  value < 0.00001\*) and the mean ± SD values of IL-6 in the pre- and post-treatment were 54.19 ± 28 and 53.61 ± 28.32, respectively, in group B. There was no significant difference of IL-6 at post-treatment in comparison to pre-treatment ( $P$  value = 0.470761).

**Between groups**

Considering the effect of the tested group on IL-6, mean values of the pre-treatment between both groups showed no significant differences ( $P = 0.149557$ ). There was a significant difference in the mean values of the post-treatment between both groups with ( $P < 0.00001^*$ ).

**Discussion**

The present study is one of the few studies that investigated the effect of Pilates exercises on the severity of post-menopausal fatigue. In our study, we found that Pilates exercises were able to reduce post-menopausal fatigue. The exercises were shown to reduce general, physical, and mental fatigue. In fact, in each of these subsets, major improvements were associated with the practice of Pilates exercises. The results revealed that there was a significant decrease in FAS and IL-6 test values post-treatment in group A (study group) compared with that pre-treatment values, while there was no significant difference between pre- and post-treatment values in FAS and IL-6 test in group B (control group).

The result of the current study comes in agreement with [19] who demonstrated the effect of Pilates exercises on fatigue and sleep quality in addition to anxiety and depression among post-menopausal women. The results

**Table 4** Mean ± SD and P values of IL-6 pre- and post-treatment at both groups

IL-6	Pre-treatment Mean ± SD	Post-treatment Mean ± SD	MD	% of change	P value
Group A	62.73 ± 31	10.58 ± 4.99	52.15	-83	<0.00001*
Group B	54.19 ± 28	53.61 ± 28.32	0.58	-1	0.470761
MD	8.54	-43.03			
P value	0.149557	<.00001*			

SD Standard deviation, MD Mean difference, P value Probability value

\* Significant level is set at alpha level < 0.05

showed significant improvement in Spanish women [20], as well as in Indian women [21].

Studies on Pilates exercises have indicated both mental and physical effects on health [22]. Findings of a study conducted by Eyigor et al. showed that Pilates exercises were a healthy and effective method for improving the functional capacity, flexibility, fatigue, depression, and quality of life of breast cancer patients [23]. Therefore, the ability of physical exercise to successfully and significantly decrease post-menopausal women's fatigue is evident in past studies. The agreement of our findings with that of previous studies clearly indicates the strong effect exercise has on reducing fatigue. That is why more attention should be paid to make an effective intervention for reducing fatigue. In conclusion, the results of this study showed that Pilates exercises are an effective, healthy, and feasible method for reducing post-menopausal fatigue.

### Limitations

There are some limitations to the current study, despite revealing objective data with statistically significant differences. The time of the study is short. The sample size is small, and the generalizability of the study is limited to post-menopausal women in one hospital. There are more objective methods available for the assessment of fatigue such as objective physical (posturography) and objective mental (psychomotor vigilance tasks). Therefore, the accuracy of measurement may be flawed.

### Conclusion

The current study showed that Pilates exercises with medical standard care for fatigue are more effective than medical standard care only for improving fatigue and sleep quality in post-menopausal women. Also, Pilates exercises are a new additional method in dealing with post-menopausal fatigue which exhibit a great advantage for post-menopausal women.

### Recommendations

Follow-up may be needed for the post-menopausal women after the course of treatment in the hope that they do not get fatigued anymore. Similar studies are needed to compare the effect of Pilates and other types of exercise such as aerobic exercise and breathing exercises on fatigue in post-menopausal women. Similar studies are needed to be applied in other communities, both in Egypt and other Arab countries to validate our results. Further studies to investigate other effects of the Pilates exercises on other symptoms of menopause rather than fatigue are needed.

### Abbreviations

BMI	Body mass index
FAS	Fatigue assessment scale
IL-6	Interleukin-6
HRT	Hormone replacement therapy
SSRIs	Selective serotonin reuptake inhibitors
SNRIs	Serotonin-norepinephrine reuptake inhibitors
RPE	Rating of perceived exertion

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### Authors' contributions

DMA contributed to the concept or design of the article. DMA, AMN, HEH, and DMK contributed to the acquisition, analysis, or interpretation of the data for the article. DMA, AMN, HEH, and DMK drafted the article or revised it critically for important intellectual content. The authors read and approved the final manuscript.

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### Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

### Declarations

#### Ethics approval and consent to participate

This was approved by the Ethics Committee of the Faculty of Physical Therapy at Cairo University (No:PT.REC/012/003239). The study was registered in the Pan African Registration Trials ([www.clinicaltrials.gov](http://www.clinicaltrials.gov) NCT05002894).

#### Consent for publication

Consent for the publication of pictures is obtained from the participants.

#### Competing interests

The authors declare that they have no competing interests.

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