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# Effect of Pilates Exercise on Lipid Profile in Post-Menopausal Obese Women

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## Abstract:

**Purpose:** to investigate the effect of Pilates exercise on lipid profile in postmenopausal obese women.

**Methods:** Thirty postmenopausal obese women aged from 45-55 years. They were randomly assigned into two equal groups: group (A): was consisting of 15 obese postmenopausal women, instructed to follow a specific low caloric diet program (1200Kcal/day) for 12 weeks. Group (B): was consisting of 15 obese postmenopausal women, instructed to follow a specific low caloric diet program as group (A) and performed Pilates exercise program for 30 minutes/ 5 times per week for 12 weeks. The Evaluation was done by measuring lipid profile [ Cholesterol (CH), High-density lipoprotein (HDL), Low-density lipoprotein (LDL) and Triglycerides (TC)] by using a Spectrophotometer, body mass index (BMI), and waist/ hip ratio (W/H ratio) before and after 12 weeks of the program in both groups.

**Results:** showed that there was a good improvement ( $P < 0.05$ ) in the lipid profile and a significant decrease in BMI and W/H ratio for both groups (A and B). However, there was a clinical difference between both groups post-treatment in favor of group (B).

**Conclusion:** Pilates exercise combined with diet control had a better effect on lipid profile in postmenopausal obese women.

**Key words:** Pilates, menopause, obese, lipid profile.

## 1. Introduction:

Menopause is distinguished by a shift in hormonal environment and a particular decrease in circulating estrogen level, which is considered a major contributor to the accumulation of central abdominal fat, reduction of subcutaneous fat and raising of total adiposity (1-4). Many Comparisons between menopausal, and non-menopausal women with a same age showed a rapid increase in visceral fat deposits due to a peripheral to central fat redistribution and an increase in total adiposity (1,2,4). In both human and animal studies, the total body fat mass and the abdominal fat mass are

decreased with estrogen therapy (1).

Women after menopause are therefore three times more likely to experience obesity and metabolic syndrome more than premenopausal women (5). The postmenopausal era is characterized by an increase in low-density lipoprotein (LDL) concentrations by a decrease in estradiol levels and high LDL cholesterol, or very low-density lipoprotein and triglycerides (TG) (6). Even the postmenopausal phase is diabetogenic manifesting as reduced glucose tolerance. Each of these elements contributes to atherosclerotic processes, and a component of a life-

threatening or health-threatening condition called the metabolic syndrome. Therefore, intervention is needed to minimize the adverse cardio-metabolic effects of menopause, including increased body weight, dyslipidemia and glucose intolerance. For the treatment of these conditions, both non-pharmacological (e.g. dietary control and enhanced physical activity) and pharmacological strategies are helpful (3). Obesity is a major postmenopausal problem that may associate with high risk of morbidity. Physical inactivity and poor nutritional habits lead to increase the risk of postmenopausal obesity. Moreover, lower expectations of quality of life and psychological issues have been linked with obesity (7). Dankel et al. (8) showed that the period of overweight/obesity condition and physical inactivity had a negative effect on the quality of life. Different forms of physical activity can be used as alternative therapies for obese women (9, 10). Barry et al. (11) Concluded that irrespective of the body mass index (BMI), physical exercise is an important technique for improving quality of life and mental health status (6) and it can reduce obesity-related morbidities, like depression, heart problems, hyperlipidemia, and Symptoms of anxiety (12, 13). Alternative workouts, such as Pilates, are recommended for postmenopausal women who are overweight / obese. Pilates is a method of body / mental training that involves various types of exercise (e.g., balance, endurance, strength and flexibility, muscle control, posture, and respiration). (14,15). Niehues et al. (15) Noted that Pilates is a resistance training form (based on isometric exercises) that has a low joint impact and may be very attractive for obese postmenopausal women. Postmenopausal symptoms have been shown to occur less often in women who exercise regularly than inactive women (16, 17). The Risk of cardiovascular diseases can be decreased with regular exercise and the effect is caused by a number of mechanisms, such as a positive impact on lipids, improve insulin effect, weight loss, and a decrease of the stiffness of the artery walls, etc. (18, 19).

This has been shown for both men and women of various ages, as well as in women around menopause. This knowledge about exercise effects becomes even more important. In addition, exercise improves aerobic fitness and endurance which hormone treatment does not do (20).

Aerobic exercise at an intensity of 70-80 percent of maximal heart rate is recommended to improve the maximal oxygen uptake (21). All activities which involve major muscle groups and by nature dynamic and rhythmic. (Cycling, brisk walks, aerobics, etc.) are recommended to increase aerobic fitness (21).

## 2. Subjects and Methods:

### 2.1. Participants

This study was carried upon thirty postmenopausal obese women with BMI ranged from 25-40 kg/m<sup>2</sup> and their ages ranged from 45-55 years. Ethical approval was obtained from the institutional review board at Faculty of Physical Therapy, Cairo University so, they were selected from El Azhar university hospital from August 2018 to March 2019. Any postmenopausal woman with a history of cardiac problems, hypertension, diabetes, and history of hyperlipidemia was excluded from this study.

The participated women were divided into equal two groups randomly (A & B). Group A: (Control group): consisted of 15 obese postmenopausal women who instructed to follow a specific low caloric diet program (1200 Cal/day) and Group B: (Study group): consisted of 15 obese postmenopausal women who instructed to follow the same low caloric diet as group (A), in addition to perform Pilates exercise program for 30minutes 5 times per week. All participants in both groups evaluated before and after the treatment program which was 12weeks.

### 2.2. Measurement equipment and tools

**All women in both groups (A) and (B) had full details about the study and signed Informed consent form before starting the study. Then each woman was assessed using the following:**

**1. Recording datasheet:** all data and information of each woman who participated in this study including name, age, address, weight, and height were recorded in the recording datasheet.

**2. Standard weight and height scale:** was used to measure weight & height to calculate body mass index (BMI) for each woman in both groups (A&B) before and after treatment.

**3. Waist and hip circumference measurements:** waist and hip circumference were taken for each woman in both groups (A&B) before and after treatment course for calculating waist and hip ratio (W/H ratio) by dividing waist circumference (WC) on the hip circumference (HC). (WC) was measured at the narrowest circumference between xiphosternum and the iliac crest at the end of gentle expiration. HC was measured at the maximum circumference at the level of the femoral trochanter.

**4. Lipid profile measurements:** Two blood samples were taken after fasting for 12 hours from each woman in both groups (A & B) before and after the treatment course, and were sent to the laboratory center to measure Cholesterol (CH), High-density lipoprotein (HDL), Low-density lipoprotein (LDL) and Triglycerides (TC) by using Spectrophotometer.

### 2.3 Treatment Procedure:

-The Control group (A) Each woman in this group was instructed to follow a specific low caloric diet program (1200 Cal/day) for 12 weeks.

A full explanation about low caloric diet program

was given for each woman individually; the types of food which would be avoided during this study and the types of food which were recommended, and each woman had received a specific menu every week to follow it.

-Study group (B): Each woman in this group was instructed to follow a specific low caloric diet program as group (A), and to perform A Pilates exercise program for 30minutes 5 times per week for 12 weeks (22&23).

Before starting the Pilates sessions, each woman is asked to do stretching movements for lower and upper limbs and breathing exercise in the upright position as a warming up for 5 minutes, then repeat it at the end of the exercise session as a cooling down. Pilates exercise program includes:

**1. The hundred exercises:** Each woman asked to lie flat on the mat, raise her head and shoulders up off the mat, and float her arms up and down for 5 times (Both arms are still by her sides, but a few inches off the mat), then relax and breath in and out for 5 times, repeated this step until reach 100 counts.

**2. Single leg stretch exercise:**

It is performed at 2 levels;

-Level 1: Each woman was asked to lie on her back with one flexed knee, breathe in to prepare. Then breathe out and slide one heel along the floor away from her bottom. Then, the therapist asked her to breathe in and slide the same leg towards her bottom, this action repeated for 10 times on both legs.

-Level 2 as level 1: Each woman lied on the mat with one flexed knee then Breathe in and lift her leg so that her hip and knee is at 90°, the therapist asked her to extend her leg as much as she can, then Breathe out and bend the knee back to 90°, then lower to the floor. Repeat 10 times on both legs.

**3. Hip twist exercises:** -Level 1: Each woman was asked to lie down on the mat, then with knee bent breathe in to prepare. Breathe out and slowly let one knee drop out to the side to reach the mat. Then Breathe in and draw the knee back to the middle. Repeat 10 times on both legs. -Level 2 Each woman asked to lie down on the mat with both knee bent, Breathe in to prepare. Then breathe out and roll both knees to the right. Let the pelvis and low back gently roll with it. At the same time let her head gently roll to the left then relax. Repeat 10 times on both legs.

**4. Roll up exercises:** Each woman asked to lie flat on the mat, breath in, dorsi-flex her feet and raise her arms to 90 degrees, then try to raise her head and shoulders from the mat then breathe out and relax. Repeat 10 times.

**5. Side kicking exercises:** Each woman asked to lie on her left side, her shoulders, hips, and ankles on the same line extended and her both legs slightly slide forward so she can see her toes. Support her head on left arm .As She inhaled, kick with her right leg to the

level of the hip twice while dorsi-flexing her foot. Then breathe out and relax. Repeat it 10 times for each leg.

**6. The saw exercises:** Each woman was asked to sit a long sitting with her both legs extended out in front of her, slightly wider than hip-distance. Keep her feet dorsi-flexed. Stretch her arms out to each side, creating a “T” shape. As she inhaled, rotate the upper body to the right, and reach her right leg with her left hand. Then breathe out and relax, Repeat on the opposite side, completing at least 5 times on each side.

**7. Spine stretch exercises:** Each woman was asked to sit in a long sitting position with her legs extended out in front of her with hip-distance apart, feet dorsiflexed. As she inhaled, her arms should be stretched out in front of her with palms down then, Exhale and reach her feet; keeping her arms parallel to the floor and contract the abdominal muscles ,then Inhale and return to her starting position. Repeat 10 times.

**8. One leg circle exercises:** each woman was asked to lie flat on the mat, breathe in and out then Contract abdominal muscles and Draw one knee in towards the chest and then extend it straight toward the ceiling, then move the same leg in a circular motion. She made five circles in the same direction, then reverse .Stretch, before switching legs, by climbing the hands up the outstretched leg to hold the ankle. Hold the position for three full breath cycles. Then repeat the steps on the opposite leg and finish with another stretch.

**9. Shoulder bridge exercises:** Each woman was asked to lie in the crock line position then gently raise her lower back until she is resting on her shoulder. Then Breathe in and hold the position. In this position lift one heel off the floor, then breathe out and lower it down. Repeat 5 times for each side.

**10. Double arm stretch exercises:** Each woman lie on the mat in a flat position and breathe in to prepare. Then breathe out and lift both arms to 90°, then slowly lower her extended arms above her head. Breathe in and circle her arms out to the side finishing with them above her head and breathe out. Repeat 10 times.

### 3. Results

The mean and standard deviation for the group (A) were age 48.87±3.833, weight 92.20±16.32 and height 165.1±4.559 while for the group (B) were age 48.93±3.058, weight 91.48±4.884, and height 161.5±5.069. By comparing both groups, there was no statistically significant difference between both groups in the mean of age, weight, and height ( $p > 0.05$ ),

**Table (1): Show the Baseline physical characteristics of individuals completing the study**

(n= 30).

Characteristics	Control (A) (n=15)	Study(B) (n=15)	P value*
Age (yrs)	48.87±3.833	48.93±3.058	0.050 <sup>NS</sup>
Weight (Kg)	92.20±16.32	91.48±4.884	0.312 <sup>NS</sup>
Height(cm)	165.1±4.559	161.5±5.069	0.334 <sup>NS</sup>

NS P > 0.05 = non-significant, P = Probability.

The mean and SD for the group (A) pre-treatment were (BMI 34.2±4.468, W/H ratio 0.897±0.0699, TC 195.3±9.407, TG 144.46±17.15, LDL 122.93±24.51, and HDL 44.06±8.171), while post-treatment they were (BMI 33.04±5.134, W/H ratio 0.870±0.0733, TC 191.1±8.717, TG 141.4±17.96, LDL 120.4±25.29, and HDL 45.80±8.018). Comparison between pre and post treatment showed statistically highly significant difference (P<0.001) in BMI, W/H ratio, TC, TG, LDL and HDL.

Also, the mean and SD for the group (B) in pre-treatment were (BMI 33.04±1.516, W/H ratio 0.885±0.0420, TC 197.3±19.71, TG 146.06±17.57, LDL 126.82±21.27, and HDL 43.91±6.155), while post treatment they were (BMI 30.01±3.142, W/H ratio 0.830±0.0533, TC 169.6±16.50, TG 124.60±16.32, LDL 105.63±18.34, and HDL 50.09±5.719). Comparison between pre and post treatment showed statistically highly significant difference (P<0.001) in BMI, W/H ratio, TC, TG, LDL and HDL.

By comparing the results of both groups (A&B), there was a statistically no significant difference (P>0.05) pretreatment, while post treatment there was a statistically highly difference (P<0.001) in BMI, W/H ratio, and lipid profiles with the favor of group (B) than group (A), Table (2).

Table 2: show Lipid profiles, body mass index (BMI) and waist/hip ratio (W/H ratio) (mean±SD) at baseline (pre) and after 12 weeks (post) for in both groups.

Variables	Control (A) (n= 15)	Study (B) (n= 15)	P value*
BMI	34.2±4.468	33.04±1.516	0.115 <sup>NS</sup>
(Kg/m <sup>2</sup> )			
Pre-treatment			
Post-treatment	33.04±5.134	30.01±3.142	0.0001 <sup>S</sup>
Imp %	5.24%	12.6%	
P value**	0.001	0.001	

W/H ratio	Pre-treatment	0.897±0.0699	0.885±0.0420	0.0569 <sup>NS</sup>
	Post-treatment	0.870±0.0733	0.830±0.0533	0.0001 <sup>S</sup>
	Imp %	2.22%	4.59%	
	P value**	0.001	0.001	
TC (mg/dl)	Pre-treatment	195.3±9.407	197.3±19.71	0.0569 <sup>NS</sup>
	Post-treatment	191.1±8.717	169.6±16.50	0.0001 <sup>S</sup>
	Imp %	1.06%	7.56%	
	P value**	0.001	0.0001	
TG (mg/dl)	Pre-treatment	144.46±17.15	146.06±17.57	0.953 <sup>NS</sup>
	Post-treatment	141.4±17.96	124.60±16.32	0.0001 <sup>S</sup>
	Imp %	0.97%	7.92%	
	P value**	0.0001	0.0001	
LDL (mg/dl)	Pre-treatment	122.93±24.51	126.82±21.27	0.054 <sup>NS</sup>
	Post-treatment	120.4±25.29	105.63±18.34	0.0001 <sup>S</sup>
	Imp %	1.01%	9.11%	
	P value**	0.05	0.0001	
HDL (mg/dl)	Pre-treatment	44.06±8.171	43.91±6.155	0.567 <sup>NS</sup>
	Post-treatment	45.80±8.018	50.09±5.719	0.0001 <sup>S</sup>
	Imp %	1.93%	6.57%	
	P value**	0.0001	0.0001	

Data Were Expressed As Mean ± Standard Deviation

\* Inter-Group Comparison, \*\* intra-group comparison Of The Results Pre- And Post-Treatment.

<sup>NS</sup> P > 0.05 = Non-Significant, <sup>S</sup> P < 0.05 = Significant, P = Probability. Abbreviations: TC: total cholesterol, TG: triglycerides, LDL: low density lipoprotein, HDL: high density lipoprotein, Imp %: improvement %.

#### 4. Discussion

One of post-menopausal common manifestations is trunk obesity. Bodyweight in general is the outcome of an energy balance, i.e. energy intake minus energy expenditure. While it is relatively easy to limit the daily energy intake by a few hundred kilocalories (kcal), it is significantly more difficult to increase energy expenditure. Also, activity advice given to obese individuals must be realistic as their physical ability may be impaired as a consequence of being overweight and obese. After menopause, women with high BMI are having some lipid profile changes which may affect their general health (10,11).

The current study was conducted to investigate the effect of Pilates exercise on the lipid profile for postmenopausal women. Thirty postmenopausal obese women were randomly divided into two groups, group (A) received a diet protocol with 1200 kcal/day, while group (B) received the same diet



protocol like group (A) with practicing Pilates exercise program for 30 minutes 5days/week.

All women were assessed pre and post-treatment (12 weeks) using BMI, W/H ratio and a lipid profile. Post-treatment results of this study showed that there was a significant improvement in all women`s lipid profile in both groups (A&B) and decreasing BMI and W/H ratio. But the Improvement in the group (B) is more than the Improvement in the group (A). The results of the present study have the same findings of Fontana et al., (2007)(24)Who reported that by applying a controlled diet accompanied by aerobic exercise for 12 months on women .This woman showed a significant reduction in body weight, and had a significant improvement in coronary heart diseases risk factors including plasma LDL-cholesterol concentration, HDL-cholesterol ratio, and CRP concentrations. Also, Poirier et al., (2002)(25)reported that there was strong evidence that women who engaged at exercise and diet showed a significant reduction in body weight ,and had a significant improvement in coronary heart diseases risk factors including plasma LDL-cholesterol concentration, HDL-cholesterol ratio ,and CRP concentrations. Weight loss in overweight and obese individuals decreases the risk factors for diabetes and coronary vascular disease. So, weight loss reduces serum TG levels and increases HDL levels came in agreement with the results of the present study.

Araujo-Gomes et al., (2019) (26).Who had made a trial to study the effect of Pilates exercise on postmenopausal women health variables, Their results came in agreement with the results of the present study as they approved that Pilates exercise had a favorable effect on decreasing TG and increasing HDL-C that leading to improve the lipid profile in cases having metabolic syndrome and it also had good results in improving other health variables. As revealed by the study of Ruiz-Montero et al.(2014)(27) who recorded a mixed aerobics and Pilates exercise program increases baseline muscle mass and reduces fat mass values for postmenopausal women. Also, research had made by Gokoul and Hazar(2017)(28)who applied eight weeks of cycling and mat Pilates exercise for postmenopausal women and they found that significant decrease in weight values, resting pulse, BMI, abdominal and hip circumferences. On the other hand, they found a significant increase in flexibility and balance values in the Pilates group and cycling group as well. Besides all these positive effects, neither Pilates exercise nor cyclic exercise had an effect on HDL and LDL levels in women`s lipid profiles. Hence these studies come in agreement with the results of the present study in the improvement of lipid profile and weight in obese postmenopausal women.

The study of Earnest et al.,2013 (29) explained how could exercise decrease the percentage of body fat and fat accumulation in the waist region, that helped in decreasing body weight and W/H ratio by enhancing the tendency of the skeletal muscles to use lipids, rather than glycogen, thus improves plasma lipid levels specially cholesterol-HDL concentration. Also, VanGemertetal.,(2015)(30) suggested that exercise interventions as compared to dietary interventions may be superior for the promotion of a healthy body composition profile including preservation of lean mass and greater decreases in body fat by increasing energy expenditure.

On the other hand, Sevimli andSanri (2017 ) (31) had a different opinion as they showed that the cardio-Pilates exercise program had no effect on the weight and BMI of female participants, but it was effective on body fat rate and body circumference values.So, the effect of an exercise program depends not only on its duration, intensity, and type but also on participants' caloric intake.

#### **5. Conclusion:**

Pilates exercise program added to a controlled diet routine, induced a greater reduction of body weight which were associated with more improvement of the lipid profile in postmenopausal obese women.

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#### **8. Declaration of interest:**

The authors declare that there is no conflict of interest in this study. The manuscript has been read and approved by the authors

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