

## A SIX-WEEK PILATES EXERCISE PROTOCOL FOR IMPROVING PHYSICAL AND MENTAL HEALTH-RELATED PARAMETERS

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### Abstract

**Main Problem:** Pilates, a body-mind exercise method, has experienced increasing popularity in recent years, especially among young women. But there is not enough evidence whether this exercise method contributes to the physical or/and psychological condition of individuals. The aim of this study was to investigate the effectiveness of an original six-week Pilates mat exercise protocol on young females' health-related parameters including anthropometric features, emotional state, fatigue, and quality of life. **Methods:** Fifty-one sedentary females aged between 18 and 25 were randomly assigned to Pilates Exercise Group (n=25), and Control Group (n=26). Pilates Exercise Group performed a six-week Pilates mat exercise protocol whereas Control Group did not participate in any regular physical activity for six weeks. Anthropometric features, anxiety, depression, fatigue, and quality of life of the subjects were assessed at the baseline and after six weeks. **Results:** Weight (p=0.005), body mass index (p=0.005), waist (p<0.001), hip (p=0.002), and thigh circumferences (p<0.001), severity of anxiety (p=0.001), depression (p=0.001), and fatigue (p<0.001) significantly decreased in the Pilates Exercise Group after six weeks and vitality (p=0.005), and mental health (p=0.021) domains of quality of life increased. There were no significant differences in Control Group (p>0.005) after six weeks except anxiety (p=0.010), and fatigue (p=0.032). **Conclusions:** The current Pilates mat exercise protocol contribute to the physical, and psychological well-being of young females in terms of anthropometric features, emotional state, fatigue, and some domains of quality of life.

**Keywords:** Depression, exercise, Pilates, quality of life

## **Introduction**

The World Health Organization defines health as “A state of complete, physical, mental, and social well-being, not merely the absence of disease or infirmity” (Callahan, 1973). The modern era and lifestyle, unfortunately, worsen well-being of the individuals and cause inactive lifestyle contrary to human biomechanics. In today's society, especially young population suffer from the consequences of inactivity (Furnham, Badmin, & Sneade, 2002; Runfola et al., 2013). Worsening of body composition and fitness levels due to an inactive lifestyle may impair the physical and psychological health of the young population (von Sperling de Souza & Brum Vieira, 2006).

There is consensus in the literature that physical activity/exercise is a correct, and healthy way to improve well-being (Kelley, Kelley, Hootman, & Jones, 2010; Sjøgaard et al., 2016; Standage & Ryan, 2012; Vancampfort et al., 2011; Wang et al., 2010). Physical activity regulates the energy balance of the body, providing weight control, and determining body composition. Also, mood and anxiety can be altered depending on the intensity and type of the physical activity.

Pilates supposed that the balance between body and mind is an important factor in achieving health, and happiness. Pilates also holds that controlology stimulates the mind and decreases mental strain (Pilates & Miller, 1945). Pilates training minimizes unnecessary muscle recruitment by maintaining a neutral spine position and core stabilization. Pilates exercises improve general body flexibility and health by improving strength, posture, and the coordination of movements. The control of large group muscles with coordination, and focusing on breathing may increase aerobic capacity (Caldwell, Harrison, Adams, & Triplett, 2009), and further improve mental health (Kucuk & Livanelioglu, 2015). Heretofore, some researchers have also reported that the holistic approach of Pilates based training may offer physical and psychological improvements for human health (Akbas & Erdem, 2016; Bernardo, 2007; Cruz-Ferreira et al., 2011; Karaman, Yuksel, Kinikli, & Caglar, 2017; Kucuk & Livanelioglu, 2015), and various intensities benefit quality of life, mental health, fatigue, physical fitness levels, and body types in diverse rates (Anderson & Spector, 2000; Arslan, Çakmakçi, Taşkin, Çakmakçi, & Ismet, 2012; Ashrafinia et al., 2015; Caldwell et al., 2009; Campos de Oliveira, Gonçalves de Oliveira, & Pires-Oliveira, 2015; Cruz-Ferreira et al., 2011; Frank, Edwards, & Larimore, 2017; Ginsberg et al., 2016; Hassan & Amin, 2011; Kucuk & Livanelioglu, 2015; Leopoldino et al., 2013; McGrath, O'Malley, & Hendrix, 2011; Memmedova, 2015; Miller & Mesa, 2013; Pourvagher, Bahram, Sharif, & Sayyah, 2014; Rogers & Gibson, 2009; Roh, 2016; Segal, Hein, & Basford, 2004; Shanazari, Marandi, & Minasian, 2013; Soysal Tomruk, Uz, Kara, & Idiman, 2016; Stan et al., 2012; Şavkın, 2014; Vieira, Faria, Wittmann, Teixeira, & Nogueira, 2013). The method is recommended by health professionals, both as rehabilitative for the people who have diseases, and preventive for undiagnosed or healthy individuals (Herrera-Gutiérrez, Olmos-Soria, & Brocal-Pérez, 2015). However, only a few clinical trials have investigated the effectiveness of Pilates training in healthy young females (Bavli & Koybasi, 2016; Caldwell et al., 2009; Kucuk & Livanelioglu, 2015; Parikh & Arora, 2016; Tolnai, Szabo, Koteles, & Szabo, 2016). Previous studies could not demonstrate the influences of Pilates-based training on psychological variables (Cruz-

Ferreira et al., 2011). Although there have been many studies describing the benefits of Pilates-based training, these studies vary in terms of duration, intensity and/or the exercises they contain and diverse periods, and intensities of Pilates training programs had different effects on health-related parameters. Furthermore, since exercise protocols have not been clearly reported in such studies, they cannot provide realistic proposals for clinics and society in order to improve the individuals' health.

The Pilates method has seen increasing popularity in last decades particularly among young women in order to avoid the physical and psychological consequences of sedentary lifestyle (Littleton & Ollendick, 2003), but evidence-based studies in this field remain limited in the context of this population. Previous studies promised certain contributions to improve health-related parameters but could not offer any clear exercise program for individuals and their outcomes were contradictory. We aimed to create a standardized protocol to improve the physical and mental health of young females with this study. The question addressed was whether our original Pilates exercise protocol would contribute to improving their anthropometric features, emotional state, fatigue, and quality of life. Our hypothesis was that the current six-week program could provide physical and psychological benefits to young females.

## **Materials and Methods**

### *Participants*

Subjects were recruited from female volunteers between the ages of 18, and 25. Written informed consent was obtained from all participants, and they signed in the form approved by Bulent Ecevit University Clinical Research Ethics Committee (2017-74-09/08) prior to participation in the study.

Pregnancy, participation in regular physical training such as exercise classes or sport for more than one hour at least once a week during the previous year, taking medications affecting the emotional state, exercise contraindications due to cardiovascular or neurological disorders, inability to cooperate for assessments and insufficient attendance at least 80% of exercise sessions were exclusion criteria.

To estimate sample size, a preliminary power analysis was applied. Per a previous study (Kucuk & Livanelioglu, 2015), we used 8.48 as the standard deviation values, and 8.19 as the difference in mean of the BDI. Consequently, we needed 19 individuals in each group to have 80% power with 5% type I error level. Anticipating 7 dropouts in each group, the sample size was determined as 26 participants for each group. Eligible participants were randomly assigned to Pilates Exercise Group (PEG) (n=26), and Control Group (CG) (n=26). One participant of the PEG excluded from the study owing to insufficient attendance. Thus, 25 subjects in the PEG and 26 in the CG completed the study (Figure I). The control group was asked to maintain their normal sedentary activities including daily living activities, and not to participate in regular physical activity during the study. Endpoint assessments were conducted after verbal confirmation that participants had not participated in regular physical activity within the past six weeks.

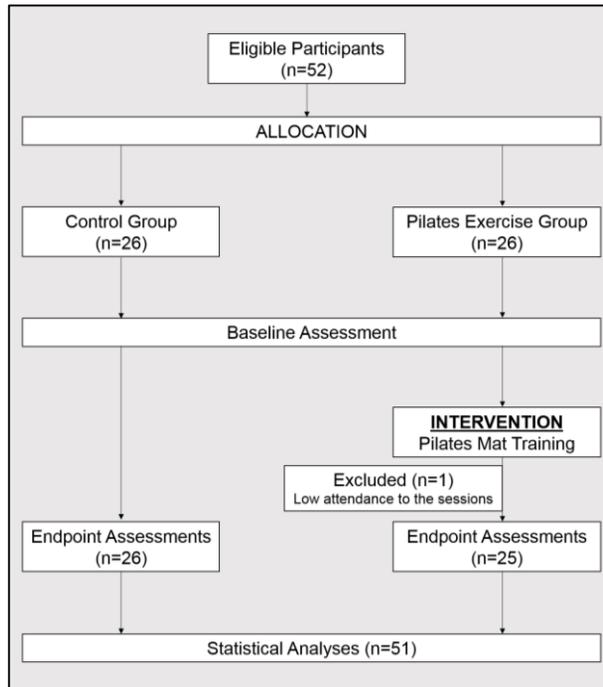


Figure 1: Flow diagram

### Assessments

This prospective, single-blind, randomized-controlled study involved pre and post-measurement tests. Assessments were conducted at the baseline and after six week period. The dependent variables including weight, waist, hip and thigh circumferences, the severity of anxiety, depression and fatigue and quality of life were assessed in all subjects. Weight was assessed while subjects were barefoot and wearing light clothes, and Body Mass Index (BMI) was calculated as weight divided by height squared ( $\text{kg}/\text{m}^2$ ). Waist circumference was measured at the mid-level between the lowest rib margin and the iliac crest. Hip circumference was measured at the widest level on great trochanters. The thigh circumference was measured 1 cm below the gluteal fold level perpendicular to the long axis of the thigh (Norton K, 1996; Snijder et al., 2003).

Beck Anxiety Inventory (BAI) was used to evaluate the anxiety symptoms. BAI is a 21-item self-report questionnaire for assessing the severity of anxiety (Ulusoy, 1998). For the assessment of depression, the Beck Depression Inventory (BDI) was used. This index evaluates the grade of depression using 21 questions similarly to BAI (Hisli, 1989). A higher score indicates more severe anxiety and depression according to the scales.

The severity of fatigue was assessed with the Fatigue Severity Scale (FSS). FSS is a self-report questionnaire investigating the severity of fatigue with 9 items. Grading of each item ranges from 1 to 7. One indicates fully disagreement where 7 indicates full agreement. The final score is calculated of the mean value of these items (Armutlu et al., 2007; Michalos, 2014).

Short Form Health Survey (SF-36) which is a multidimensional test was used to assess the quality of life of the subjects. SF-36 is comprised of Functional Capacity, Physical Aspects, Bodily Pain, General Health, Vitality, Social Aspect, Emotional Aspect, and Mental Health domains. A higher score indicates a better quality of life (Kocyigit, 1999).

#### *Pilates Mat Exercise Protocol*

The Pilates exercise group followed an original six-week Pilates mat exercise protocol created by the researchers of this study (Table I). According to previous reports, 6 to 8 weeks of Pilates training has positive effects on physical and psychological health (Bavli & Koybasi, 2016; Pourvagher, Bahram, Sharif, & Sayyah, 2014; Rogers & Gibson, 2009). We preferred the 6-week protocol to demonstrate efficacy as soon as possible in this study. Sessions were conducted twice a week and duration of each session was 40-50 minutes in average including 5 minutes of warming up and 5 minutes of cooling down. Exercises were performed as group training and supervised by a physical therapist, taking into account the potential benefits of group interaction on motivation and coordination. The protocol was predominantly composed of training for the abdomen, hip and lower limbs in order to improve body image by the way of reducing body weight, waist, hip and thigh circumferences. All exercises were performed focusing on the alignment, and awareness of the core, and breathing correctly. Current protocol comprised of progressive three phases. Phase-1 contained simple movements such as hundreds, crunches, rolling and some simple training series for back and hip during the first two weeks. All Phase-1 exercises were part of the program of the following phases. At the beginning of the third week, a few more complicated exercises were added to the program. Phase-3, which was performed during last two weeks period of the protocol, was composed of the most complicated and difficult exercises in addition to the previous ones. Figure II contains detailed information about the current protocol. Individual limitations were respected while training, and exercises were modified according to the subjects' abilities. The trainer demonstrated each activity using verbal and visual instructions to facilitate the correct position and movement. All exercises were coordinated in the group. There was a 10 seconds rest interval between each exercise.

**Table 1:** Pilates Mat Exercise Protocol

Phase 1 (1&2 Weeks)	Phase 2 (3&4 Weeks)	Phase 3 (5&6 Weeks)	Frequency
Warm up (5 min)	Warm up (5 min)	Warm up (5 min)	
Hundreds	Hundreds	Hundreds	
Crunches/extended legs and arms	Crunches/extended legs and arms	Crunches/extended legs and arms	
Bent knee crunch	Bent knee crunch	Bent knee crunch	
Rolling like a ball	Rolling like a ball	Rolling like a ball	
Bent knee raise in crawling position	Bent knee raise in crawling position	Bent knee raise in crawling position	
Fire hydrant	Bent knee cross in crawling position	Bent knee cross in crawling position	2
Hip isometrics	Fire hydrant	Fire hydrant	times/week
Bridging	Hip isometrics	Hip isometrics	
Knee Swim	Bridging	Bridging	
Side leg series	Knee Swim	Knee Swim	
Cool down (5 min)	Hip abduction/in bridging	Hip abduction/in bridging	
	Cross bridging	Cross bridging	
	Cat and cow	Straight leg raise/in bridging	
	Side leg series	Cat and cow	
	Cool down (5 min)	Straight leg raise/in crawling	
		Leg raise with bent knee/in crawling	
		Side leg series	
		Cool down (5 min)	

\* min: minutes

### Statistical Analysis

Data were analyzed using SPSS 15.0 for Windows. Level of 5% was used to determine significant differences. Normality tests indicated that quantities data were not normally distributed. Descriptive statistics were used for demographic data, while the Wilcoxon signed-rank test was used for comparing intra-group, and the Mann-Whitney U test was used for inter-group analysis.

### Results

Demographic features and the baseline outcomes of the participants are shown in Table 2. At baseline, no significant differences were found between the PEG, and CG in age (years), height (cm), thigh circumference (cm), and the scores of BDI, BAI, FSS, and SF-36 ( $p>0.05$ ). Weight (Kg), BMI ( $\text{kg}/\text{m}^2$ ) waist circumference (cm), and hip circumference (cm) were significantly higher in the PEG at the baseline ( $p<0.05$ ) (Table 2).

**Table 2:** Demographic Features and Initial Outcomes of the Participants

	PEG (n=25)	CG (n=26)	p
Age (year)	21.44±1.35	21.26±1.51	0.549
Height (m)	1.61±0.51	1.63±0.49	0.163
Weight (kg)	57.00±4.78	54.65±6.41	0.025*
BMI (kg/m <sup>2</sup> )	21.88±1.68	20.44±2.05	0.001*
Waist Circumference (cm)	70.56±4.37	66.00±5.62	<0.001*
Hip Circumference (cm)	96.68±4.36	92.57±6.24	0.001*
Thigh Circumference (cm)	54.00±4.05	51.00±4.87	0.054
BAI	15.88±1.07	17.57±8.48	0.336
BDI	13.32±7.72	13.38±7.83	0.917
FSS	4.69±1.04	4.81±1.24	0.450
SF36-Functional Capacity	88.00±9.78	86.34±1.17	0.788
SF36-Physical Aspects	69.00±34.06	65.38±36.79	0.795
SF36-Bodily Pain	70.28±2.00	70.26±2.24	0.970
SF36-General Health	58.52±16.39	61.30±16.20	0.550
SF36-Vitality	55.80±14.69	48.46±21.94	0.198
SF36-Social Aspect	71.68±2.28	66.50±2.58	0.263
SF36-Emotional Aspect	54.52±35.75	55.30±37.57	0.954
SF36-Mental Health	60.00±1.36	54.92±2.10	0.460

Mann-Whitney U test \* p<0.05

m: meter; kg: kilogram; cm: centimeter; BMI: Body Mass Index; BAI: Beck Anxiety Inventory; BDI: Beck Depression Inventory; FSS: Fatigue Severity Scale; SF36: Short Form Health Survey

Intragroup analysis revealed a significant reduction in weight, BMI, waist circumference, hip circumference, and thigh circumference (p<0.05) in the PEG while there was no significant difference in CG after six weeks (p>0.05) (Table III).

Six weeks after the baseline, BAI scores significantly decreased in both groups (Table III) nevertheless inter-groups analysis indicated that the reduction in the anxiety was significantly in favor of PEG (p=0.017). There was also a significant reduction in BDI score (p<0.05) in the PEG, while it did not change in CG after six weeks (p>0.05) (Table III).

FSS scores significantly decreased in the both of the groups compared to baseline outcomes (p<0.05) (Table III) moreover reduction in fatigue was significantly over in the PEG (p=0.007).

Analysis revealed that vitality and mental health domains significantly increased after six weeks in the PEG (p<0.05) while no significant differences were identified for the functional capacity, physical aspects, bodily pain, general health, social aspect or emotional aspect items (p>0.05) (Table III). Quality of life did not change in CG in terms of emotional or physical components after six weeks (p>0.05) (Table III).

**Table 3:** Intra-group Analysis of the Outcomes

	PEG (n=25)			CG (n=26)		
	Before	After	p	Before	After	p
Weight (kg)	57.00±4.78	56.28±4.80	0.005*	54.65±6.41	54.53±5.88	0.617
BMI (kg/m <sup>2</sup> )	21.88±1.68	21.61±1.69	0.005*	20.44±2.05	20.41±1.93	0.649
Waist Circumference (cm)	70.56±4.37	68.20±4.84	<0.001*	66.00±5.62	66.19±6.01	0.352
Hip Circumference (cm)	96.68±4.36	95.12±4.62	0.002*	92.57±6.24	92.76±6.20	0.375
Thigh Circumference (cm)	54.00±4.05	51.64±3.62	<0.001*	51.00±4.87	51.69±5.27	0.552
BAI	15.88±1.07	8.80±7.99	0.001*	17.57±8.48	13.07±8.79	0.010*
BDI	13.32±7.72	6.92±5.09	0.001*	13.38±7.83	9.88±9.48	0.067
FSS	4.69±1.04	3.30±1.03	<0.001*	4.81±1.24	4.29±1.39	0.032*
SF36-Functional Capacity	88.00±9.78	88.00±13.69	0.655	86.34±1.17	83.46±14.47	0.346
SF36-Physical Aspects	69.00±34.06	80.00±25.00	0.162	65.38±36.79	65.38±36.10	0.937
SF36-Bodily Pain	70.28±2.00	75.16±25.29	0.159	70.26±2.24	72.07±15.07	0.414
SF36-General Health	58.52±16.39	63.52±16.97	0.129	61.30±16.20	54.23±12.46	0.060
SF36-Vitality	55.80±14.69	66.68±15.72	0.005*	48.46±21.94	52.88±18.71	0.385
SF36-Social Aspect	71.68±2.28	76.20±19.31	0.233	66.50±2.58	63.38±20.15	0.936
SF36-Emotional Aspect	54.52±35.75	59.92±31.75	0.531	55.30±37.57	59.11±35.58	0.573
SF36-Mental Health	60.00±1.36	68.72±14.72	0.021*	54.92±2.10	58.92±16.95	0.389

Wilcoxon signed-rank test \* p<0.05

m: meter; kg: kilogram; cm: centimeter; BMI: Body Mass Index; BAI: Beck Anxiety Inventory; BDI: Beck Depression Inventory; FSS: Fatigue Severity Scale; SF36: Short Form Health Survey

## Discussion

This study investigated the effectiveness of an original Pilates mat exercise protocol on weight, BMI, anthropometric features, emotional state, fatigue, and quality of life among young females. Our findings revealed that the six weeks Pilates mat Exercise Protocol contribute to decrease weight, BMI, waist circumference, hip circumference, thigh circumference, anxiety, depression, fatigue, and improve some domains of quality of life of young females.

Physical exercise is one of the most common weight control and slimming methods worldwide and is frequently preferred by females (von Sperling de Souza & Brum Vieira, 2006). Among exercise methods, Pilates-based training has seen increasing popularity in recent years. However, results of the studies investigating the effect of Pilates on anthropometric features and body mass are conflicting (Arslan, Çakmakçi, Taşkin, Çakmakçi, & Ismet, 2012; Kucuk & Livanelioglu, 2015; Rogers & Gibson, 2009; Segal, Hein, & Basford, 2004; Şavkın, 2014). Trials have shown that different periods and intensities of Pilates training programs have different effects on these parameters. In the current study, a six-week Pilates mat exercise protocol provided a reduction in weight, BMI, waist, hip, and thigh circumferences compared to baseline outcomes of the participants. This study confirms the findings of some previous ones, however, contradicts to the report of Segal et al, who indicated 6 months of Pilates training did not change weight, or other body composition parameters in adults (Segal et al., 2004). Segal et al. explained this absence of changes in body composition with the low intensity of Pilates exercise program (one hour per week). Although the intensity of the program conducted in that study was lower than ours, the duration was higher. We think that the difference between the outcomes of our study and previous one might be related to the differences in content rather than the length of the training programs. Rogers and Gibson (2009) and

Şavkın (2014) both reported that 8 weeks Pilates training was sufficient in slimming the participants in the waist and other regions of the body except thigh circumference. Unlike these studies, a more intensive use of lower extremity exercises in our study might have resulted in the reduction in thigh circumference. It is not possible to comment on this issue since the authors did not provide detailed information about their exercise protocols.

In today's society, body image problems are unfortunately becoming widespread, and unhealthy methods are taken depending on these perceptions especially of young girls. Many studies have found high levels of subjective, and extreme body image dissatisfaction about a person's physical appearance (Runfolo et al., 2013). Weight control and slimness may contribute women to improve their satisfaction with body image, and physical health. According to our findings, the current Pilates mat exercise protocol promises to achieve this in a correct and healthy way.

Present study also indicated that the severity of anxiety and depression of young females who participated in Pilates training decreased compared to baseline. These findings are inconsistent with previous reports in this subject (Cruz-Ferreira et al., 2011; Hassan & Amin, 2011; Memmedova, 2015; Miller & Mesa, 2013; Roh, 2016). In a case report, Miller and Mesa (2013) declared that "Pilates can help in the present moment releasing anxiety, and stress but depending on the severity of anxiety it can add to the levels once the client leaves, and goes back into the world." This emphasizes the importance of consistency for the effectiveness of the exercise. Simple, practical, feasible and entertaining programs may help individuals to incorporate exercise into their lifestyle and provide permanence of the positive effects. Heretofore, many opinions have been developed about the effective mechanisms of Pilates exercises on the emotional health. Memmedova (2015) summarized the mechanisms of Pilates on reducing anxiety through the increase of body energy, sleep quality, attention, concentration, blood circulation, and oxygen flow to the brain owing to blood circulation increment, relaxing of muscles, and whole body, and breathing effect. The Pilates method has often been shown to be effective in the increased release of serotonin from the brain. Increased levels of serotonin can be helpful in the reduction of the symptoms associated with depressive symptoms and poor or pessimistic attitudes (Ginsberg et al., 2016; Hassan & Amin, 2011). Further, breathing as an integral aspect of Pilates has been found to have a positive effect on the vagus nerve, which can influence emotional states such as anxiety and depression (Frank, Edwards, & Larimore, 2017). Additionally, we think that group training might contribute to the emotional state in terms of anxiety, and depression of the subjects through promoting social interaction which helps the individuals to get rid of their daily stress.

There have been very few trials examining the effects of Pilates exercises on fatigue in the literature (Ashrafinia et al., 2015; Shanazari, Marandi, & Minasian, 2013; Soysal Tomruk, Uz, Kara, & Idiman, 2016; Stan et al., 2012). Our finding is consistent with the previous researchers in terms of reduction in fatigue but none of them were conducted in healthy populations. Our study is unique at this point. Authors reported that Pilates exercises might reduce fatigue by the way of reducing redundant muscle activity and activate needful muscles for functionality (Anderson & Spector, 2000). When people learn to contract their muscles correctly in training sessions, they may use their muscles more effectively during their daily activities. Further, the acceleration of physical activity might increase the

fatigue threshold by improving endurance. Another possible mechanism might be the deep, and relaxing respiration associated with the Pilates. Increasing airflow and lung capacity might be easier to perform any activity. In the current study, body mass reduction might be another factor which helped fatigue reduction in the participants.

Our findings confirmed the past knowledge in terms of improving vitality, and mental health domains of SF-36. The positive effects of Pilates training in quality of life in the sedentary population were previously reported (Campos de Oliveira, Gonçalves de Oliveira, & Pires-Oliveira, 2015; Leopoldino et al., 2013; McGrath, O'Malley, & Hendrix, 2011; Vieira, Faria, Wittmann, Teixeira, & Nogueira, 2013). However, frequency, duration or intensity of training were all incomparable with our study. Pilates thought the contrology stimulates the mind and decreases mental strain (Cruz-Ferreira et al., 2011; Pilates & Miller, 1945). By allowing the brain to relax, it is possible for Pilates to increase focus and concentration. Additionally, the control of muscles with coordination and focusing on breathing might increase aerobic capacity, and further improve mental health (Caldwell et al., 2009; Kucuk & Livanelioglu, 2015). We think that a longer and more intensive program may be more effective to improve the quality of life of practitioners.

According to the present study, it is possible to report that the current Pilates mat exercise protocol has positive effects on the health-related physical and psychological parameters of young females. But as a limitation, it is not possible to reveal the mechanisms of effects through this study. We could only guess, and comment on possible effect mechanisms. The baseline outcomes of weight, BMI, waist and hip circumferences of PEG and CG were significantly different despite randomization. We were unable to achieve homogeneity between the two groups at the baseline. Relatively small sample size might be the possible reason for this limitation. Besides, we did not perform normality test amongst the groups prior to the intervention. More accurate results could be obtained from normally distributed data obtained from a larger number of participants. Heretofore several studies investigated the possible effects of Pilates exercises on undiseased or diseased populations, but our study was different from previous ones in terms of offering an original six-week Pilates exercise protocol which is effective at weight loss, slimming, emotional state, fatigue and some domains of quality of life. This evidence-based study is significant in terms of presenting a clear, reliable, basic, and effective protocol to the literature in order to improve the physical, and psychological well-being of young females.

## **Conclusion**

In conclusion, an original 6-week (twice a week for a total of 12 sessions) Pilates mat exercise protocol contributes to the physical, and psychological well-being of young females in terms of body mass, slimness, anxiety, depression, fatigue, and quality of life. However, there is still need for long-term and larger sample sized future studies to clarify the possible effect mechanisms of Pilates exercises and evidence based on this subject.

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