



## Investigation of the Effect of 8-Week Reformer Pilates Exercise on Flexibility, Heart Rate and Glucose Levels in Sedentary Women

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### Abstract

The aim of this study is to investigate the effects of reformer pilates exercises on flexibility, heart rate and glucose levels of sedentary women for 8 weeks. 30 sedentary women between 30-36 years old were joined to the study. Participated in the research sedentary women' ages' mean was  $32,20 \pm 1,78$  year, lengths' mean was  $166,76 \pm 3,93$  cm. It is announced to the participants that personal information and findings obtained during and after the research will be kept strictly confidential and also "Informed Voluntary Consent Form" was filled up. Reformer pilates exercise was performed regularly for 8 weeks, %40-60 loading intensity, 3 days a week, 60 minutes per day. Measurements were obtained as pre-test and post-test. SPSS programme was used. "Paired t test" was used to determine the difference before and after exercise. The results were evaluated at  $p < 0,05$  significance level. The comparison of body weight, resting-maximum heart rate, flexibility and glucose 1. day and 8. week post- exercise measurements were statistically significant ( $p < 0,05$ ). But there were no significant different in glucose 1. day and 8. week pre- exercise measurements ( $p > 0,05$ ). As a result of our study based on the data obtained, it was determined that regular reformer pilates exercises accelerated weight loss on sedentary women. In addition, it had positive effects on flexibility, heart rate and glucose measurements.

**Keywords:** Reformer pilates, Exercise, Sedentary women, Heart rate, Glucose, Flexibility.

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**Ethical:** This study follows all ethical practices during writing.

### Contents

1. Introduction .....	227
2. Material and Method.....	227
3. Findings .....	228
4. Conclusion .....	228
References.....	229

### Contribution of this paper to the literature

This study contributes to the literature in terms of monitoring the progress both by themselves and their trainers and improving the quality of life by seeing the physical and physiological changes of the reformer pilates, which has become a popular, exercise recently, in sedentary women.

## 1. Introduction

The idea of the design of the reformer was laid by Joseph Pilates in an attempt to self-treat the beds of soldiers wounded during the First World War. It can be said that Joseph Pilates's treatment of patients with springs attached to beds and walls in the hospital is in fact the first days of the foundation of modern Reformer tools. The main purpose of exercising on the reformer is to strengthen the body as well as to give the body the right flexibility within the framework of its current potential, to correct posture disorders and to keep proper breathing control during all these practices and to stick to the principles of smooth movement at an appropriate pace (Bullo et al., 2015; Rodrigues, Cader, Torres, de Oliveira, & Dantas, 2009; Sekendiz, Altun, Korkusuz, & Akin, 2006; Tamer, 1995).

Another reason why reformer pilates exercises have been popular for years is that they work against the springs, not against gravity. In a study, it was emphasized that gravity provides a constant external resistance to the angle of movement in exercise, while the springs provide an increased external resistance while the muscles extend (Siler, 2000).

In Pilates, the anatomical structure and muscles of the participant, structurally considered as a whole. In addition to reducing the risk of injury, Pilates increases endurance and metabolic rate of participants (Kılıç, Uğurlu, & Dikdağ, 2018). With the help of equipment used in pilates exercises, it is necessary to create posture correcting and balancing positions and movements in order to improve the participant's whole body. Pilates exercise, from the initial stage to the mastery stage, is a wide range of various exercises can be performed by using some devices and apparatus. Stretches with different resistance levels, pulleys, and gravity-driven equipment, affect the muscle structure of the participants from various angles. It helps to focus especially on the internal muscular system. By working the deep layers of the muscles, the correct position, posture and optimum movement capacity is tried to be obtained (Isacowitz & Clippinger, 2001).

Although Pilates is a less severe exercise than other aerobic and dance exercises, it is a very important type of exercise for a healthy body with concentration, control, centering, flowing movement rhythm, precision of movement and breathing technique during the exercise. Some studies have shown that pilates exercises reduce the risk of heart disease, prevent osteoporosis, shape the body, improve balance, flexibility and strength (Robinson & Hunter, 2003; Schroeder, Crusemeyer, & Newton, 2002; Segal, Hein, & Basford, 2004). With Pilates exercises, muscle flexibility is increased (Otto et al., 2004; KV. Rogers & Gibson, 2006; Schroeder et al., 2002; Segal et al., 2004) compression forces on articular and pelvic tilt are reduced, spine stability and posture disorders corrected (McMillan, Proteau, & Lèbe, 1998). Furthermore, it is stated that body awareness is improved with these exercises, there are decreases in low back pain (Anderson & Spector, 2009) and increases in bone density (Betz, 2005). In addition to the mentioned benefit, the positive effects of pilates exercises on strength, posture, flexibility, basal metabolism, lean mass and general body values have been examined and proven in many studies (Bernardo, 2007; Cakmakçi, 2011; de Souza & Vieira, 2006).

The aim of this study is to investigate the effects of reformer pilates exercises on flexibility, heart rate and glucose of sedentary women for 8 weeks.

## 2. Material and Method

### 2.1. Participants

Thirty sedentary women, between 30-36 years old participated in the study. It is announced to the participants that personal information and findings obtained during and after the research will be kept strictly confidential and also "Informed Voluntary Consent Form" was filled up. According to the information given, the research group was asked not to engage in any strenuous physical activity before the tests. Reformer pilates exercise with instruments was performed regularly for 8 weeks, 3 days a week, 60 minutes per day.

### 2.2. Measures

#### 2.2.1. Measurement of Height

The height of the athletes was measured by using a SECA brand height scale having an accuracy of 0.01 mm sensitivity. The values were recorded as "cm".

#### 2.2.2. Measurement of Body Weight

The body weight of the athletes was measured by using a SECA brand weight scale having an accuracy of 0.001 kg sensitivity. The values were recorded as "kg".

#### 2.2.3. Measurement of Heart Rate

Heart Rate with Nimo brand pulse meter, before and after exercise measurements were taken.

#### 2.2.4. Measurement of Blood Glucose

OKmeter Optima OK-10H (Taiwan) glucose meter was used in the measurement of blood glucose values of the research group. Glucose measurement was recorded before and after the test.

#### 2.2.5. Measurement of Flexibility

The flexibility of the athletes was measured by a sit and lie test on the flexibility table. The athletes were taken to this test after warming up for five minutes. Stretching distance was recorded as the athletes, with their naked soles, sitting on the floor, leaning forward on the test stand, reaching forward without bending their knees,

pushing the ruler on the stand forward, and stretching for 2 seconds at the furthest point on which they lie. The athletes repeated the test three times, and the maximum value that they took was recorded in cm.

### 2.2.6. Exercise Program

Reformer pilates exercise program was used for all muscle groups. Reformer exercises include Kneeling arms, Double Leg Press Plantar Flexed, Standing Series, Chest fly, Feet in starps, Single Leg Press Series, Squat spinning movements. Exercises, the movement is made to be fluent in the transition. Each movement was performed %40-60 of maximal heart rate in loading intensity, 3 sets, with 12 repetitions and yielding rest. Before and after the exercises, stretching movements were performed for 15-20 minutes for the purpose of warming-cooling.

### 2.2.7. Data Analysis

In the study, the data were analyzed by using statistical package program. Descriptive statistics were used for mean and standard deviation values, "Shapiro-Wilk" test was used to determine whether the data showed normal distribution or not and determining whether there is a difference before and after exercise, "Paired t Test" was analyzed. The results were evaluated according to " $p < 0,05$ " significance level.

## 3. Findings

**Table-1.** Physical information of training groups participating to research.

Parameters	N	Minimum	Maximum	Mean±Sd
Age (year)	30	30,00	36,00	32,20±1,78
Height (cm)		160,00	175,00	166,76±3,93

Note: \* $p < 0,05$ .

As shown in Table 1, the mean age of the participants was  $32,20 \pm 1,78$  years and the mean height was  $166,76 \pm 3,93$  years.

**Table-2.** Comparison of body weight pre and post-test measurements of participants.

Parameters	Tests	Mean ±Sd	t	p
Body Weight (kg)	1. Day Pre-Exercise	63,43±7,46	4,147	,000*
	8. Week Post- Exercise	61,8±7,01		

Note: \* $p < 0,05$ .

According to the Table 2, a significant decrease was found in body weight values of women who participated in the study as a result of comparison of pre-test and post-test averages ( $p < 0,05$ ).

**Table-3.** Comparison of heart rate pre and post-test measurements of participants

Parameters	Tests	Mean ±Sd	t	p
Resting Heart Rate (beat/min)	1. Day Pre- Exercise	86,53±8,40	2,43	,021*
	8. Week Pre- Exercise	85,50±8,32		
Maximum Heart Rate (beat/min)	1. Day Post- Exercise	112,70±12,83	2,79	,009*
	8. Week Post- Exercise	109,50±12,86		

Note: \* $p < 0,05$ .

As shown in Table 3, statistically significant difference was found between the rest and maximum pulse values of the participants before and after exercise ( $p < 0,05$ ).

**Table-4.** Comparison of glucose pre and post-test measurements of participants.

Parameters	Tests	Mean ±Sd	t	p
Glucose (mg/dl)	1. Day Pre- Exercise	92,36±14,23	-,151	,881
	8. Week Pre- Exercise	92,50±12,65		
	1. Day Post- Exercise	92,10±11,89	2,942	,006*
	8. Week Post- Exercise	90,76±11,90		

Note: \* $p < 0,05$ .

When examined in Table 4, there was no statistically significant difference between the 1. day and 8. weeks before exercise ( $p > 0,05$ ); It was found to be significant after 1. day and 8. weeks after exercise ( $p < 0,05$ ).

**Table-5.** Comparison of flexibility pre and post-test measurements of participants.

Parameters	Tests	Mean ±Sd	t	p
Flexibility (cm)	1. Day Pre- Exercise	24,70±7,96	-7,045	,000*
	8. Week Post- Exercise	26,50±8,36		

Note: \* $p < 0,05$ .

According to the Table 5, a statistically significant difference was found between the flexibility measurement values of the participants before and after exercise ( $p < 0,05$ ).

## 4. Conclusion

As a result of the 8-week reformer pilates exercises applied to sedentary women, it was determined that reformer pilates exercise positively caused physical and physiological differences. In our study, the comparison of body weight, resting-maximum heart rate, flexibility and glucose 1. day and 8. week post- exercise measurements

were statistically significant ( $p < 0,05$ ). But there were no significant different in glucose 1. day and 8. week pre-exercise measurements ( $p > 0,05$ ). We think that the reason for the development of is the effect of the reformer pilates exercises.

Kurşun, Suna, and Alp (2016) examined the effect of 12-week regular step aerobic exercises on body fat values in adult sedentary women found that although there was a decrease in body weight values, it did not cause a statistically significant change. This study is similar to our study in terms of reduction in body weight.

In a similar survey conducted with 47 adult individuals, it is presented that, when the pilates exercises applied regularly (at least 1 hour per week), it improved the flexibility values (2nd month: 3.4cm (1.3-5.7cm), 4th month: 3.3 cm (0.3- 7.8 cm) and 6th month: 4.3cm (1.5-7.6 cm). When these studies were compared, it was found that flexibility values are increased (Segal et al., 2004). While the arithmetic mean of the pre-exercise flexibility values of the experimental group was  $31.30 \pm 7.18$ , this value was found to be  $35.90 \pm 5.74$  after the exercise (Kılıç et al., 2018). 4.60 cm increase between pre- and post-exercise values was found to be statistically significant ( $p < 0,01$ ). Turna and Alp (2020) also reported in their study that trainings had positive effects on flexibility of participants. Altıntaş (2006) after exercising pilates with women over the age of 30, he looked at the flexibility values in flexibility measurements. As a result of these measurements, statistically significant differences were found. Kate Rogers and Gibson (2009) reported that regular pilates studies in middle-aged sedentary women have significant effects on muscle endurance, body composition and flexibility. Otto et al. (2004) also supported the positive effects of pilates exercise method on flexibility values. In this reformer study, it was reported that the flexibility values of the group performing the reformer exercises were significantly different from the group performing the resistance exercises. Babayiğit (2009) study showed that the 12-week, 3-day per week, and 1-hour per day pilates exercise program increased the flexibility values of the women participating in the study. This development shows that Pilates exercises have significant effects on improving flexibility values. Çağlav (2005) on the other hand, found significant differences in flexibility measurements after pilates exercise performed by women aged 40-45 years. This study is in line with the studies in literature. We can say that the increase in flexibility values of women is beneficial on flexibility feature of doing Pilates exercise.

In a study conducted by Rico-Sanz, Zehnder, Buchli, Dambach, and Boutellier (1990) blood glucose levels were  $87 \pm 2.7$  mg / dl at before and  $42 \pm 2.5$  mg / dl at after. When exercise is severe and prolonged, it is seen that blood glucose also falls below normal resting levels due to decreased liver glycogen. In a study by Cox et al. (2001) on sedentary women aged 40-65 years, the effect of exercise on blood pressure was examined. At the end of 60 exercises of 18 months, systolic and diastolic blood pressures of the subjects were decreased. Colakoğlu and Senel (2003) examined the effect of 8-week aerobic exercise program on some physical parameters in middle-aged women and found a significant decrease in resting pulses of 9.2 beats / min between experimental subjects.

Erbas (2007) examined the effect of aerobic exercise program on physical and physiological parameters in middle-aged sedentary women. He took three measurements, before, in the middle and at the end of the exercise, and found a significant reduction in resting pulse rates.

Velasques and Wilmore (1991) investigated changes in body composition and cardiorespiratory fitness after a 12-week step study in women aged 18-33 years. At the end of the study, it was observed that the resting heart rate decreased. When the results in the literature are examined, we believe that the data in our study support the results.

Çolakoğlu and Karacan (2006) applied aerobic exercises in their research and they observed reductions in the number of resting heart rate after exercise. The results of this study support our results.

As a result, based on the data obtained from our study, we can say that there are positive changes in physical and physiological characteristics of regular reformer pilates exercises performed on sedentary women. For the continuation of these changes and for an ideal body structure and health, we can say that these and similar exercises should be done regularly. In addition, we think that these kinds of exercises can overcome many health problems that may arise in the elderly ages. In addition to exercises done for health and physical fitness, people may also be advised to check their nutritional habits before and after exercise and also they may be advised to exercise with the help of an experts.

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