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Original Article

Evaluation of the Effects of Reformer Pilates Exercises on Women's Anthropometric Parameters

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Abstract

Although the positive effects of Reformer Pilates (RP) exercises on anthropometric parameters are frequently emphasized in the literature, existing knowledge regarding the temporal changes induced by this exercise protocol remains limited. In this context, the present study was designed to address this gap by evaluating the effects of a 12-week RP exercise protocol on the anthropometric parameters of female participants (n=24) at four different time points. This longitudinal quasi-experimental study employed a repeated-measures design. The temporal changes in measurement variables were assessed at pre-exercise and at the end of the 1st, 2nd, and 3rd months. Participants engaged in a structured RP exercise protocol three times per week for 12-weeks, with each session lasting 60 minutes. The exercise program consisted of systematic warm-up, main exercise, and cool-down phases. To assess the effects of the RP exercise protocol on anthropometric parameters, circumferential measurements of the waist, chest, hips, thigh, arm, and leg regions were obtained. The results of the study revealed statistically significant reductions in all body circumference measurements ($p<0.05$). The greatest reduction was observed during the first month, with a continued but decelerated decrease in the second month. The decline persisted in the third month, albeit at a markedly slower rate. In conclusion, a regular and structured RP exercise program facilitates notable reductions in body circumference, and this effect appears to be sustainable over time. In particular, reductions in waist and hip circumference suggest a decrease in abdominal and visceral fat, which may be considered a favorable indicator of cardiometabolic health.

Keywords: Anthropometry, Body composition, Exercise, Reformer pilates.

Introduction

With the impact of technological advancements, sedentary lifestyles are becoming increasingly prevalent, posing a significant threat to human health. The reduction in physical activity leads to various adverse health effects, making exercise an essential necessity for maintaining and improving health in today's world (Ilić et al., 2023; Kilincarslan et al., 2022). Recognizing this reality, individuals actively seek solutions and engage in various physical activities. Alongside participation in different sports disciplines, there has been a noticeable increase in interest in fitness center activities aimed at weight loss (Kilincarslan et al., 2022).

Enhancing physical activity levels and increasing energy expenditure play a crucial role in achieving the desired body composition (Swift et al., 2014). In this context, fitness centers serve as key environments that facilitate individuals in reaching their body composition goals. Many people utilize fitness centers for weight loss, weight gain, and maintaining body composition and shape (İlbak et al., 2022). Therefore, identifying exercise programs that contribute to overall body health and positively impact body composition is of great importance (İlbak & Bayer, 2021). However, despite the widespread availability of exercise programs in fitness centers, evidence regarding how quickly measurable anthropometric changes occur remains limited.

Currently, various exercise modalities such as bodybuilding, step aerobics, Zumba, spinning, and Reformer Pilates are commonly practiced in fitness centers (İlbak et al., 2022). Among these, Reformer Pilates has gained popularity due to its primary objectives, which include enhancing body strength and flexibility, correcting postural misalignments, and ensuring proper breathing control during exercises (Bullo et al., 2015; Siqueira Rodrigues et al., 2010). These benefits have made Reformer Pilates an attractive method for both exercise practitioners and researchers investigating its effects on body composition. In particular, the use of spring-based resistance allows for progressive loading, which may induce early and continuous adaptations in body circumferences

A meta-analysis study demonstrated that Pilates exercises significantly contribute to weight loss (MD = -2.40) and a reduction in body fat percentage (MD = -4.22) (Wang et al., 2021). Furthermore, participation in Reformer Pilates programs has been reported to result in noticeable increases in muscle mass, particularly in the abdominal and limb regions (Jo & Seo, 2023; Vaquero-Cristóbal et al., 2016). Among women engaging in Reformer Pilates, significant reductions in body fat percentage, waist-to-hip ratio, and endomorphic body characteristics were observed following a 16-week training program, alongside an increase in muscle mass (Vaquero-Cristóbal et al., 2016). Similarly, a combination of a 10-week Reformer Pilates and controlled breathing exercise program yielded significant improvements in body weight, body mass index, and body fat percentage (Adıgüzel et al., 2023). Additionally, when compared to mat Pilates, Reformer Pilates has been shown to provide similar benefits, with greater improvements in trunk flexor muscle strength (Bulguroglu et al., 2017). Nevertheless, most of these studies report only pre- and post-intervention results, making it difficult to determine at which stages of training the most pronounced changes occur.

Although the literature frequently highlights the positive effects of Reformer Pilates exercises on anthropometric parameters, there remains limited information regarding the changes induced by this exercise protocol over different time intervals. To address this knowledge gap, the present study aims to evaluate the effects of a 12-week Reformer Pilates exercise program on women's anthropometric parameters across four distinct time points. This time-course analysis may help practitioners optimize program duration and expectations by identifying periods of rapid versus gradual anthropometric adaptation

Material and Methods

Participant Group

The sample size of the study was determined using the G*Power 3.1.9.7 software (University of Düsseldorf, Düsseldorf, Germany). A repeated measures ANOVA from the F-test family was selected for the analysis, with an effect size of 0.25, an alpha error probability of 0.05, and a test power (1-β) of 0.80. The power analysis was conducted assuming four repeated measurements. The analysis indicated that at least 24 participants were required for the study. Accordingly, 24 female individuals were included.

The inclusion criteria for participation were as follows: a body mass index (BMI) within the range of 25–29.9 kg/m² (classified as overweight), no regular medication use in the past six months, absence of any dietary regimen, no use of nutritional supplements, and no current or suspected pregnancy. The exclusion criteria were defined as follows: BMI outside the designated "overweight" category, regular medication or nutritional supplement use, adherence to any dietary program or intermittent fasting, and pregnancy or suspicion thereof. Participants were instructed to maintain their habitual dietary intake throughout the study period. The descriptive characteristics of the participants, including age, height, body weight, and BMI values, are presented in Table 1.

Table 1. The descriptive characteristics of the participants.

Variable	Min	Max	$\bar{X}$ ± SD
Age (year)	25	45	35.33±6.75
Height (cm)	150	174.6	161.88±7.69
Body weight (kg)	62.8	86.8	72.70±7.63
BMI (kg/m²)	25.2	29.7	27.69±1.26

Min: mibimum; Max: maksimum; $\bar{X}$ ± SD: mean ± standard deviation.

Table 1 presents the minimum, maximum, mean ($\bar{X}$ ± SD), and standard deviation (SD) values of the variables related to age, height, body weight, and body mass index (BMI) of the study participants. The participants' age range is between 25 and 45 years, with a mean age of 35.33 ± 6.75 years. Height varies between 150 cm and 174.6 cm, with a mean value of 161.88 ± 7.69 cm. Body weight ranges from 62.8 kg to 86.8 kg, with a mean body weight of 72.70 ± 7.63 kg. BMI values range between 25.2 kg/m² and 29.7 kg/m², with a mean of 27.69 ± 1.26 kg/m².

Study Design

This longitudinal quasi-experimental study adopted a repeated measures model. The temporal changes in the predetermined measurement variables were assessed at baseline (pre-exercise) and at the 1st, 2nd, and 3rd months of the intervention. Participants engaged in a 12-week Reformer Pilates exercise protocol, performed three times per week, with each session lasting 60 minutes. The exercise program consisted of a systematic application including warm-up, main exercise, and cool-down phases.

To evaluate the effects of the Reformer Pilates exercise protocol on the anthropometric parameters of female individuals, circumference measurements of the waist, chest, hips, thigh, arm, and leg were taken. Measurements were conducted at designated time points in accordance with standardized anthropometric assessment protocols. All measurements were performed at the same time of day for each participant to minimize diurnal variation. This study was approved by Inonu University Health Sciences Non-Interventional Clinical Research Ethics Committee (approval no: 2025/7476) and was conducted in accordance with the helsinki declaration.

Reformer Pilates Exercise Protocol

The participants engaged in Reformer Pilates exercises three times per week for 12 weeks. On non-exercise days, they were instructed to refrain from performing any physically demanding activities. In our study, Reformer Pilates exercises were implemented three times per week following warm-up exercises. All exercise sessions were supervised by a certified Pilates instructor to ensure correct technique and adherence to the protocol.

The exercises selected were in accordance with the Reformer exercise protocols and durations determined by the Pilates Committee of the Turkish Gymnastics Federation, with each session lasting approximately 60 minutes (Aka et al. 2020). Each exercise was performed using a 30-second exertion and a 1-minute rest interval (1:2 ratio). The exercise series is presented in figure 1 and the exercises are described in detail below.

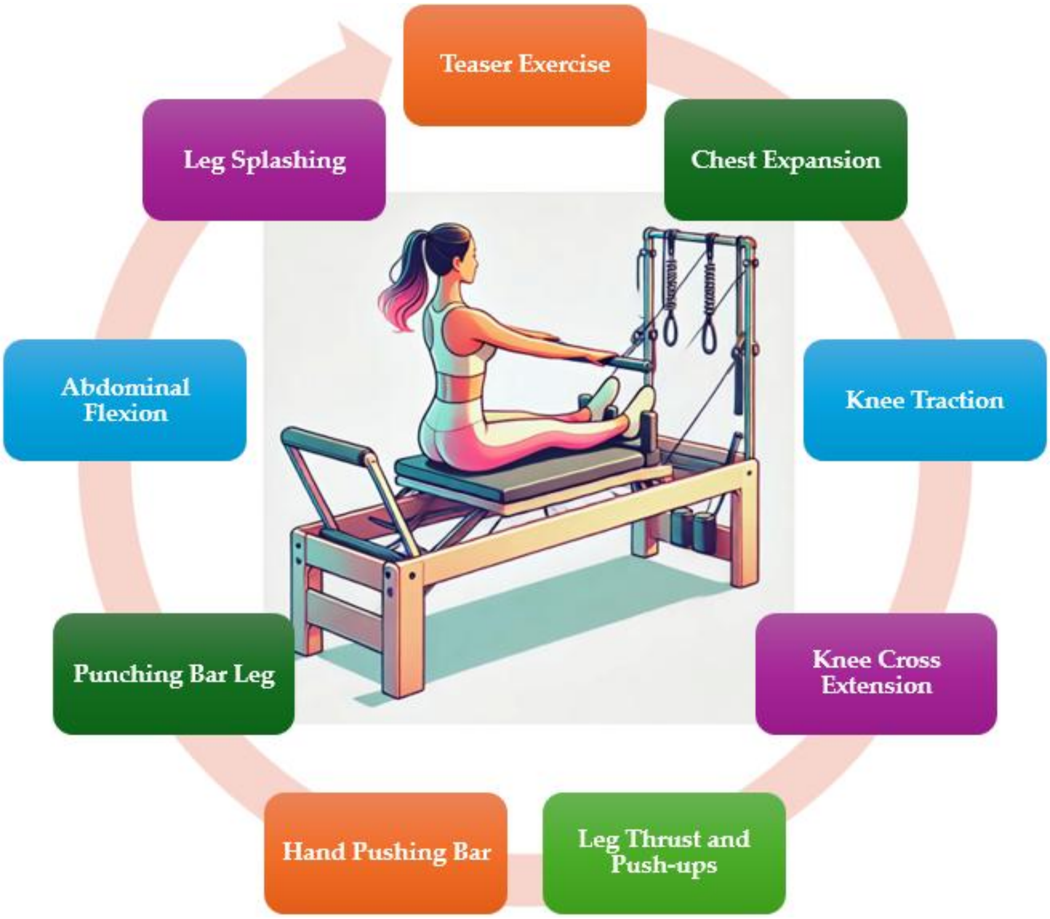

Figure 1. The exercise series.

Teaser Exercise: The participant lies supine on a box placed on the carriage. The legs are positioned in a tabletop stance (knees at 90 degrees), holding the straps, with arms extended to the sides in an eagle position and the head tilted back. While exhaling, the straps are pulled towards the hips, and the body transitions into a seated teaser position. The movement is completed by returning to the starting position.

Chest Expansion: The participant stands on the carriage, with one foot in a toe position and the other in the middle of the platform. While holding the straps and inhaling, the arms are extended backward past the hips without bending the elbows. Simultaneously, the knees are fully extended, and the body is raised onto the feet. The movement is completed by returning to the starting position.

Knee Traction: One foot is placed against the shoulder rest, while the other foot is positioned between the springs on the platform. The hands grip the foot bar. The back leg pushes against the foot bar, extending without bending the knee. The front leg then pushes off, drawing the knee towards the body. The movement is completed by returning to the starting position.

Knee Cross Extension: One foot is placed against the shoulder rest, while the other foot is positioned between the springs on the platform. The hands grip the foot bar. The back leg pushes against the foot bar, extending into a long, straight position. The front leg bends first towards the body and then extends diagonally outward. The movement is completed by returning to the starting position.

Leg Thrust and Push-ups: A box is placed laterally on the carriage. The participant places one foot on the front part of the box while keeping the other foot on the platform between the springs. Holding the foot bar, the participant pushes the carriage with the back foot, bringing the feet together on the carriage. A push-up is performed before returning to the starting position, alternating foot placement in the subsequent repetition.

Hand Pushing Bar: The participant lies supine on the carriage with legs in a tabletop position (knees at 90 degrees) and holds the bar with both hands. The upper body lifts towards the hips while the legs extend forward into a V position. Then, the legs return to tabletop, and the body slowly reclines back onto the carriage. The movement is completed by returning to the starting position.

Punching Bar Leg: The participant lies supine with feet placed on the bar, positioning the balls of the feet against it. The lower back is pressed against the carriage, and the hips lift off the surface, maintaining contact only through the shoulder blades. The knees are then drawn towards the body. The movement is completed by returning to the starting position.

Abdominal Flexion: The participant lies supine with the head resting against the headrest. The feet are placed in a theraband loop positioned on the foot bar. The theraband is held with both hands while the legs extend forward, reaching a long-sitting position. During this phase, the back, pelvis, and legs lift off the carriage. After 3–5 repetitions, the spine is gradually lowered back onto the carriage, completing the movement.

Leg Splashing: The participant lies supine on the carriage with a small Pilates ball placed beneath the lower scapula. The feet are positioned at the center of the jump board. Holding 0.5 kg weight balls in both hands, the arms bend at the elbows. While executing a double-leg jump, one knee is drawn towards the body, while the other remains extended. Simultaneously, the arms are raised above the head without bending the elbows. The movement is completed by returning to the starting position.

Anthropometric Measurements

In this study, anthropometric assessments included circumference measurements of the waist, chest, hips, thighs, legs, and arms, as well as height, body weight, and BMI calculations. Measurements were performed in accordance with the guidelines of the World Health Organization (WHO) and the International Society for the Advancement of Kinanthropometry (ISAK) by an experienced researcher. All measurements were conducted in the morning, in a fasting state, and with participants wearing only lightweight clothing. No participants dropped out during the intervention period, and all measurements were completed as planned. Height and body weight were measured using a calibrated digital body analysis device. Circumference measurements were performed using a non-elastic flexible tape measure. During each measurement, care was taken to ensure that the tape was positioned parallel to the body surface, in contact with the skin without causing compression or gaps. Measurements were conducted by two independent researchers, and in cases where the difference between the two measurements exceeded 0.5

cm, a third measurement was taken, and the mean value was used. Anthropometric measurements are presented in Figure 2 and these measurements are described in detail below.

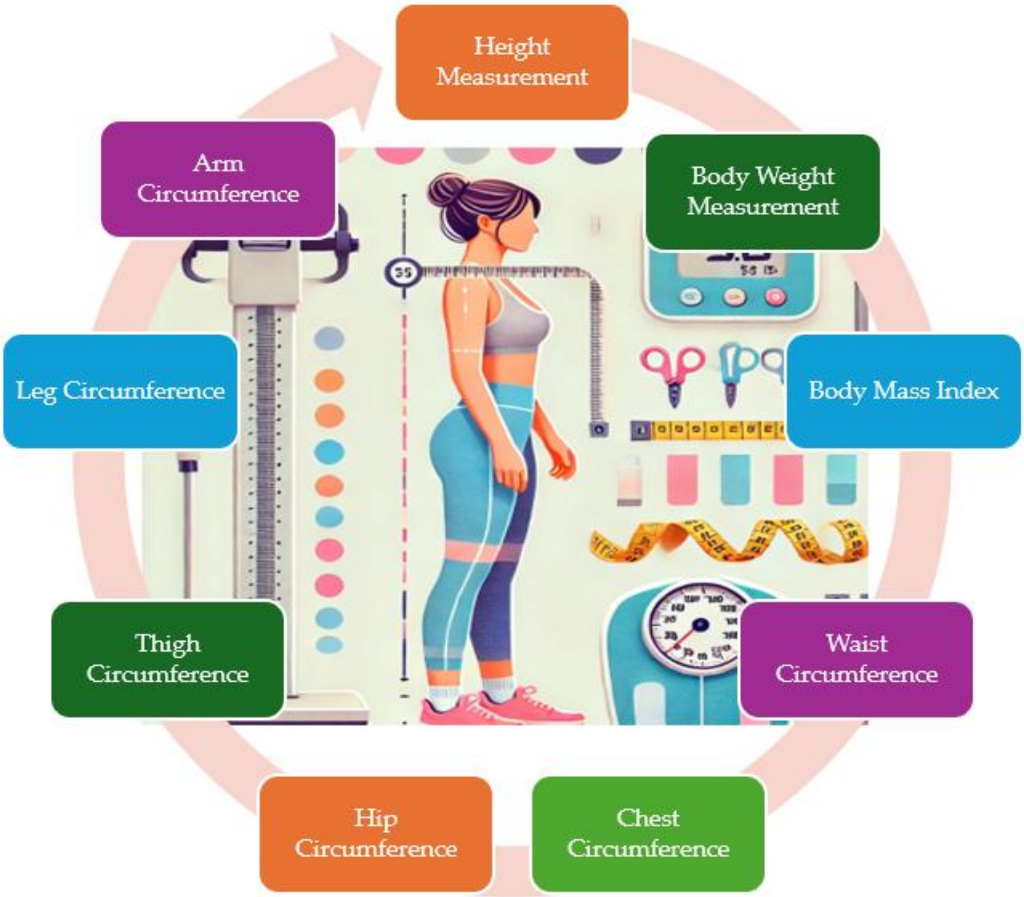

Figure 1. The anthropometric measurements.

Height Measurement: Participants were positioned barefoot in an upright stance with the head aligned in the Frankfurt plane. During the measurement, feet were placed together, knees extended, shoulders in a neutral position, and arms parallel to the body. Height was recorded with a precision of 0.1 cm.

Body Weight Measurement: Participants, wearing light clothing and without shoes, were positioned at the center of a digital scale. Body weight was recorded with a precision of 0.1 kg.

Body Mass Index (BMI): BMI was calculated by dividing the participant's body weight (in kilograms) by the square of their height (in meters) (BMI = kg/m^2). The obtained values were evaluated based on the standard reference ranges defined by the WHO.

Waist Circumference: Measured while the participant was standing upright with feet approximately 25–30 cm apart. The tape was placed at the narrowest point between the iliac crest and the lower ribs, and the measurement was recorded at the end of a normal exhalation.

Chest Circumference: Measured at the widest point of the thorax while the participant was in an upright posture with arms parallel to the body. The measurement was taken following a deep inhalation and exhalation, during normal respiration.

Hip Circumference: Measured at the widest point of the gluteal region while the participant was standing upright with equal weight distribution on both feet.

Thigh Circumference: Measured at the widest point of the thigh while the participant was standing upright. Care was taken to ensure that both legs were relaxed and in a natural position.

Leg Circumference: Measured 15 cm above the patella (kneecap) while the participant was in a standing position.

Arm Circumference: Measured at the widest point of the upper arm (biceps brachii) while the participant's arm was relaxed and hanging freely at the side.

All measurements were conducted on the same day, by the same researchers, and under consistent environmental conditions to ensure measurement reliability.

Statistical Analysis

The data obtained in this study were analyzed using GraphPad Prism software (version 9.0.0, GraphPad Software Inc., San Diego, CA, USA). The Shapiro-Wilk test was applied to assess the normality distribution of the data. As the normality assumption was met, Repeated Measures Analysis of Variance (ANOVA) was employed to evaluate temporal changes. In cases where significant differences were detected, Tukey post-hoc tests were conducted to determine pairwise differences between time points. All measurements were assessed at four time points: baseline (pre-exercise), 1st month, 2nd month, and 3rd month. The statistical analysis examined whether changes over time in anthropometric parameters (waist, abdomen, chest, hip, pelvis, arm, and leg circumferences) and body weight were significant. Additionally, data at each measurement point were reported as mean ± standard deviation ($\bar{X}$ ± SD). The level of statistical significance was set at $p < 0.05$.

Results

The results obtained from the research are presented in the tables below.

Table 2. ANOVA (Analysis of Variance) results for repeated measures.

Independent Variable	Sum of Squares (SS)	df	Mean Squares	F	p
Waist Circumference (cm)	996.2	3	332.1	1172	0.01
Chest Circumference (cm)	631.2	3	210.4	245.8	0.01
Hip Circumference (cm)	1034	3	344.7	486.2	0.01
Thigh Circumference (cm)	1185	3	394.9	800.2	0.01
Leg Circumference (cm)	485.4	3	161.8	681.3	0.01
Arm Circumference (cm)	145.7	3	48.57	459.6	0.01

The ANOVA results for repeated measures presented in Table 2 indicate statistically significant differences for all variables ($p = 0.0001$). This finding suggests that the reformer plates exercise program leads to substantial changes in body measurements. The highest F-value was calculated for waist circumference (F = 1172), indicating that this variable exhibited the most pronounced variation over time. The high F-values obtained for thigh circumference (F = 800.2) and leg circumference (F = 681.3) demonstrate that significant changes occurred particularly in the lower extremities. Statistically significant differences were also observed for hip circumference (F = 486.2) and arm circumference (F = 459.6). Although the F-value for chest circumference (F = 245.8) was relatively lower compared to other variables, the changes over time were still statistically significant.

Table 3. Post-hoc results for Hip and chest circumference variables.

Independent Variable	Time	Mean	Mean Difference	Standard Error of Difference	p
Waist Circumference (cm)	**Baseline**	92.96	3.667	0.1300	0.01
	1st month	89.29			
	Baseline	92.96	6.417	0.1797	0.01
	2nd month	86.54			
	Baseline	92.96	8.625	0.1886	0.01
	3rd month	84.33			
	1st month	89.29	2.750	0.1241	0.01
	2nd month	86.54			
	1st month	89.29	4.958	0.1532	0.01
	3rd month	84.33			
	2nd month	86.54	2.208	0.1343	0.01
	3rd month	84.33			
Chest Circumference (cm)	**Baseline**	100.2	2.750	0.1241	0.01
	1st month	97.46			
	Baseline	100.2	5.167	0.3223	0.01
	2nd month	95.04			
	Baseline	100.2	6.792	0.3806	0.01
	3rd month	93.42			
	1st month	97.46	2.417	0.2476	0.01
	2nd month	95.04			
	1st month	97.46	4.042	0.3038	0.01
	3rd month	93.42			
	2nd month	95.04	1.625	0.1009	0.01
	3rd month	93.42			

Table 3 shows a consistent decrease in waist circumference measurements from the initial point. In the first month, a reduction of 3.67 cm occurred, and in the second month, the decrease became more pronounced, reaching a total of 6.42 cm. This decline continued in the third month, resulting in a total difference of 8.62 cm compared to the baseline. The most rapid reduction in waist circumference was observed in the first month, while the decrease continued at a slower rate in the following months.

Similarly, chest circumference measurements also showed a regular decline over time. A reduction of 2.75 cm was observed in the first month, with the total decrease reaching 5.17 cm in the second month. By the third month, the total reduction was calculated as 6.79 cm. The fastest reduction in chest circumference occurred in the first month, with the rate of decrease slowing in the second month and reaching its lowest level in the third month.

Table 4. Post-hoc results for hip and thigh circumference variables.

Independent Variable	Time	Mean	Mean Difference	Standard Error of Difference	p

Hip Circumference (cm)	Baseline	118.8	3.208	0.1472	0.01
	1st month	115.6			
	Baseline	118.8	6.458	0.2691	0.01
	2nd month	112.3			
	Baseline	118.8	8.667	0.3645	0.01
	3rd month	110.1			
	1st month	115.6	3.250	0.1831	0.01
	2nd month	112.3			
	1st month	115.6	5.458	0.2691	0.01
	3rd month	110.1			
	2nd month	112.3	2.208	0.1472	0.01
	3rd month	110.1			
Thigh Circumference (cm)	Baseline	100.9	3.958	0.1123	0.01
	1st month	96.92			
	Baseline	100.9	7.375	0.2237	0.01
	2nd month	93.50			
	Baseline	100.9	9.208	0.2691	0.01
	3rd month	91.67			
	1st month	96.92	3.417	0.1896	0.01
	2nd month	93.50			
	1st month	96.92	5.250	0.2500	0.01
	3rd month	91.67			
	2nd month	93.50	1.833	0.1153	0.01
	3rd month	91.67			

Table 4 demonstrates a significant reduction in hip circumference over time. A decrease of 3.21 cm was observed in the first month, with the total reduction reaching 6.46 cm in the second month. By the third month, a total decrease of 8.67 cm was recorded. The fastest reduction in hip circumference occurred in the second month, while the rate of decrease slowed slightly in the third month.

Thigh circumference followed a similar decreasing trend as the other variables. In the first month, a reduction of 3.96 cm was observed, with the total decrease reaching 7.38 cm in the second month. By the third month, a total decrease of 9.21 cm had occurred. The most significant reduction in thigh circumference was observed in the first month, with a similar rate of decline continuing in the second month, but slowing down in the third month.

Table 5. Post-hoc results for leg and arm circumference variables.

Independent Variable	Time	Mean	Mean Difference	Standard Error of Difference	p
Leg Circumference (cm)	Baseline	63.63	2.875	0.1250	0.01
	1st month	60.75			
	Baseline	63.63	4.833	0.09829	0.01
	2nd month	58.79			
	Baseline	63.63	5.917	0.1694	0.01
	3rd month	57.71			
	1st month	60.75	1.958	0.07321	0.01
	2nd month	58.79			
	1st month	60.75	3.042	0.1853	0.01

	3rd month	57.71			
	2nd month	58.79	1.083	0.1583	0.01
	3rd month	57.71			
Arm Circumference (cm)	**Baseline**	29.58	1.292	0.1274	0.01
	1st month	28.29			
	Baseline	29.58	2.292	0.1123	0.01
	2nd month	27.29			
	Baseline	29.58	3.333	0.09829	0.01
	3rd month	26.25			
	1st month	28.29	1.000	0.08513	0.01
	2nd month	27.29			
	1st month	28.29	2.042	0.07321	0.01
	3rd month	26.25			
	2nd month	27.29	1.042	0.04167	0.01
	3rd month	26.25			

Table 5 indicates a significant reduction in leg circumference over time. In the first month, a decrease of 2.88 cm was observed, followed by a total reduction of 4.83 cm in the second month and 5.92 cm in the third month. The highest rate of reduction in leg circumference was recorded in the first month, with the rate of decrease gradually slowing in the subsequent months.

A noticeable decreasing trend was also observed in arm circumference. A reduction of 1.29 cm occurred in the first month, followed by a total decrease of 2.29 cm in the second month and a total difference of 3.33 cm in the third month. The decline in arm circumference followed a more stable pattern, with similar rates of reduction observed each month.

Discussion

This study aimed to evaluate the effects of a 12-week Reformer Pilates exercise protocol on the anthropometric parameters of female participants across four different time points. The findings indicate that Reformer Pilates exercises lead to statistically significant changes in body measurements. The ANOVA results revealed significant differences across all variables, with the highest F-value observed for waist circumference ($F = 1172$), indicating that this parameter exhibited the most pronounced change over time. Previous studies have similarly reported significant reductions in waist circumference following Pilates-based interventions; however, these studies predominantly relied on pre- and post-intervention comparisons (Cakmakçi, 2011; Lee et al., 2023; Omidali et al., 2012). By contrast, the present study provides a time-course analysis, demonstrating that the greatest reduction in waist circumference occurs during the early phase of training, suggesting that Reformer Pilates may have a substantial impact on central adiposity, particularly in the initial weeks of exercise.

In the existing literature, Reformer Pilates has been reported to contribute positively to body composition, particularly in terms of reducing body fat percentage and enhancing muscle tone (Vaquero-Cristóbal et al., 2015). In this context, the marked reduction in waist circumference observed in the present study may be attributed to the strengthening of core muscles and improvements in postural stability induced by Pilates. This interpretation is supported by previous research demonstrating increased activation of deep abdominal muscles, improved trunk stabilization, and enhanced neuromuscular control following Pilates training (Endleman & Critchley, 2008; Sekendiz et al., 2007). Moreover, the most rapid decrease in waist circumference occurred within the first month, followed by a continued but slower decline in the subsequent months. This pattern may be explained by the body's adaptation processes to exercise over time.

Significant changes were also observed in lower extremity measurements. Particularly, high F-values were recorded for thigh circumference (F = 800.2) and leg circumference (F = 681.3), suggesting substantial reductions in these regions. A reduction of 3.96 cm in thigh circumference was observed in the first month, reaching a total decrease of 7.38 cm in the second month and 9.21 cm by the end of the third month. Similarly, leg circumference decreased by 2.88 cm in the first month, 4.83 cm in the second month, and 5.92 cm in the third month. These findings suggest that the reduction in fat mass and increased muscle tone in the lower extremities may have been influenced by the exercise regimen. Previous studies have also reported that Reformer Pilates enhances lower limb muscle strength and flexibility, supporting our findings (Jo & Seo, 2023).

Regarding upper extremity measurements, a significant reduction in arm circumference was observed (F = 459.6). A decrease of 1.29 cm occurred in the first month, reaching 2.29 cm in the second month and a total reduction of 3.33 cm in the third month. Compared to other body regions, the reduction in arm circumference was relatively lower, which may be attributed to the fact that Reformer Pilates primarily emphasizes core and lower body resistance exercises.

Statistically significant reductions were also noted in chest circumference (F = 245.8), with a decrease of 2.75 cm in the first month, 5.17 cm in the second month, and a total reduction of 6.79 cm by the third month. The observed changes in chest circumference may be related to the effects of Pilates on respiratory muscles and thoracic mobility. Previous research has demonstrated that Pilates training improves respiratory muscle function and enhances chest wall elasticity (Vaquero-Cristóbal et al., 2016), findings that are consistent with those of the present study.

Hip circumference also showed significant reductions over time (F = 486.2), with a decrease of 3.21 cm in the first month, 6.46 cm in the second month, and a total reduction of 8.67 cm by the third month. Notably, the most rapid reduction was observed in the second month, suggesting that Reformer Pilates exerts a substantial effect on the hip and gluteal muscles. The isometric and dynamic resistance exercises incorporated in Pilates are known to enhance muscle activity in these regions, which may explain the observed reductions in hip circumference (Louise Thomas et al., 2000).

This study has several limitations. First, the research was conducted with a sample consisting solely of female participants, which limits the generalizability of the findings to male individuals. Additionally, the study duration was restricted to 12 weeks, and the effects of longer-term Reformer Pilates programs were not evaluated. Future studies with extended follow-up periods are necessary to assess long-term changes in body composition. Another limitation is that only anthropometric measurements were assessed in this study. To obtain a more comprehensive understanding of body composition changes, future research should include additional measures such as body fat percentage, muscle mass, and metabolic parameters. Lastly, this study was conducted within a specific age range, and further research involving broader age groups is needed to determine how the effects of Reformer Pilates may vary across different age populations.

Conclusions

In conclusion, the findings of this study suggest that a 12-week Reformer Pilates program induces significant reductions in body circumference measurements in female participants, particularly in the waist, thigh, and leg regions. These results support the premise that Reformer Pilates has beneficial effects on body composition. Importantly, by evaluating multiple measurement time points, this study provides a time-course perspective, demonstrating how anthropometric adaptations to Reformer Pilates evolve throughout the intervention period. Furthermore, the most rapid changes were observed during the early phase of the intervention, with a gradual decline in the rate of change over time. This trend indicates that while the body initially adapts quickly to the exercise stimulus, the rate of change slows as the body adjusts to the training load.

From a practical perspective, these findings may assist exercise professionals in designing effective, low-impact training programs for overweight women, particularly by setting realistic expectations regarding the timing of measurable outcomes. Future research should explore the effects of different exercise intensities and durations on body composition and incorporate additional outcome measures and comparison groups to further optimize Reformer Pilates programs according to individual variations.

Author Contributions: Authors of this article made the following contributions: conceptualization, Z.A.; methodology, Z.A.; software, Z.A.; validation, G.B.; formal analysis, Z.A.; investigation, Z.A.; resources, G.B.; data curation, G.B.; writing—original draft preparation, Z.A. and G.B.; writing—review and editing Z.A.; visualization, Z.A.; supervision, Z.A.; project administration, Z.A. and G.B. All authors have read and agreed to the published version of the manuscript.

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Informed Consent Statement: Informed consent was obtained from all participants involved in the study.

Conflict of Interest: The authors declare no conflicts of interest regarding this study.

Data Availability Statement: Data supporting this study is available from the authors upon reasonable request.

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References

Adıgüzel, S., Aras, D., Gülü, M., Aldhahi, M. I., Alqahtani, A. S., & Al-Mhanna, S. B. (2023). Comparative effectiveness of 10-week equipment-based Pilates and diaphragmatic breathing exercise on heart rate variability and pulmonary function in young adult healthy women with normal BMI: A quasi-experimental study. *BMC Sports Science, Medicine and Rehabilitation, 15*(1), 82. https://doi.org/10.1186/s13102-023-00693-5

Aka, H., İbiş, S., & Arıcı, R. (2020). Kadınlara uygulanan 8 haftalık reformer pilates egzersizlerinin vücut kompozisyonuna ve bazı fiziksel uygunluk parametrelerine etkisi. *Gaziantep Üniversitesi Spor Bilimleri Dergisi, 5*(4), 573-589. https://doi.org/10.31680/gaunjss.831609

Bulguroğlu, I., Güçlü-Gündüz, A., Yazıcı, G., Özkul, C., İrkec, C., Nazliel, B., & Batur-Çağlayan, H. Z. (2017). The effects of mat Pilates and reformer Pilates in patients with multiple sclerosis: A randomized controlled study. *NeuroRehabilitation, 41*(2), 413–422. https://doi.org/10.3233/NRE-162121

Bullo, V., Bergamin, M., Gobbo, S., Sieverdes, J. C., Zaccaria, M., Neunhaeuserer, D., & Ermolao, A. (2015). The effects of Pilates exercise training on physical fitness and well-being in the elderly: A systematic review for future exercise prescription. *Preventive Medicine, 75*, 1–11. https://doi.org/10.1016/j.ypmed.2015.03.002

Cakmakçi, O. (2011). The effect of 8 week plates exercise on body composition in obese women. Collegium antropologicum, 35(4), 1045-1050.

Endleman, I., & Critchley, D. J. (2008). Transversus abdominis and obliquus internus activity during Pilates exercises: Measurement with real-time ultrasound scanning. Journal of Bodywork and Movement Therapies, 12(4), 364–371.

Ilić, T., Rančić, D., Stojanović, S., & Ilbak, I. (2023). Health aspects of aerobic interval training in the rehabilitation of patients with cardiovascular diseases: A systematic review. *Annales Kinesiologiae, 14*(1), 5–18. https://doi.org/10.35469/ak.2023.390

İlbak, İ., & Bayer, R. (2021). B-Fit egzersiz uygulamalarının sedanter kadın bireylerin bazı antropometrik parametreleri üzerindeki etkilerinin incelenmesi. *Mediterranean Journal of Sport Science, 4*(3), 342-349. https://doi.org/10.38021/asbid.1009891

İlbak, İ., Düz, S., & Bayer, R. (2022). B-Fit egzersiz protokolünün kadınlarda bazı antropometrik parametrelere etkisi. *Çanakkale Onsekiz Mart Üniversitesi Spor Bilimleri Dergisi, 5*(1), 1-9.

Jo, H. H., & Seo, Y. H. (2023). Effects of equipment Pilates reformer exercise on changes in body composition and abdominal muscle strength in adult women. *The Korean Journal of Growth and Development, 31*(1), 25–29.

Kılınçarslan, G., İlbak, İ., & Sadır, Y. (2022). Examination of anthropometric profiles of individuals who exercise in the gym. *Pakistan Journal of Medical and Health Sciences, 16*(1), 477–479. https://doi.org/10.53350/pjmhs22161477

Lee, N., Bae, Y. H., Fong, S. S., & Lee, W. H. (2023). Effects of Pilates on inter-recti distance, thickness of rectus abdominis, waist circumference and abdominal muscle endurance in primiparous women. BMC Women's Health, 23(1), 626.

Louise Thomas, E., Brynes, A. E., McCarthy, J., Goldstone, A. P., Hajnal, J. V., Saeed, N., Frost, G., & Bell, J. D. (2000). Preferential loss of visceral fat following aerobic exercise, measured by magnetic resonance imaging. *Lipids, 35*(7), 769–776. https://doi.org/10.1007/s11745-000-0584-0

Omidali, Z., Taheri, H., Asfarjani, F., Bambaeich, E., & Marandi, S. M. (2012). The effect of pilates training on selective physiological and physical fitness in untrained females with overweight. Journal of Research in Rehabilitation Sciences, 8(1), 180-191.

Sekendiz, B., Altun, Ö., Korkusuz, F., & Akın, S. (2007). Effects of Pilates exercise on trunk strength, endurance, and flexibility in sedentary adult females. Journal of Bodywork and Movement Therapies, 11(4), 318–326.

Siqueira Rodrigues, B. G. de, Ali Cader, S., Bento Torres, N. V. O., Oliveira, E. M. de, & Martin Dantas, E. H. (2010). Pilates method in personal autonomy, static balance and quality of life of elderly females. *Journal of Bodywork and Movement Therapies, 14*(2), 195–202. https://doi.org/10.1016/j.jbmt.2009.12.005

Swift, D. L., Johannsen, N. M., Lavie, C. J., Earnest, C. P., & Church, T. S. (2014). The role of exercise and physical activity in weight loss and maintenance. *Progress in Cardiovascular Diseases, 56*(4), 441–447. https://doi.org/10.1016/j.pcad.2013.09.012

Vaquero-Cristóbal, R., Alacid, F., Esparza-Ros, F., López-Plaza, D., Muyor, J. M., & López-Miñarro, P. A. (2016). The effects of a reformer Pilates program on body composition and morphological characteristics in active women after a detraining period. *Women & Health, 56*(7), 784–806. https://doi.org/10.1080/03630242.2015.1118723

Wang, Y., Chen, Z., Wu, Z., Ye, X., & Xu, X. (2021). Pilates for overweight or obesity: A meta-analysis. *Frontiers in Physiology, 12*. 643455. https://doi.org/10.3389/fphys.2021.643455