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The effect of non-contact boxing training on physical performance in sedentary women

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Abstract

Aim: The aim of this study is to investigate the effects of non-contact boxing training, applied two days a week for eight weeks, on certain physical parameters in sedentary women. **Method:** Nineteen healthy female volunteers participated in the study. Participants were assigned to either an experimental group (n = 10) or a control group (n = 9) using a stratified randomization procedure. Anthropometric measurements of the participants (height, body weight, body fat percentage, body mass index and muscle mass) were recorded. Modified 30-second push-up, 30-second sit-up, 30-second squat, agility, simple visual reaction time, and handgrip strength tests were administered to the participants both prior to and following the training period. **Results:** Within-group (pre-test–post-test) comparisons showed significant improvements in handgrip strength, 30-second push-up, 30-second sit-up, 30-second squat, and agility in the experimental group, whereas the control group showed a significant increase only in the 30-second squat. No significant between-group differences were observed at baseline; however, post-test comparisons demonstrated significant differences in muscle mass and agility in favor of the experimental group. **Conclusion:** The results suggest that non-contact boxing training performed twice per week for eight weeks is an effective method for enhancing physical performance indicators in sedentary women.

Introduction

Boxing is a demanding and competitive sport discipline. As a complex activity, it requires a combination of strength, speed, coordination, balance, agility, reaction time, and specific technical/tactical skills (Dinçer et al., 2022; Swiecicki et al., 2013). Boxing has traditionally been associated with traits linked to masculinity, such as aggression, power, and courage. Therefore, it is known that women encounter various challenges during their participation in boxing training; families and close circles often view boxing as an aggressive sport and hinder women's participation due to concerns regarding physical injury (Mariante Neto & Wenetz, 2022). In line with increasing concerns that full-contact boxing poses a risk of head trauma, a significant shift has occurred in training methods. This shift has accompanied a transition towards a non-contact boxing training format that preserves the physiological benefits of boxing but completely eliminates physical contact and head blows. Non-contact boxing is an exercise method aimed at developing physical fitness and boxing-specific skills without establishing physical contact or fighting with another athlete. These trainings include exercises such as stretching, rope skipping, shadow boxing, pad work, and bag work (Bellinger et al., 1997; Morales, 2020).

Global technological advancements, while offering convenience, are leading to the adoption of an increasingly sedentary lifestyle among both adults and children (Coşkuntürk et al., 2023). A sedentary lifestyle plays a significant role in the etiology of various chronic diseases (Bonnie, 2020). Conversely, the benefits of regular physical activity in shaping individuals' quality of life are widely accepted (Senduran et al., 2019). Considering these health risks and the benefits of physical activity, there has been an increased demand for alternative exercise methods that maintain high motivation, support regular activity, and carry a low risk of injury. In this context, the present study aimed to investigate the effects of non-contact boxing training, applied two days a week for eight weeks, on certain physical parameters in sedentary women.

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Methods

Participants

Nineteen healthy female volunteers, aged between 18 and 26 years, with no prior regular sports experience, participated in this study. In accordance with the principles of the Declaration of Helsinki, all procedures and potential risks of the study were explained to the participants in detail. The study was approved by the Şırnak University Scientific Research and Publication Ethics Committee (Date: 10.03.2025, No: 127224). All participants signed a written informed consent form. Furthermore, participants had the right to withdraw from the study at any time without any penalty. Participants were allocated to the experimental (n = 10; age: 20.5 ± 2.22 years; height: 163.0 ± 5.6 cm; body mass: 63.0 ± 12.97 kg) and control (n = 9; age: 20.1 ± 1.62 years; height: 160.3 ± 4.87 cm; body mass: 55.2 ± 7.45 kg) groups using a stratified randomization method.

Anthropometric Measurements

Height measurements were performed with the participants in an anatomical standing position, barefoot, with heels together, breath held, and the head positioned in the frontal plane (Frankfort plane). After positioning the headboard to touch the vertex point, the measurement was recorded in centimeters (cm) using a stadiometer with ± mm sensitivity (Mesilife 13539) (Taraf & Özal, 2022). An Inbody 120 Bioimpedance Body Composition Analyzer (Seoul, South Korea) was utilized to measure body weight (kg), muscle mass (kg), body fat percentage (%) and body mass index (BMI). To standardize the measurements, participants were instructed to refrain from eating for at least 3 hours, avoid caffeine and alcohol consumption for 12 hours, and abstain from strenuous exercise for 24 hours prior to testing (Kızılörs et al., 2023).

Thirty-Second Modified Push-up Test

Participants assumed the starting position on a gymnastic mat with hands shoulder-width apart, elbows fully extended, knees touching the ground, and without sagging in the lumbar region. Since the participants consisted of women with no prior strength training experience, a modified push-up test performed on the knees was used to ensure technique standardization for all subjects. Upon the "start" command, participants lowered their bodies until their elbows formed a 90-degree angle and then returned to the starting position. The test continued for 30 seconds, and the number of valid repetitions completed at the end of the period was recorded as the test score (Dharmadi, 2022; DiStefano et al., 2013; Suprak et al., 2011).

Thirty-Second Sit-up Test

Participants were positioned with their hands on their shoulders, knees bent at 90 degrees, soles of the feet touching the mat, and torsos upright. The soles of the feet were held by an assistant. The test was administered with duration of 30 seconds upon the "start" command. The number of valid repetitions completed at the end of the time was recorded as the test score (El-Ashker, 2018; Luqman et al., 2018; Uçan et al., 2018).

Thirty-Second Squat Test

Participants took the starting position with feet shoulder-width apart and the torso in an upright position. Upon the "start" command, the hips were pushed back, knees were bent, and the squat movement was completed until the thighs were parallel to the floor. Subsequently, participants were asked to return to the starting position. Participants were asked to perform maximum repetitions in valid form for 30 seconds, and the number of completed repetitions was recorded (Kara et al., 2019).

Handgrip Strength Test

Handgrip strength measurements were performed using a Takei Grip-D digital hand dynamometer. The dynamometer was adjusted according to the participants' hand sizes prior to measurement. Participants gripped the dynamometer while standing in an upright position, with the arm at the side of the body and hanging down, and squeezed with maximum force. The test was applied twice for the dominant hand, and the highest value obtained was recorded in kilograms (kg) (Ateş & Ateşoğlu, 2007; Azab, 2019; Guidetti et al., 2002).

Hexagon Agility Test

Participants assumed the starting position standing in the center of a hexagon drawn on the floor, facing point A (start line), with feet together and the body upright. Point A remained in front of the participant throughout the test. With the "start" command, the stopwatch was started, and the participant jumped over line B with both feet and then returned to the center of the hexagon with both feet. The same movement was repeated for lines C, D, E, F, and finally A, completing one full circuit. The test was considered invalid if the lines were stepped on

during the jump or if the wrong sequence was followed. This procedure was completed three times (three circuits) in total, and the stopwatch was stopped at the end of all circuits to record the total time in seconds (Mackenzie, 2005).

Visual Reaction Time

A Blazepod device (Blazepod, Thailand) was used to evaluate the simple visual hand reaction times of the participants. All participants were asked to use their dominant hands during the measurement. The Blazepod device was connected to a smartphone via Bluetooth, and the "random" mode was selected from the application. In random mode, depending on the initially set duration, the next light turns on with a random delay after the first sensor light is extinguished by the participant. The Blazepod light color was set to blue, the number of pods to 6, and the duration to 10 seconds. The sensors were placed on a table in a semi-circle shape. The participants' hands were positioned in the center of the semi-circle. The center point of each sensor was positioned 40 cm away from the center of the semi-circle, and the sensors were arranged at 25 cm intervals. Participants brought their hands to the starting point (center) before the test began. They started the test with the "start" command given via the smartphone, and the test was terminated with the "finish" command sound. Participants extended their hands to the lit light for 10 seconds to extinguish it, returned their hands to the center point, and then quickly extinguished the next lit light. The average reaction time of all hits made during 10 seconds was recorded. The test was conducted in an environment free of any noise that could distract the participants (de-Oliveira et al., 2021; Janković et al., 2022).

Experimental Design

For the pre-test phase of the study, participants arrived at the sports hall. Anthropometric measurements were performed before the warm-up protocol. Subsequently, a standard 15-minute warm-up protocol and, finally, physical performance tests were administered. To minimize the effect of extraneous variables, all participants were asked to maintain their current lifestyle and dietary habits before and during the study. Additionally, they were asked not to exercise within 24 hours prior to the tests and to have consumed their last meal at least 3 hours before the test. Only water consumption was allowed during all tests and training sessions. Post-test measurements were carried out 72 hours after the end of the eight-week training period using the same conditions and test batteries as the pre-test.

Training Program

The experimental group participated in training sessions involving non-contact boxing training two days a week for eight weeks. The control group did not participate in any training program during this period. The experimental group trainings consisted of three main parts: a 15-minute warm-up protocol, 60 minutes of basic boxing training (guard stance, footwork, punching techniques, feints, dodging/slipping, rope skipping, coordination, and competition techniques), and 15 minutes of cool-down exercises. Throughout the intervention period, the training protocol consisted of 3-minute exercise intervals followed by 1-minute rest intervals (Çakmakçı et al., 2019). Throughout the eight-week research period, all participants in the experimental group attended the sessions on time, with discipline, and high motivation. This ensured that the research process proceeded smoothly.

Data Analysis

The Jamovi (version 2.7.6) statistical software was used for data analysis. The Shapiro-Wilk normality test was applied to determine whether the data showed a normal distribution. For the comparison of dependent groups, the paired samples t-test was used for parametric data, and the Wilcoxon signed-rank test was used for non-parametric data to analyze within-group pre-test and post-test differences. For the comparison of independent groups, the independent samples t-test was used for parametric data, and the Mann-Whitney U test was used for non-parametric data. The significance level was accepted as $p<0.05$.

Results

There were no statistically significant differences between the groups in terms of pre-test values ($p > 0.05$). In contrast, between-group comparisons of post-test values revealed a statistically significant difference in muscle mass ($p < 0.05$). No statistically significant between-group differences were detected for the remaining measured parameters ($p > 0.05$; Table 1).

Table 1
Within-group and between-group comparisons of anthropometric measurements of the experimental and control groups (Mean ± SD).

Variable		Experimental (n=10)	Control (n=9)	p-value
Body Weight (kg)	Pre-test	63.0 ± 12.97	55.2 ± 7.45	0.133
	Post-test	63.7 ± 13.05	55.4 ± 7.69	0.112
	p-value	0.053	0.690	
Body Fat Percentage (%)	Pre-test	30.5 ± 7.89	28.4 ± 9.43	0.608
	Post-test	31.1 ± 7.50	28.4 ± 9.16	0.500
	p-value	0.119	0.999	
Muscle Mass (kg)	Pre-test	23.3 ± 2.80	21.1 ± 2.00	0.073
	Post-test	23.6 ± 3.03	21.1 ± 1.90	0.047
	p-value	0.382	0.999	
BMI (kg/m²)	Pre-test	23.7 ± 4.53	21.5 ± 3.26	0.254
	Post-test	24.0 ± 4.59	21.4 ± 2.96	0.170
	p-value	0.053	0.508	

BMI: Body mass index.

Table 2
Within-group and between-group comparisons of physical parameters of the experimental and control groups (Mean ± SD).

Variables		Experimental (n=10)	Control (n=9)	p-value
Handgrip Strength (kg)	Pre-test	30.6 ± 4.95	29.7 ± 3.55	0.666
	Post-test	32.5 ± 6.05	28.5 ± 2.57	0.084
	p-value	0.039	0.385	
30s Push-up	Pre-test	15.5 ± 3.84	14.9 ± 5.37	0.777
	Post-test	19.8 ± 4.34	16.3 ± 5.45	0.142
	p-value	0.011	0.260	
30s Sit-up	Pre-test	15.7 ± 3.62	16.7 ± 4.87	0.627
	Post-test	18.4 ± 3.78	16.8 ± 5.61	0.465
	p-value	0.001	0.898	
30s Squat	Pre-test	19.5 ± 5.04	18.9 ± 5.44	0.802
	Post-test	24.4 ± 3.84	22.7 ± 2.83	0.136
	p-value	0.006	0.020	
Agility (s)	Pre-test	14.3 ± 1.33	15.0 ± 1.20	0.244
	Post-test	13.2 ± 1.29	14.6 ± 1.61	0.049*
	p-value	0.001	0.346	
Reaction Time (ms)	Pre-test	504.0 ± 45.54	520.2 ± 55.51	0.595
	Post-test	486.5 ± 29.72	491.6 ± 29.24	0.714
	p-value	0.343	0.150	

** p<0.05.*

Following the eight-week intervention, within-group analyses revealed statistically significant improvements in the experimental group for handgrip strength, 30-second push-up, 30-second sit-up, 30-second squat, and agility measures ($p < 0.05$). No statistically significant changes were observed in the remaining parameters ($p > 0.05$). In the control group, a statistically significant improvement was detected solely in the 30-second squat performance ($p < 0.05$; Table 2).

No statistically significant differences were identified between the groups at baseline (pre-test values; $p > 0.05$). However, between-group comparisons of post-test values demonstrated a statistically significant difference in agility ($p < 0.05$), while no significant differences were observed for the other measured parameters ($p > 0.05$; Table 2).

Discussion

The aim of this study was to investigate the effects of non-contact boxing training, applied two days a week for eight weeks, on certain physical parameters in sedentary women. As a result of the present study, no significant within-group improvement was observed in body weight, body fat percentage, muscle mass, and BMI values in the experimental group; however, a significant difference was detected in muscle mass values in favor of the experimental group when compared to the control group. This suggests that while short-term training may have limited effects on muscle mass, more pronounced improvements could be achieved if the training duration were extended. A review of the literature reveals studies reporting similar results regarding body composition parameters. It has been stated that boxing training applied during the pre-season and competition period in experienced boxers did not create a significant difference in the athletes' body fat percentage (Akgul & Cakmakcı, 2017; Savaş & Uğraş, 2004). Cheema et al. (2015) stated that non-contact boxing training in individuals with abdominal obesity did not cause a significant difference in body weight and BMI values. Croom (2023) noted that training involving shadow boxing exercises did not result in any statistically significant difference in participants' body weight values. Another study stated that kickboxing training did not create any statistically significant difference in participants' body fat percentages (Ouergui et al., 2014).

However, there are also studies contradicting the body composition findings of the present study. In a study by Akgul and Cakmakcı (2017), it was stated that competition-period boxing training caused a statistically significant decrease in athletes' body weight and BMI values. Factors such as the participants being selected from elite athletes, the training being conducted in the pre-competition period, athletes maintaining weight control due to upcoming competitions, and high training frequency may explain the differences between the findings of that study and the results of the present research. It has been reported that non-contact boxing training significantly reduced body fat percentage in individuals with abdominal obesity (Cheema et al., 2015). Differences in participant characteristics and training protocols may account for the divergence between the findings of the present study and those reported in the literature. Kürkçü (2009) reported that although wrestling training increased participants' body weight, it significantly decreased body fat percentage. It is thought that the differences between the findings of that study and the present study may stem from differences in the participant population and the content and duration of the applied programs. It has been stated that training containing shadow boxing exercises significantly reduced participants' body fat percentage and caused a significant increase in muscle mass (Croom, 2023; Nugraha et al., 2025). The differences in findings between the present study and the aforementioned studies can be explained by factors such as variability in the number of participants and training volume. In sedentary individuals, it has been stated that kickboxing training provided significant improvement in BMI values (Senduran et al., 2019. It is suggested that the differences between the findings of the present study and the previous study may be attributed to the content and duration of the training programs. Arslan et al. (2024) stated that karate training significantly reduced the participants' body fat percentage. The observed differences may be attributed to the number of participants, population characteristics, and variations in training volume.

When within-group comparisons were examined at the end of the study, statistically significant improvements were observed in the experimental group in 30-second push-up, sit-up, squat tests, handgrip strength, and agility values. In the control group, a statistically significant increase was observed only in the 30-second squat value. The observed increase in the control group may be attributed to the continuous mechanical loading of lower extremity muscles during daily living activities

Reviewing the literature, there are studies reporting improvements in handgrip strength similar to the present study (Azatovich, 2025; Doherty et al., 2021; Kürkçü, 2009; Pala & Savucu, 2011; Sariman et al., 2014; Savaş & Uğraş, 2004). However, studies reporting results contrary to the findings of the present study also exist. Rutkowski and Chwałczyńska (2025) reported that karate training did not create a statistically significant increase in participants' handgrip strength. It is suggested that the differences in findings between the present study and the previous study could be attributed to differences in participant numbers and population characteristics. Roh et al. (2020) reported that taekwondo training did not cause a significant

change in participants' handgrip strength. The fact that participants use the lower extremities more intensively due to the requirements of the branch may explain why the findings regarding handgrip strength differ from the present study.

The literature review shows that, consistent with the results of the present study, there are studies reporting that combat sports training provides significant increases in repetition numbers in 30-second push-up, sit-up, and squat tests. Furthermore, studies reporting similar results in 10 and 60-second application durations also exist (Azatovich, 2025; Çakmakçı et al., 2019; Doherty et al., 2021; El-Ashker, 2018; Janyacharoen et al., 2018; Kürkçü, 2009; Senduran et al., 2019).

In the present study, a statistically significant improvement was observed in the agility values of the experimental group. The literature review widely includes studies supporting the increases occurring in agility parameters in the present study (Azatovich, 2025; El-Ashker, 2018; Ouergui et al., 2014; Saraiva et al., 2025; Senduran et al., 2019; Tova et al., 2020). In the literature, in line with our research, no studies reporting a lack of improvement in the agility parameter in sample groups engaged in combat sports were encountered. While this situation limits comparative discussion regarding this parameter, it also indicates that the positive effect of combat sports training on agility shows general consistency in the literature.

According to the findings of the present study, no statistically significant improvement was detected in the reaction time values of the experimental group. However, studies reporting findings that contradict the present study's reaction time results have also been reported in the literature. Savaş and Uğraş (2004) reported that boxing-based training significantly improved participants' visual and auditory reaction times. The inclusion of experienced athletes in that study, variations in measurement protocols, and training volume may explain the discrepancy between the findings of the present study and those reported in the literature. Çakmakçı et al. (2019) stated in their study that boxing training provided a statistically significant improvement in participants' reaction time values. The use of different devices for reaction time measurement, and differences in terms of training duration and training protocol can be evaluated among the possible explanations for the observed difference in results. Solovey et al. (2021) reported that non-contact boxing training provided statistically significant improvement in motor reaction responses. The discrepancies between the present study and the previous study may be explained by factors such as the limited sample size, the eight-week training duration, and the use of different measurement methods. Bendo et al. (2025) stated that special reaction training applied in addition to basic boxing training improved reaction times. Differences between the present study and the previous study in terms of application duration and training method may help explain the discrepancy between the results. Türkeri and Ince (2023) reported that karate training significantly improved participants' reaction speed. The discrepancy between the findings of the previous study and the present study may be attributed to variations in sample size and intervention duration.

Conclusion

Eight weeks of non-contact boxing training led to statistically significant improvements in handgrip strength, muscular endurance (30-second push-up, 30-second sit-up, 30-second squat), and agility in sedentary female participants. These findings support that the protocol, performed twice per week, may serve as an effective and feasible method for enhancing physical performance indicators in this population.

This study has several methodological limitations that may restrict the generalizability of the findings. First, participants were limited to sedentary women, which limit the applicability of the results to other populations. Second, the eight-week intervention period may not be sufficient to draw definitive conclusions about long-term physiological and morphological adaptations. Third, the relatively small sample size may have reduced the statistical power of the analyses. Finally, the absence of dietary monitoring prevented complete control over potential nutritional effects, particularly on changes in muscle mass and strength outcomes.

To further clarify the benefits of non-contact boxing training, future studies should compare this protocol with traditional aerobic and/or resistance training methods. Training frequency, duration, and intensity should be optimized to achieve maximum adaptations. Additionally, to enhance external validity, the effects of the intervention on physical performance indicators should be investigated in

populations of different age groups and varying activity levels.

Author Contributions

The author was responsible for the study conception and design, data collection, data analysis and interpretation, manuscript drafting, and final approval of the version to be published.

Ethical Approval

The study was approved by the Şırnak University of Scientific Research and Publication Ethical Committee (10.03.2025/127224), and it was carried out in accordance with the Code of Ethics of the World Medical Association also known as a declaration of Helsinki.

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Conflict of Interest

The authors declare that they have no conflict of interest and received no financial support for this research.

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