ORIGINAL ARTICLE

Evaluating the effect of a 12-session Tabata training program on VO_2max and body composition in female workers: a randomized controlled trial

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Abstract

Background and Study Aim Aerobic fitness (VO_2max) and optimal body composition are key components of health and work capacity in adult populations. Among female workers, sedentary lifestyles and poor body composition are commonly associated with reduced aerobic performance, increased obesity, and elevated cardiometabolic risk. Despite the use of various exercise interventions, their relative effectiveness in improving VO_2max and body composition in this specific group remains a subject of practical interest. This study investigated the impact of a four-week Tabata-based HIIT program on VO_2max and body composition in female workers.

Material and Methods A randomized controlled trial was conducted with twenty female workers (mean age 35.1 ± 9.4 years) from Grit Fitness Center. Participants were divided into two groups. Ten women in the experimental group performed Tabata-based HIIT three times per week for four weeks. Ten women in the control group continued their usual routines without exercise. Aerobic capacity (VO_2max) was assessed using the Multistage Fitness Test, which involved shuttle runs at increasing speeds. Body composition was measured with the OMRON HBF-375 bioelectrical impedance analyzer, which estimates fat percentage using small electrical currents. Statistical analysis included paired and independent t-tests with a significance level of $p < 0.05$.

Results After the intervention, the experimental group showed significantly higher VO_2max levels compared to the control group ($t(18) = 2.665$, $p = 0.016$). Significant reductions were also observed in whole-body fat ($t(18) = -5.404$, $p < 0.001$), trunk fat ($t(18) = -4.203$, $p < 0.001$), arm fat ($t(18) = -6.691$, $p < 0.001$), total fat percentage ($t(18) = -2.753$, $p = 0.013$), and BMI ($t(18) = -4.909$, $p < 0.001$). No significant changes were found in visceral fat, resting metabolism, or leg composition ($p > 0.05$).

Conclusions A short Tabata-based HIIT program can improve VO_2max and reduce body fat in female workers. This approach may be effective for promoting workplace health.

Keywords: aerobic capacity, body fat distribution, female workers, high-intensity interval training, workplace wellness.

Introduction

In recent years, workplace health promotion programs have increasingly incorporated time-efficient exercise interventions to counter sedentary behavior among employees. Research findings show that female employees experience higher rates of physical inactivity and body fat accumulation, which negatively affect their body composition and aerobic capacity (VO_2max) [1, 2]. The combination of time constraints, sedentary work routines, and psychological stress among female workers leads to decreased muscle mass and reduced cardiovascular fitness [3]. Body fat levels directly influence VO_2max, while skeletal muscle mass determines oxygen uptake and endurance performance [4, 5]. Maintaining optimal body composition and aerobic capacity serves two critical functions: it supports work performance and helps prevent future cardiometabolic diseases.

Female employees in administrative and service roles spend most of their time sitting and performing mentally demanding tasks without access to structured physical exercise [6]. This work environment contributes to body fat accumulation and reduced aerobic capacity (VO_2max), resulting in lower metabolic performance and decreased work ability [7]. The body requires a balanced distribution of fat and lean mass to maintain musculoskeletal stability, prevent obesity-related health problems, and support posture and daily energy needs. Workers with higher VO_2max levels show greater endurance in daily tasks, reduced fatigue, and improved cardiovascular health,

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which enhances concentration and productivity [1, 8]. Improvements in body fat levels and aerobic capacity directly influence workplace wellness, functional independence, and long-term health. For women balancing professional and personal responsibilities, Tabata-based high-intensity interval training (HIIT) offers an efficient exercise strategy to improve physical fitness.

Poor body composition, marked by high fat levels and low lean mass, increases the risk of obesity and metabolic syndrome and accelerates the aging process [9]. VO_2max is a key indicator of the body's ability to transport and utilize oxygen during physical activity. Studies show that women with lower VO_2max levels tend to have poorer cardiovascular health and reduced work capacity [10]. Improving VO_2max and body composition is essential for female workers to enhance functional ability, delay age-related decline, and improve overall health.

Recent studies have investigated the effects of high-intensity interval training (HIIT), particularly Tabata protocols, on cardiorespiratory and metabolic outcomes in various groups, including inactive women, freestyle wrestlers, and student-athletes participating in virtual reality-based Tabata training [11, 12, 13]. These studies reported positive changes in body composition, aerobic fitness, and mental health. The Tabata HIIT protocol involves 20 seconds of maximal effort followed by 10 seconds of rest, repeated in multiple rounds during a short exercise session. This approach has been shown to significantly improve VO_2max and reduce body fat in young female participants [14].

A meta-analysis by Milanović et al. showed that HIIT methods lead to greater improvements in VO_2max compared to traditional endurance training when participants exercise at 80% of their maximum heart rate or higher [15]. Keating et al. found that interval training reduced body fat more effectively than moderate-intensity continuous training (MICT), while requiring less time and producing better metabolic outcomes [16]. Sooryajith et al. examined the effects of a 12-week Tabata-based HIIT program on sedentary female university students. Participants lost 1.6 kg/m^2 of body mass, reduced their waist-to-hip ratio by 5.45 cm, and lowered body fat percentage by 4.1%, while also improving endurance, agility, and leg strength [17]. These findings suggest that Tabata-based training offers women an effective way to improve physical fitness and body composition through short, equipment-free workouts. Evidence also indicates that Tabata protocols enhance aerobic performance and metabolic function by increasing post-exercise oxygen consumption and activating both aerobic and anaerobic pathways [18, 19].

Analysis of research findings has shown that high-intensity interval training, including Tabata protocols, can produce measurable improvements in VO_2max and body fat reduction across various populations. Researchers emphasize that these physiological adaptations are closely linked to enhanced work capacity, metabolic efficiency, and health-related quality of life in physically inactive individuals. While existing studies demonstrate the general effectiveness of such interventions, their specific application in occupational contexts, particularly among time-constrained female workers, continues to present practical and methodological challenges. This gap limits the ability to develop targeted and time-efficient exercise strategies for improving fitness within real-world work environments.

Although previous studies have examined the effects of Tabata or HIIT in adolescents, obese women, and athletes, the specific impact of this protocol on adult female workers with limited time for exercise has not been clearly established. Therefore, the aim of this study is to evaluate the impact of a four-week Tabata-based HIIT program on VO_2max and body composition in female workers.

Materials and Methods

Participants

This study recruited twenty female office workers aged 19 to 59 years, employed in administrative, cashier, or teaching positions within sedentary occupational settings. These individuals typically engaged in low-activity, desk-based tasks for approximately eight hours per day and had limited access to structured physical exercise.

Eligibility criteria were as follows: (1) no diagnosed cardiovascular or musculoskeletal disorders; (2) no participation in regular exercise programs; and (3) willingness to attend all intervention sessions and complete all required assessments. All participants received written information about the study and provided written informed consent.

At baseline, the physical characteristics of the experimental and control groups were comparable. The mean participant age was approximately 32 years, and average body mass index (BMI) values ranged from normal to slightly overweight. No significant differences were found between groups in height, body weight, or baseline VO_2max, indicating successful randomization. Most participants were office-based and reported sedentary work activity patterns. Baseline physical characteristics are summarized in Table 1.

Ethical Approval

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki and was approved by the Ethics Committee of Universitas Negeri Malang (Protocol No. 14.10.02/UN32.14.2.8/LT/2025).

Research Design

The study used a randomized controlled trial (RCT) with two parallel groups: an experimental group (Tabata-based high-intensity interval training, HIIT) and a control group (normal daily activities). Randomization was conducted by an independent researcher using a computer-generated random sequence (1:1). Allocation was concealed in opaque sealed envelopes. A single-blind design was applied. The assessors were unaware of the participants' group assignments to reduce bias (Figure 1).

Training Intervention

The Tabata-based exercise program was conducted over four weeks and included 12 supervised training sessions. Sessions were held three times per week, on Mondays, Wednesdays, and Fridays from 4:00 to 5:00 p.m. Each session lasted approximately 40 minutes and consisted of three phases:

1. Warm-up (8–10 minutes): This phase included dynamic mobility drills and low-intensity resistance exercises using SMARTBANDs or light barbells (2–4 kg, approximately 30–40% of estimated 1RM). Exercises such as shoulder rotations, squat push–pulls, and reverse fly were used to activate major muscle groups and increase heart rate.
2. Main Tabata Session (20 minutes): This phase consisted of 3 to 4 Tabata sets. Each set included eight cycles of 20 seconds of high-intensity effort followed by 10 seconds of rest, following the original Tabata protocol. Functional strength exercises included barbell squats, loaded lunges, high pulls, wide rows, and Copenhagen planks.

    a. Intensity Monitoring: Exercise intensity

Table 1. Baseline physical characteristics of participants (mean ± SD)

Variable	Experimental Group (N = 10)	Control Group (N = 10)	p-value
Age (years)	31.7 ± 6.6	38.5 ± 10.8	0.110
Height (cm)	159.35 ± 3.60	154.3 ± 7.86	0.124
Weight (kg)	71.99 ± 14.49	68.62 ± 14.48	0.610
BMI (kg/m²)	28.85 ± 6.21	29.66 ± 4.77	0.577

*p is significant at < 0.05

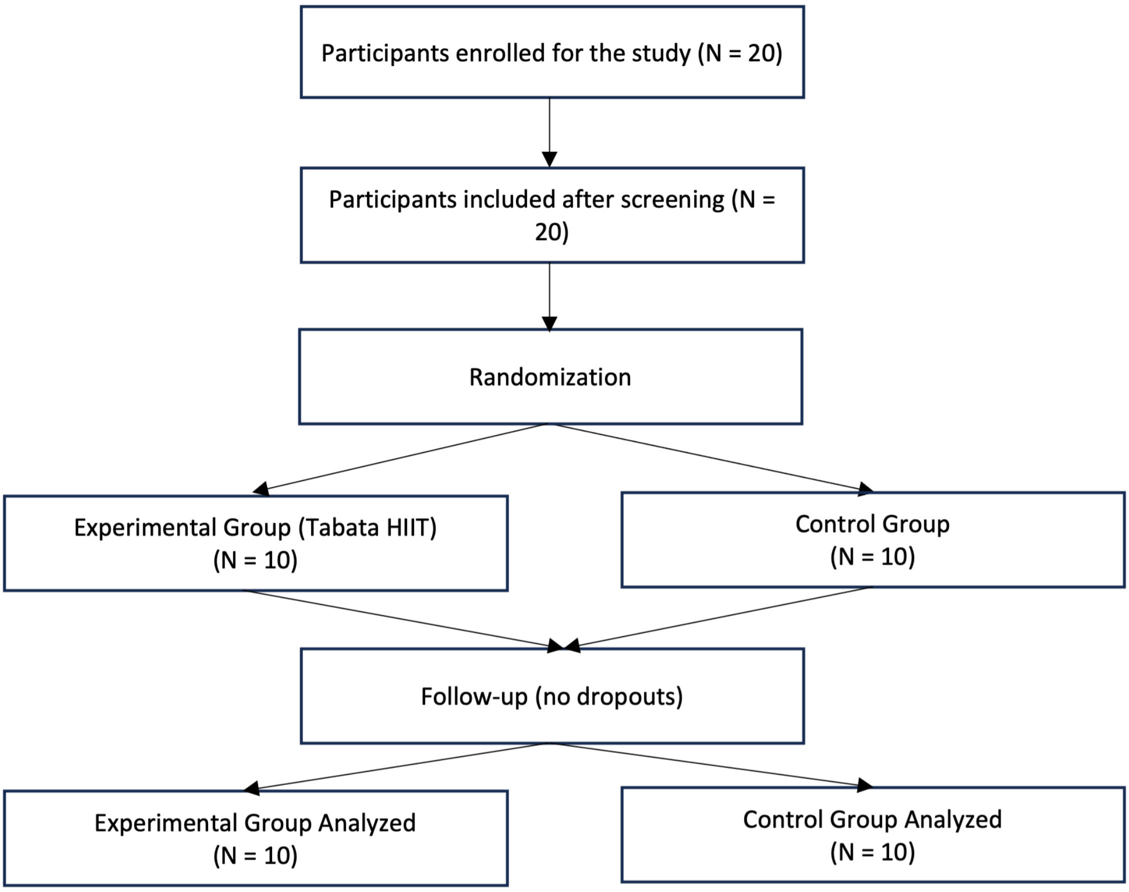

Figure 1. CONSORT flow diagram of participant recruitment, randomization, and analysis

was maintained at 70–85% of HRmax. Heart rate was tracked using a Polar H10 sensor and confirmed using Borg's Rating of Perceived Exertion (RPE 14–16).

b. Progression Strategy: A two-minute passive recovery was provided between sets. Load, tempo, and movement complexity increased each week. For example, Week 1 focused on technique with lighter resistance. Week 4 included complex multi-joint movements at a higher tempo. A summary of the weekly program structure is presented in Table 2.

3. Cool-down (8–10 minutes): This phase involved

Table 2. Four-Week Functional Strength Training Schedule

Week/Session	Training Component	Time / Tempo	Detailed Program
Week 1 – Session 1	Resisted Warm-Up	0:45 each exercise	Shoulder Rotations, Squat + Reverse Fly, Backward-Stepping Lunge L+R + Push Pull, Deadlift + Reverse Fly. Equipment: SMARTBAND + medium–heavy barbell.
	Supersets 1 (Lower Body Focus)	0:30–0:45 / (3)-0-1-0, (1)-H1-X-0	Barbell Front Squat, Offset Loaded Squat with Single-Arm Shoulder Press L/R, Barbell Back Squat, Offset Suitcase Swing Catch L/R. Recovery 0:20 between exercises.
Week 1 – Session 2	Resisted Warm-Up + Supersets 1	25–30 min total	Repeat Session 1 with focus on form and progressive overload. Option to add weight plates.
Week 1 – Session 3	Supersets 1 (Lower Body Focus)	30 min	Repeat with increased intensity, optional heavier barbell. Focus on technique consistency.
Week 2 – Session 1	Supersets 1 (Lower Body Focus)	0:45 each exercise / (3)-0-1-0	Barbell Front Squat, Offset Loaded Squat with Shoulder Press, Barbell Back Squat, Suitcase Swing Catch + Knee Lift L/R.
	Supersets 2 (Upper Body Focus)	0:30–0:45 / (P1)-H1-X-0	Barbell High Pull, Squat Double Pulse Plate Snatch L/R, Barbell Wide Row, Sumo Squat to Lateral Lunge + Arm Reverse Fly. Recovery 0:20 between exercises.
Week 2 – Session 2	Supersets 2 (Upper Body Focus)	30 min	Maintain tempo 3-0-(1)-0. Option to use SMARTBAND or medium-heavy barbell.
Week 2 – Session 3	Supersets 1 + 2 (Full Body Integration)	35 min	Combine key movements from both supersets. Focus on control and range of motion.
Week 3 – Session 1	Supersets 2 (Upper Body Focus)	0:30–0:45 / (P1)-H1-X-0	Barbell High Pull, Squat Double Pulse Single-Arm Plate Snatch + Knee Lift, Barbell Wide Row, Sumo Squat to Lateral Lunge + Arm Reverse Fly.
	Supersets 3 (Lower Body Focus + Core)	0:30–0:45 / 1-(H1)-X-0	Barbell Lunge L/R, Lunge Knee Lift + Suitcase Swing Catch, Copenhagen Plank (Front + Back) with Plate Hold or Powell Arm.
Week 3 – Session 2	Supersets 3 (Lower Body + Core)	30 min	Alternate L/R sides each set. Focus on balance and stability.
Week 3 – Session 3	Supersets 2 + 3 (Upper + Core Focus)	35–40 min	Combine upper body pull/push with lower body + core stabilization drills.
Week 4 – Session 1	Supersets 3 (Lower Body + Core)	0:30–0:45 / varied tempo	Lunge Knee Lift with Suitcase Swing Catch, Copenhagen Plank + Plate Hold, Barbell Lunge L/R. Recovery 0:20–0:30 between exercises.
Week 4 – Session 2	Full Circuit (Superset 1–3 Combo)	40 min	Sequence: Warm-up → Superset 1 → Superset 2 → Superset 3. Perform 2 sets each, 10–15 sec rest.
Week 4 – Session 3	Stretch & Cool Down	10–15 min	Static and dynamic stretching: hamstrings, quads, chest, shoulders, back. Focus on breathing and recovery.

static and dynamic stretching targeting the major muscle groups used during the main session.

Participant compliance was monitored through attendance logs and session-by-session recordings of heart rate and perceived exertion, with an overall attendance rate exceeding 85%.

Control Group

Participants in the control group were instructed to maintain their usual daily routines and to avoid any structured exercise throughout the four-week study period. Compliance was monitored using the International Physical Activity Questionnaire–Short Form (IPAQ-SF), which participants completed weekly to record daily activity levels. This method was used to control for potential bias caused by unplanned changes in physical activity outside the intervention period.

Procedure

The study was carried out in three phases: baseline assessment (pre-test), intervention, and post-intervention assessment (post-test). An initial orientation session was held to explain testing procedures and safety instructions in detail. Baseline measurements of body composition and aerobic capacity (VO_2max) were taken in a controlled laboratory setting before randomization.

After group allocation, the intervention group completed 12 supervised Tabata-based HIIT sessions over four weeks. The control group continued their regular daily routines. At the end of the intervention, both groups completed post-test assessments under the same standardized conditions as at baseline.

All measurements were conducted by three trained assessors who were blinded to group assignment. Assessors completed a two-week training program to ensure inter-rater reliability and adherence to standardized protocols for the OMRON HBF-375 body composition analysis and the Multistage Fitness Test (MFT).

Aerobic Capacity Assessment

Aerobic capacity (VO_2max) was estimated using the 20-meter Multistage Fitness Test (MFT). The test was conducted indoors on a smooth, non-slippery floor at a controlled temperature of 24–26°C. Participants ran back and forth between two lines, 20 meters apart, in time with pre-recorded audio signals that increased in frequency at regular intervals. The test ended when a participant failed to reach the line twice in a row or chose to stop due to fatigue. VO_2max values were calculated using the Leger–Lambert formula [20]. The MFT shows high criterion validity (r = 0.92) compared to direct gas analysis and excellent test–retest reliability (r = 0.95).

To ensure consistency between pre- and post-test assessments, all tests were administered by the same trained assessors under identical environmental conditions. A 10-minute dynamic warm-up was completed before each test. Standardized verbal encouragement was used to support maximal effort throughout.

Body Composition Assessment

All body composition assessments were conducted in a controlled environment at the indoor Grit Fitness Studio. Participants were instructed to arrive at 9:00 a.m. wearing light athletic clothing and no shoes. They were asked to avoid food, caffeine, alcohol, and strenuous exercise for 12 hours before testing to ensure accurate and consistent results. Detailed instructions were provided before each assessment.

Body composition was measured using the OMRON HBF-375 digital bioelectrical impedance analyzer (Omron Healthcare Co., Kyoto, Japan). Bioelectrical impedance analysis (BIA) is a widely used, non-invasive, and reproducible method for assessing fat mass and fat-free mass in healthy adults. Validation studies have shown acceptable agreement between commercial BIA devices, including Omron models, and reference methods, although accuracy may vary across devices and populations [21].

The following measurements were recorded during the assessment:

a. Subcutaneous fat percentage for the whole body, along with specific values for the trunk, arms, and legs, to assess fat distribution.
b. Skeletal muscle percentage for the whole body and segmented measurements for the trunk, arms, and legs to examine muscle distribution.

Height was measured using a stadiometer with 0.1 cm precision. Body weight was recorded automatically by the OMRON HBF-375 scale. Participants stood upright, barefoot, and held the device electrodes lightly with both hands, following the manufacturer's protocol.

The assessment was conducted in a temperature-controlled indoor environment (24–26°C) to maintain consistency. Each participant completed two measurements. The average of the two was used for data analysis.

All tests were performed by trained assessors who followed the manufacturer's instructions to ensure accuracy and consistency.

Statistical Analysis

All statistical analyses were conducted using JASP software (version 0.18.0; University of Amsterdam, The Netherlands). Data normality was tested using the Shapiro–Wilk test. All variables were normally distributed ($p > 0.05$). Baseline differences between the experimental and control groups were analyzed using independent samples t-tests. Within-group changes from pre- to post-intervention were examined using paired samples t-tests. Between-group differences over time were evaluated with a two-way mixed-design ANOVA (Group × Time) to assess the interaction effect of the Tabata-based HIIT program. Effect sizes (Cohen's d) were calculated using the pooled standard deviation. The effect magnitude was classified as small (d = 0.2), medium (d = 0.5), or large (d ⩾ 0.8). Pairwise deletion was used for missing data. Outliers were identified through visual inspection and statistical outlier tests. Statistical significance was set at $p < 0.05$. All results are reported with 95% confidence intervals.

Results

A comparative analysis of baseline body composition and physiological variables was conducted between the experimental and control groups to ensure initial equivalence before the intervention. As shown in Table 3, no statistically significant differences were found between the groups in height, weight, BMI, VO_2max, or other key parameters, with the exception of arm fat percentage, which showed a significant difference ($p < 0.05$).

The independent samples t-test results from Table 3 showed no statistically significant differences between the experimental and control groups for any of the pretest variables ($p > 0.05$). This confirmed their initial comparability. There were no significant differences in height, weight, VO_2max, BMI, body fat percentage, resting metabolism, or most body composition indicators. The groups also showed no statistically significant differences in

Table 3. Baseline comparison of body composition and physiological variables between the experimental and control groups of female workers

Variables	Group	Mean	SD	t-test	p	Mean Difference	Cohen's d	Levene's Test	
								F	p
Height (cm)	Experiment Control	159.45 154.40	3.69 7.85	1.842	0.082	5.05	-0.890	1.713	0.207
Weight (kg)	Experiment Control	71.8 69.0	14.71 14.73	0.425	0.676	2.8	-0.890	0.089	0.768
VO_2max (ml/kg/min)	Experiment Control	23.30 22.55	3.70 2.82	2.938	0.009*	0.75	1.192	0.542	0.471
BMI (kg/m^2)	Experiment Control	28.18 30.25	5.91 4.80	-0.859	0.401	-2.07	-2.195	0.153	0.700
Body Age (year)	Experiment Control	47.7 54.4	11.31 11.74	-1.229	0.210	-6.7	-0.392	0.346	0.564
FAT (%)	Experiment Control	32.33 36.47	4.83 4.48	-1.988	0.620	-4.14	-1.231	0.196	0.664
RM (kcal/day)	Experiment Control	1,448.1 1,439.4	221.17 225.36	0.087	0.932	8.7	-0.157	0.305	0.587
Subcutaneous Fat									
Whole Body (%)	Experiment Control	21.19 33.86	8.13 5.10	-5.636	0.001*	-12.67	-2.417	1.110	0.306
Trunk (%)	Experiment Control	27.96 29.76	6.44 5.11	-6.760	0.001*	-1.8	-1.880	4.209	0.055
Arm (%)	Experiment Control	23.45 48.35	4.94 5.13	-11.056	0.001*	-24.9	-2.992	0.016	0.900
Leg (%)	Experiment Control	38.13 45.50	2.19 6.13	-0.677	0.507	-7.37	-0.392	1.615	0.220
Skeletal Muscle									
Whole Body (%)	Experiment Control	24.57 33.86	2.04 5.10	1.174	0.256	-9.29	0.079	0.230	0.638
Trunk (%)	Experiment Control	18.22 30.86	2.57 3.59	1.004	0.329	-12.64	-0.195	1.018	0.326
Arm (%)	Experiment Control	23.45 48.35	4.94 5.13	0.444	0.662	-24.9	-0.233	0.452	0.510
Leg (%)	Experiment Control	43.11 45.50	9.33 6.13	0.522	0.608	-2.39	-0.602	0.151	0.703

Note: BMI – Body Mass Index; FAT – Body Fat Percentage; RM – Resting Metabolism.; p is significant at < 0.05* segmental fat and muscle distribution, although minor variations were observed. Levene's test results indicated homogeneity of variance across all variables ($p > 0.05$). This confirms that both groups were statistically equal at baseline. Therefore, the post-intervention changes can be attributed to the Tabata-based HIIT intervention rather than to pre-existing differences.

Post-intervention comparisons were conducted to evaluate differences in physiological and body composition outcomes between the experimental and control groups. As shown in Table 4, statistically significant improvements were observed in the experimental group for VO_2max and several fat-related measures, particularly in whole-body fat, trunk fat, and arm fat percentages ($p < 0.05$). These results suggest a favorable effect of the Tabata-based HIIT intervention on aerobic capacity and subcutaneous fat distribution among female workers.

The independent samples t-test results presented in Table 4 showed several statistically significant differences between the experimental and control groups after the four-week intervention. The Tabata HIIT group demonstrated greater improvements in VO_2max ($t(18) = 2.938$, $p = 0.009$, $d = 1.19$) and notable reductions in body fat indicators. These included subcutaneous fat in the whole body, trunk, and arms, as well as total fat percentage and BMI ($p < 0.05$, $d = 1.23–2.99$).

All variables satisfied the assumption of equal variances based on Levene's test ($p > 0.05$). These results indicate large to very large effect sizes in favor of the Tabata group. The findings support the

Table 4. Comparison of post-intervention body composition and physiological variables between the experimental and control groups (mean ± SD, Cohen's d)

Variables	Group	Mean	SD	t-test	p	Mean Difference	Cohen's d	Levene's Test	
								F	p
Height (cm)	Experiment Control	159.45 154.40	3.69 7.85	1.842	0.082	5.05	-0.890	1.713	0.207
Weight (kg)	Experiment Control	71.8 69.0	14.71 14.73	0.425	0.676	2.8	-0.890	0.089	0.768
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BMI (kg/m^2)	Experiment Control	28.18 30.25	5.91 4.80	-0.859	0.401	-2.07	-2.195	0.153	0.700
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Trunk (%)	Experiment Control	27.96 29.76	6.44 5.11	-6.760	0.001*	-1.8	-1.880	4.209	0.055
Arm (%)	Experiment Control	23.45 48.35	4.94 5.13	-11.056	0.001*	-24.9	-2.992	0.016	0.900
Leg (%)	Experiment Control	38.13 45.50	2.19 6.13	-0.677	0.507	-7.37	-0.392	1.615	0.220
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Whole Body (%)	Experiment Control	24.57 33.86	2.04 5.10	1.174	0.256	-9.29	0.079	0.230	0.638
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Leg (%)	Experiment Control	43.11 45.50	9.33 6.13	0.522	0.608	-2.39	-0.602	0.151	0.703

Note: BMI – Body Mass Index; FAT – Body Fat Percentage; RM – Resting Metabolism. p is significant at < 0.05* effectiveness of short-term high-intensity interval training in improving aerobic capacity and reducing body fat among female workers.

To evaluate the intervention's effectiveness more precisely, gain scores (pre- to post-test differences) were compared between the experimental and control groups. As shown in Table 5, statistically significant group differences were observed in several key variables, particularly those related to fat distribution and aerobic capacity.

As shown in Table 5, the experimental group demonstrated significantly greater improvements in aerobic capacity and body composition compared to the control group. Participants in the Tabata HIIT group experienced increased VO_2max, along with reductions in whole-body fat, trunk fat, arm fat, total fat percentage, and BMI. These findings suggest that the four-week Tabata HIIT intervention improved both aerobic performance and fat-related body composition parameters among female workers. No statistically significant differences were observed for leg composition (p = 0.392), resting metabolism (p = 0.730), visceral fat (p = 0.064), or body age (p = 0.392), indicating that these parameters were less responsive to the short-term intervention.

Figure 2 illustrates the mean changes in VO_2max, BMI, total body fat, and regional fat (whole body, trunk, and arm) between the experimental and control groups following the four-week Tabata-based HIIT intervention. Only variables with

Table 5. Comparison of changes (gain scores) in body composition and VO_2max between the experimental and control groups

Variables	t	df	p
Weight (kg)	-1.990	18	.062
VO_2max (ml/kg/min)	2.665	18	.016*
Whole Body (%)	-5.404	18	< .001*
Trunk (%)	-4.203	18	< .001*a
Arm (%)	-6.691	18	< .001*a
Leg (%)	-0.877	18	.392
FAT (%)	-2.753	18	.013*
RM (kcal/day)	-0.350	18	.730
BMI (kg/m^2)	-4.909	18	< .001*
Visceral Fat (%)	-1.972	18	.064
Body Age (year)	-0.876	18	.392
Whole Body (%)	0.177	18	.861
Trunk (%)	-0.435	18	.669
Arm (%)	-0.522	18	.608
Leg (%)	-1.346	18	.195

Note: Student's t-test. *a Brown–Forsythe test was significant (p < 0.05), indicating a violation of the equal variance assumption. p is significant at < 0.05*

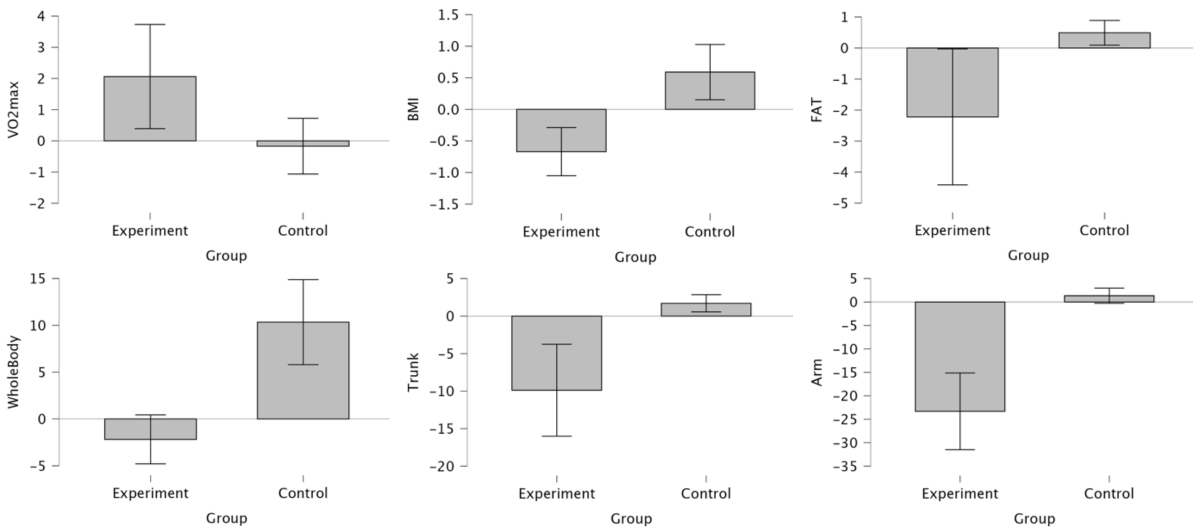

Figure 2. Comparison of mean changes in VO_2max, BMI, total body fat, and regional fat (whole body, trunk, and arm) between the experimental and control groups following the four-week Tabata-based HIIT intervention. Only variables showing statistically significant between-group differences (p < 0.05) are presented.

statistically significant between-group differences ($p < 0.05$) are presented.

The four-week Tabata-based HIIT intervention led to significant improvements in aerobic capacity (VO_2max) and reductions in BMI, total body fat, and regional fat in the whole body, trunk, and arms. The experimental group showed greater gains in VO_2max and more pronounced fat loss compared to the control group. Participants in the Tabata group experienced substantial decreases in body fat in all reported regions, accompanied by reductions in BMI, indicating favorable changes in body composition. No significant changes were observed in the control group. These results confirm that Tabata-based HIIT is an effective strategy for improving aerobic fitness and reducing regional body fat over a short intervention period.

Discussion

This study examined the effects of a 12-session Tabata-based high-intensity interval training (HIIT) program conducted over four weeks on VO_2max, body fat, and BMI in female workers. Participants in the intervention group demonstrated greater improvements in VO_2max, along with reductions in body fat, trunk fat, arm fat, total fat percentage, and BMI, compared to the control group.

Research evidence, including a systematic review and meta-analysis, has shown that HIIT significantly improves cardiovascular fitness and body composition, producing greater reductions in body fat and larger gains in VO_2max compared to no exercise or moderate-intensity exercise [22]. The Tabata method induces both anaerobic and aerobic adaptations through its interval structure of 20 seconds of work followed by 10 seconds of rest, as reported in a dedicated review [23]. Studies involving overweight women found that brief HIIT programs increase VO_2max and decrease body fat percentage [24]. Similar results have been observed in elite martial arts athletes, where HIIT was associated with favorable changes in body composition [25]. Another study showed that obese middle-aged women who completed eight weeks of aquatic HIIT improved physical fitness and demonstrated reductions in total cholesterol and interleukin-6 (IL-6) levels, indicating cardiovascular and metabolic benefits [26]. Research on women aged 25–30 found that attending Tabata sessions three times per week promoted fat loss and improvements in muscular strength and endurance [27]. Similarly, Shah et al. [28] reported that Tabata training reduced waist circumference and BMI in women aged 20–35 years. The study found that 20-minute Tabata sessions reached 86% of maximum heart rate and 74% of VO_2max, supporting its role as a time-efficient workout strategy [19].

The Tabata-HIIT protocol enhances VO_2max by increasing maximal cardiac output, stroke volume, and skeletal muscle mitochondrial oxidative capacity. High-intensity exercise intervals stimulate type II muscle fiber activation and mitochondrial growth, which improves oxygen uptake and utilization efficiency [23]. Elevated post-exercise oxygen consumption (EPOC) and a higher metabolic rate during recovery contribute to greater fat oxidation, leading to reductions in total body fat as well as regional fat in the trunk and arms. A meta-analysis reported a significant average weight loss of −1.86 kg (95% CI: −2.55 to −1.18) following HIIT, based on 36 randomized controlled trials [17]. Reductions in central and arm fat are also associated with improvements in BMI and total fat percentage.

This study highlights two key benefits for female workers. First, brief Tabata-HIIT programs deliver measurable health improvements within a limited time frame. Second, such interventions may enhance workplace wellness initiatives by supporting body composition improvements and cardiovascular fitness among employees.

Limitations of the Study

This study faced several limitations. The intervention lasted only four weeks and included a small number of participants from a single workplace. Body composition was assessed using the OMRON Karada Scan HBF-375, a bioelectrical impedance device that is sensitive to hydration levels, which may have introduced measurement error compared to more accurate methods.

In addition, several factors may have influenced internal validity. Dietary intake, occupational physical activity, and sleep patterns were not strictly controlled and could have affected changes in body composition and aerobic capacity. Although attendance was supervised, the quality of adherence, including intensity compliance, may have varied among participants. These limitations should be considered when interpreting the study results.

Future Research Directions

Future studies should extend the intervention period to 8–12 weeks and include larger and more diverse samples of female workers. The use of biochemical markers, such as irisin levels and mitochondrial enzyme activity, would help clarify the physiological mechanisms behind fat loss and improvements in aerobic performance.

Conclusions

This study provides evidence that a short-term Tabata-based high-intensity interval training (HIIT) protocol can significantly improve aerobic capacity and reduce body fat among female workers. After four weeks of supervised training, participants demonstrated increases in VO_2max and decreases in trunk fat, arm fat, and total body fat percentage compared to a control group maintaining usual daily activities.

Despite these promising findings, the short intervention period and small sample size require caution in interpretation. Nevertheless, the Tabata-based HIIT approach appears to be a time-efficient and practical strategy that could be implemented in workplace wellness programs for populations with limited time availability.

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Conflict of Interest

The authors declare no conflicts of interest related to the research, authorship, or publication of this article.

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