

The comparison between HIIT vs low-intensity exercise on physical fitness and mental health among sedentary females

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Abstract.

Introduction. Sedentary women face cardiometabolic and mental-health risks, yet direct comparison of high-versus low-intensity exercise on integrated physical and psychological outcomes is sparse. **Objective.** To compare six weeks of high-intensity interval training (HIIT) with slow jogging in sedentary Malaysian women. **Methods.** Thirty sedentary females aged 24–34 years were randomised to HIIT ($n = 15$) or slow jogging ($n = 15$) and completed supervised 30-minute sessions three times weekly. Outcomes assessed at baseline and post-intervention were estimated VO_2 max (20-m shuttle), curl-ups, handgrip strength, sit-and-reach, body composition (InBody 270), Rosenberg Self-Esteem Scale and Quality of Life Scale. Within-group changes were tested with paired t-tests and between-group intervention effects with independent t-tests on change scores. Effect sizes are reported as Cohen's d with 95% confidence intervals. **Results.** Both groups improved comparably in VO_2 max (HIIT +2.32, slow +2.11 $\text{mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$), curl-ups (+5.53 vs. +5.20 reps), sit-and-reach (+7.32 vs. +5.73 cm) and self-esteem (+2.94 vs. +1.80; all $p > .11$). HIIT increased handgrip by 2.23 kg while slow jogging decreased it by 2.60 kg (between-group $d = 1.63$ [0.80, 2.46], $p < .001$). HIIT improved all four body-composition outcomes ($d = 1.44$ – 2.66 , all $p < .001$); slow jogging increased body fat (+2.44%) and lost skeletal muscle (–0.73 kg). Quality of life rose in HIIT (+8.87) and declined in slow jogging (–6.20); $d = 1.53$ [0.72, 2.34], $p < .001$. **Conclusion.** Both modalities improve cardiorespiratory fitness, muscular endurance, flexibility and self-esteem comparably; HIIT is significantly superior for handgrip, body composition and quality of life, and is the preferred modality for time-efficient, multi-domain improvement in this population.

Keywords: High-Intensity Interval Training; Slow Jogging; Sedentary Females; Body Composition; Physical Fitness; Mental Health.

Introduction

Physical inactivity is among the leading global health risks of the twenty-first century. Approximately 31% of adults worldwide, an estimated 1.8 billion people, did not meet the recommended levels of physical activity in 2022, and global prevalence has risen by five percentage points since 2010 (Strain et al., 2024). Women remain consistently less active than men, with the global gap unchanged for more than two decades and exceeding twenty percentage points in some countries (Strain et al., 2024). The cumulative metabolic load of sedentary behaviour is independently associated with cardiovascular disease, type-2 diabetes, obesity and all-cause mortality (Booth, Roberts, & Laye, 2012). In Malaysia, the most recent National Health and Morbidity Survey reports an adult physical-inactivity prevalence of 29.9% and a sedentary-behaviour prevalence of 49.9% (Lim et al., 2025). Working-age women aged 24–34 years face distinct barriers such as occupational demands, caregiving responsibilities and time scarcity that suppress regular exercise (Lovell, El Ansari, & Parker, 2010).

This results in elevated anxiety, depression and reduced self-esteem relative to active peers (Schuch et al., 2018). Exercise interventions for this population must therefore address physical and psychological outcomes together. High-intensity interval training (HIIT) consists of short bursts of near-maximal effort interspersed with brief recovery periods and has become a widely adopted alternative to continuous exercise. Across populations from sedentary adults to competitive athletes, HIIT produces robust gains in cardiorespiratory fitness, muscular performance and body composition (Atakan et al., 2020; Weston, Wisløff, & Coombes, 2014). Population-specific evidence in overweight sedentary women has shown significant VO_2 max gains from short-duration HIIT (Vigriawan et al., 2022). These adaptations reflect increased stroke volume, mitochondrial biogenesis,

improved insulin sensitivity and elevated post-exercise oxygen consumption (Gibala & Jones, 2013). Critically, 20–30-minute sessions address the time barrier that disproportionately affects working-age women (Reljic et al., 2019). Slow jogging is defined as continuous low-intensity running at approximately 60–65% maximal heart rate. It is widely promoted to previously inactive individuals for its minimal equipment requirement, low orthopaedic loading and low injury risk, and improves aerobic capacity through oxidative-enzyme and capillarisation adaptations (Ikenaga et al., 2017; Tanaka & Furukawa, 2018). Its low metabolic stimulus, however, may be insufficient to elicit gains in muscular strength or rapid body-composition change in short intervention periods (Donnelly et al., 2009).

Direct head-to-head comparisons of HIIT and slow jogging in sedentary female populations remain rare. Existing comparative work has predominantly contrasted HIIT with moderate-intensity continuous training at calorically matched workloads (Maillard, Pereira, & Boisseau, 2018; Martins et al., 2016). Recent evidence in young women confirms HIIT's superiority for body composition and cardiometabolic adaptation (Lu et al., 2023; Suhaimi et al., 2025; Syamsudin et al., 2023). Slow jogging, however, operates below typical moderate-intensity prescriptions and represents a distinct modality favoured by sedentary individuals; whether HIIT retains its advantage against this low-intensity comparator is unknown. Prior comparative trials have also rarely examined physical-fitness and psychological outcomes together, leaving practitioners without integrated guidance. Evidence that high-intensity multi-modal training improves strength and conditioning markers in women further supports the contrast tested here (Fedorova et al., 2024).

The present study addresses this gap with a six-week randomised controlled trial comparing supervised HIIT and slow jogging in sedentary Malaysian women aged 24–34 years. The aim was to determine whether the two modalities differ in their effects on cardiorespiratory fitness, muscular performance, flexibility, body composition, self-esteem, and quality of life. Based on the principle of specific adaptation to imposed demands (SAID) and the established mechanistic profile of HIIT, we hypothesised that (a) both modalities would produce comparable improvements in cardiorespiratory fitness and self-esteem, but (b) HIIT would produce significantly greater improvements in muscular strength, body composition, and quality of life owing to its higher metabolic stimulus, broader neuromuscular engagement, and more diverse movement repertoire.

Methodology

Study Design and Participants

This study employed a two-group, pre-test/post-test randomised controlled trial design and is reported in accordance with the CONSORT 2010 Statement for parallel-group randomised trials (Schulz, Altman, & Moher, 2010). The six-week intervention duration was selected to capture short-term physiological adaptations while remaining feasible within the host institute's academic calendar, consistent with comparable HIIT trials in sedentary adults (Atakan et al., 2020; Syamsudin et al., 2023). Thirty sedentary females (age: 28.43 ± 2.94 years; height: 157.9 ± 5.78 cm; weight: 62.9 ± 14.42 kg) were recruited via convenience sampling from the female trainee population of the Malaysian Statistical Training Institute (ILSM).

Participants were classified as Tier 0 (Sedentary) under the McKay et al. (2022) participant classification framework, based on their pre-recruitment IPAQ scores and absence of structured exercise in the preceding six months. Inclusion criteria were: (1) females aged 24–34 years; (2) sedentary classification on the International Physical Activity Questionnaire (IPAQ); (3) body mass index within the range observed in the recruited population ($16.8\text{--}35.5\text{ kg}\cdot\text{m}^{-2}$), reflecting the heterogeneous BMI distribution of sedentary working-age Malaysian women; (4) absence of chronic injury or medical contraindication to exercise; and (5) capacity to complete the six-week supervised intervention.

Exclusion criteria were pregnancy, established cardiovascular disease, uncontrolled diabetes, musculoskeletal injury within the preceding three months, or participation in structured exercise within the preceding six months. All participants provided written informed consent. The study was conducted in accordance with the Declaration of Helsinki, and ethical approval was granted by the Sultan Idris Education University Human Research Ethics Committee (reference: 2024-0248-01). No a priori sample size calculation was performed; the analytic sample reflects the total available trainee cohort at the host institute during the recruitment period, and the resulting power limitations are discussed in §Strengths and Limitations.

Randomisation and Blinding

The participants were randomly allocated to the HIIT group ($n = 15$) or the slow-jogging group ($n = 15$) using a computer-generated random number sequence with allocation concealment maintained until the point of group assignment. Independent-samples t-tests confirmed no significant baseline differences between groups on any outcome variable (all $p > .05$).

Owing to the nature of the exercise interventions, participants and instructors could not be blinded to group allocation; however, outcome assessors were blinded to group assignment for all post-intervention measurements.

Intervention Protocols

Table 1. Description of the 6-Week HIIT and Slow-Jogging Intervention Protocols

Feature	HIIT	Slow Jog
Frequency	3 sessions/week (Mon, Wed, Fri)	3 sessions/week (Mon, Wed, Fri)
Duration per Session	30 minutes	30 minutes
Intensity	Maximum effort (perceived ≥ 17 on Borg 6–20 RPE)	60–65% maximal heart rate (conversational pace)
Work : Rest Ratio	40 sec work : 20 sec rest	Continuous
Progression	Intensity maintained at 40:20 ratio across all six weeks	Weeks 1–4: 15 min jog + 15 min walk; Weeks 5–6: 25 min jog + 5 min walk
Exercises	2 rounds $\times$ 10 exercises: burpees, skaters, squat kicks, jump squats, switch lunges, lunges with pulses, plank-to-forearm with leg raise, mountain climbers with push-up, double leg raises, oblique leg lowers, three-way push-ups	Continuous jogging at 4–6 km/h

Note: All sessions were supervised by trained instructors who monitored technique, adherence to prescribed intensity, and safety throughout the intervention.

Adherence and Monitoring

All 30 participants attended 100% of the 18 scheduled sessions, with no dropouts and no adverse events. While this adherence rate exceeds the typical attrition observed in community-based exercise trials (Reljic et al., 2019), it is attributable to the structured environment of the residential training institute, in which exercise sessions were scheduled at 07:00–08:00 each session day and were integrated into the institute's daily programme with institutional support and peer-group participation. The replicability of this adherence level in self-directed or community-based contexts cannot be assumed.

Outcome Measures

Physical Fitness Assessments

All physical fitness measurements were conducted by trained assessors at baseline and post-intervention in a standardised order following a 10-minute dynamic warm-up.

Body Composition

Body composition was assessed using a multi-frequency bioelectrical impedance analyser (InBody 270, InBody Co., Seoul, South Korea; validity $r = 0.97$ – 0.99 , reliability ICC = 0.98 – 1.00 ; Larsen et al., 2021). Recorded variables included body weight, body mass index (BMI), percentage body fat, and skeletal muscle mass. Participants abstained from food and caffeine for two hours and strenuous exercise for 24 hours prior to assessment.

Cardiorespiratory Endurance

The 20 m multistage shuttle run test was used to assess cardiorespiratory endurance. Participants ran continuously between two markers 20 m apart in time with audio beeps of increasing frequency until volitional exhaustion. The achieved stage was converted to estimated VO_2 max using the test's established conversion table (validity $r = 0.72$ – 0.85 ; Mayorga-Vega, Aguilar-Soto, & Viciana, 2015).

Muscular Endurance

Abdominal muscular endurance was assessed using a one-minute curl-up test. Participants assumed a supine position with knees flexed at 140° , and the maximum number of correctly executed curl-ups completed within 60 seconds was recorded (ICC = 0.92 ; Sparling, Millard-Stafford, & Snow, 1997).

Muscular Strength

Handgrip strength was measured using a hydraulic hand dynamometer (Jamar Plus+, Performance Health, Warrenville, IL, USA; ICC = 0.80 – 0.90 ; Huang et al., 2022). Participants stood with arms by their sides and squeezed the dynamometer maximally for three seconds. Three trials per hand were performed with two-minute inter-trial recovery, and the highest value across hands was retained for analysis.

Flexibility

Hamstring and lower-back flexibility were assessed using the sit-and-reach test. Participants sat with legs extended and feet flat against a sit-and-reach box, then reached forward as far as possible without bending the knees. The maximum of three trials was recorded (criterion validity $r = 0.46$ – 0.67 ; reliability $r = 0.96$ – 0.99 ; Mayorga-Vega, Merino-Marban, & Viciana, 2014).

Mental Health Assessments

Mental-health outcomes were assessed using two validated self-report instruments at baseline and post-intervention. The Rosenberg Self-Esteem Scale (RSES), a 10-item instrument scored on a 4-point Likert scale (total range 10–40), was used to assess global self-esteem ($\alpha = 0.88$ – 0.90 ; test-retest $r = 0.82$ – 0.88 ; Sinclair et al., 2010). The Quality of Life Scale (QOLS), a 16-item instrument scored on a 7-point Likert scale (total range 16–112), was used to assess satisfaction across multiple life domains ($\alpha = 0.82$ – 0.92 ; test-retest $r = 0.78$ – 0.84 ; Burckhardt & Anderson, 2003).

Statistical Analysis

Data were analysed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics (mean $\pm$ SD) characterised participants and outcomes. The Shapiro-Wilk test confirmed normality at both time points (all $p > .05$), permitting parametric tests. Because no a priori sample size calculation was performed, all outcomes are reported with equal inferential weight and no primary outcome was pre-designated; findings should therefore be interpreted as informative for hypothesis refinement rather than confirmatory. Within-group changes from baseline to post-intervention were assessed using paired-samples t-tests. Between-group intervention effects were assessed using independent-samples t-tests on change scores ($\Delta = \text{post} - \text{pre}$), equivalent to the group $\times$ time interaction in a 2×2 mixed-model ANOVA and recommended as a direct test of differential intervention effects in randomised pre-post designs (Vickers & Altman, 2001).

This approach was chosen in preference to comparison of post-test means alone because the latter ignores baseline information and is vulnerable to bias when even small baseline differences exist between groups. Statistical significance was set at $\alpha = .05$ (two-tailed). Effect sizes were calculated as Cohen's d : for within-group changes, $d = \text{mean change} / \text{SD of the change scores}$; for between-group comparisons, $d = \text{mean difference in change scores} / \text{pooled SD of change scores}$. 95% confidence intervals for d were estimated using the standard approximations ($SE_d = \sqrt{(1/n + d^2/(2n))}$ for paired comparisons; $SE_d = \sqrt{((n_1+n_2)/(n_1n_2) + d^2/(2(n_1+n_2)))}$ for independent comparisons). Effect-size magnitudes were interpreted per Cohen's conventions: small (0.20), medium (0.50), large (0.80). Percentage changes were calculated as $[(\text{post} - \text{pre}) / \text{pre}] \times 100$. The multiple-outcome design without formal correction for family-wise error rate is acknowledged as a limitation; results with p -values near the conventional threshold should be interpreted with caution.

Results

Participant Flow and Baseline Characteristics

Thirty-two women were screened for eligibility; two were excluded for failing to meet inclusion criteria (one for recent structured exercise, one for a recent musculoskeletal injury). The remaining 30 participants were randomised in a 1:1 ratio to HIIT ($n = 15$) or slow jogging ($n = 15$) and entered the supervised intervention. All 30 attended every one of the 18 prescribed sessions (100% adherence) and completed both baseline and post-intervention assessments. No participants withdrew, were lost to follow-up, or experienced adverse events. The intention-to-treat sample therefore equals the per-protocol sample ($n = 30$). Baseline characteristics were comparable between groups (Table 2), and independent-samples t-tests confirmed no significant between-group differences on any baseline outcome (all $p > .05$).

Table 2. Participant Demographics and Baseline Characteristics

Characteristic	Overall ($n = 30$)	HIIT ($n = 15$)	Slow Jog ($n = 15$)
Age (years)	28.43 $\pm$ 2.94	28.47 $\pm$ 3.02	28.40 $\pm$ 2.91
Height (cm)	157.9 $\pm$ 5.78	158.1 $\pm$ 5.92	157.7 $\pm$ 5.71
Weight (kg)	62.9 $\pm$ 14.42	66.59 $\pm$ 13.85	60.99 $\pm$ 15.62
BMI (kg/m ²)	25.34 $\pm$ 5.35	26.45 $\pm$ 4.44	24.22 $\pm$ 6.07

Note. Values are mean $\pm$ SD. No significant between-group differences at baseline (all $p > .05$).

Within-Group Changes — HIIT Group

The HIIT group showed statistically significant improvements across all measured outcomes (Table 3). Cardiorespiratory endurance improved by 10.3%, muscular endurance by 38.8%, handgrip strength by 8.5%, and sit-and-reach flexibility by 33.8%. Body-composition changes were uniformly favourable, with reductions in body weight (−2.7%), BMI (−2.5%), and body fat percentage (−3.5%), and a small but statistically significant increase in skeletal muscle mass (+2.0%). Both mental-health outcomes improved significantly: self-esteem increased by 13.8% and quality of life by 9.8%. All effect sizes were large ($d \geq 0.92$).

Table 3. Within-Group Changes in HIIT Group ($n = 15$)

Variable	Pre-test	Post-test	Δ	% Δ	p	d [95% CI]
VO ₂ max (mL/kg/min)	22.59 $\pm$ 2.64	24.91 $\pm$ 2.33	+2.32	+10.3	.003	0.92 [0.32, 1.52]
Curl-ups (reps)	14.27 $\pm$ 6.08	19.80 $\pm$ 6.92	+5.53	+38.8	< .001	1.28 [0.60, 1.96]
Handgrip (kg)	26.37 $\pm$ 5.18	28.61 $\pm$ 5.24	+2.23	+8.5	< .001	1.70 [0.91, 2.49]
Sit-and-Reach (cm)	21.67 $\pm$ 6.13	28.99 $\pm$ 4.47	+7.32	+33.8	< .001	1.41 [0.70, 2.12]
Weight (kg)	66.59 $\pm$ 13.85	64.78 $\pm$ 13.84	−1.81	−2.7	< .001	−1.29 [−1.97, −0.61]
BMI (kg/m ²)	26.45 $\pm$ 4.44	25.78 $\pm$ 4.41	−0.67	−2.5	< .001	−1.49 [−2.23, −0.75]

Body Fat (%)	37.71 ± 5.04	36.37 ± 5.05	-1.33	-3.5	< .001	-1.25 [-1.93, -0.57]
Skeletal Muscle (kg)	22.13 ± 4.00	22.57 ± 3.99	+0.43	+2.0	< .001	1.44 [0.72, 2.16]
Self-Esteem (RSES)	21.33 ± 2.23	24.27 ± 1.34	+2.94	+13.8	< .001	1.29 [0.61, 1.97]
Quality of Life (QOLS)	90.40 ± 10.08	99.27 ± 10.79	+8.87	+9.8	< .001	1.21 [0.54, 1.88]

Note. All within-group changes statistically significant ($p \leq .003$); effect sizes large ($d \geq 0.92$).

Within-Group Changes — Slow Jogging Group

The slow-jogging group showed significant improvements in cardiorespiratory endurance (+9.4%), muscular endurance (+38.6%), sit-and-reach flexibility (+20.9%), and self-esteem (+8.1%) (Table 4). Handgrip strength decreased significantly by 10.1%. Body-composition results were heterogeneous: body weight (+1.2%) and BMI (+1.3%) showed non-significant increases, whereas body fat percentage increased significantly (+7.3%, $p = .017$) and skeletal muscle mass decreased significantly (-3.4%, $p < .001$; 9 of 15 participants showed individual decreases). Quality of life declined by 6.4% ($p = .061$); the within-group test did not meet the conventional $\alpha = .05$ threshold.

Table 4. Within-Group Changes in Slow-Jogging Group ($n = 15$)

Variable	Pre-test	Post-test	Δ	% Δ	p	d [95% CI]
VO ₂ max (mL/kg/min)	22.58 ± 2.88	24.69 ± 2.35	+2.11	+9.4	.007	0.82 [0.24, 1.40]
Curl-ups (reps)	13.47 ± 5.49	18.67 ± 6.45	+5.20	+38.6	.007	0.82 [0.24, 1.40]
Handgrip (kg)	25.85 ± 4.82	23.25 ± 4.02	-2.60	-10.1	.024	-0.65 [-1.21, -0.09]
Sit-and-Reach (cm)	27.35 ± 9.00	33.07 ± 7.68	+5.73	+20.9	< .001	1.19 [0.53, 1.85]
Weight (kg)	60.99 ± 15.62	61.74 ± 15.12	+0.75	+1.2	.157	0.39 [-0.13, 0.91]
BMI (kg/m ²)	24.22 ± 6.07	24.53 ± 5.85	+0.31	+1.3	.179	0.37 [-0.15, 0.89]
Body Fat (%)	33.59 ± 10.09	36.03 ± 10.10	+2.44	+7.3	.017	0.70 [0.14, 1.26]
Skeletal Muscle (kg)	21.17 ± 2.88	20.44 ± 2.88	-0.73	-3.4	< .001	-1.35 [-2.05, -0.65]
Self-Esteem (RSES)	22.20 ± 2.15	24.00 ± 2.20	+1.80	+8.1	< .001	1.27 [0.59, 1.95]
Quality of Life (QOLS)	96.73 ± 10.83	90.53 ± 14.32	-6.20	-6.4	.061	-0.53 [-1.07, 0.01]

Note. Mixed pattern of effects: significant improvements in aerobic capacity, muscular endurance, flexibility, and self-esteem; significant detriments in handgrip strength, body fat, and skeletal muscle mass.

Between-Group Comparisons of Intervention Effects

Independent-samples t-tests on change scores ($\Delta = \text{post} - \text{pre}$) tested whether HIIT and slow jogging produced different magnitudes of change across the six-week intervention (Table 5). HIIT produced significantly greater improvements than slow jogging in handgrip strength ($t_{28} = 4.47$, $p < .001$, $d = 1.63$), all four body-composition outcomes (weight, BMI, body fat, and skeletal muscle mass; all $p < .001$, d range 1.44–2.66), and quality of life ($t_{28} = 4.20$, $p < .001$, $d = 1.53$).

The between-group difference for muscle mass was particularly striking ($d = 2.66$), reflecting opposing directional changes (HIIT +0.43 kg vs. slow jog -0.73 kg). The two modalities did not differ significantly on cardiorespiratory endurance, muscular endurance, flexibility, or self-esteem (all $p > .11$), indicating that for these outcomes the prescribed dose of either modality is sufficient to produce comparable adaptations.

Table 5. Between-Group Comparison of Change Scores (HIIT vs. Slow Jogging)

Variable	HIIT Δ	Slow Jog Δ	$t(28)$	p	d [95% CI]
VO ₂ max (mL/kg/min)	+2.32 ± 2.52	+2.11 ± 2.58	0.22	.826	0.08 [-0.64, 0.80]
Curl-ups (reps)	+5.53 ± 4.31	+5.20 ± 6.36	0.17	.868	0.06 [-0.66, 0.78]
Handgrip (kg)	+2.23 ±	-2.60 ± 3.97	4.47	<	1.63 [0.80, 2.46]

	1.31				.001		
Sit-and-Reach (cm)	+7.32 ± 5.20	±	+5.73 ± 4.83	0.87	.392	0.32 [-0.40, 1.04]	
Weight (kg)	-1.81 ± 1.40	±	+0.75 ± 1.93	-4.15	< .001	-1.52 [-2.33, -0.71]	
BMI (kg/m ²)	-0.67 ± 0.45	±	+0.31 ± 0.86	-3.94	< .001	-1.44 [-2.24, -0.64]	
Body Fat (%)	-1.33 ± 1.07	±	+2.44 ± 3.47	-4.02	< .001	-1.47 [-2.28, -0.66]	
Skeletal Muscle (kg)	+0.43 ± 0.30	±	-0.73 ± 0.54	7.29	< .001	2.66 [1.68, 3.64]	
Self-Esteem (RSES)	+2.94 ± 2.29	±	+1.80 ± 1.42	1.64	.112	0.60 [-0.13, 1.33]	
Quality of Life (QOLS)	+8.87 ± 7.36	±	-6.20 ± 11.78	4.20	< .001	1.53 [0.72, 2.34]	

Note. Δ values represent mean change from baseline $\pm$ SD of change. Positive d values favour HIIT; negative d values for weight, BMI, and body fat indicate greater reduction in HIIT (i.e., favour HIIT). Significant between-group differences in handgrip, all body-composition outcomes, and quality of life — all favouring HIIT.

Figures 1 and 2 summarise the comparative effects across all ten outcomes. Figure 1 presents the four outcomes on which the two modalities produced statistically comparable improvements: cardiorespiratory endurance (Panel A), muscular endurance (Panel B), sit-and-reach flexibility (Panel C), and self-esteem (Panel D).

Figure 2 presents the six outcomes on which HIIT was significantly superior, with body-composition and quality-of-life changes diverging in opposing directions between groups: handgrip strength (Panel A), body weight (Panel B), BMI (Panel C), body fat percentage (Panel D), skeletal muscle mass (Panel E), and quality of life (Panel F).

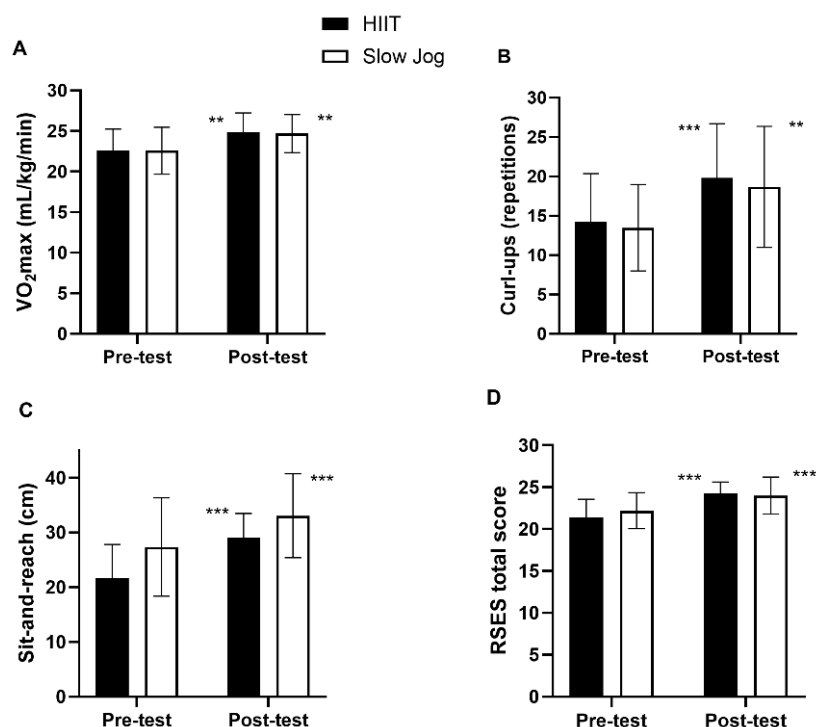


Figure 1. Pre-to-post changes in convergent outcomes. HIIT (black) and slow jogging (white), mean $\pm$ SD, $n = 15$ per group. ** $p < .01$, *** $p < .001$ (within-group). All between-group comparisons non-significant.

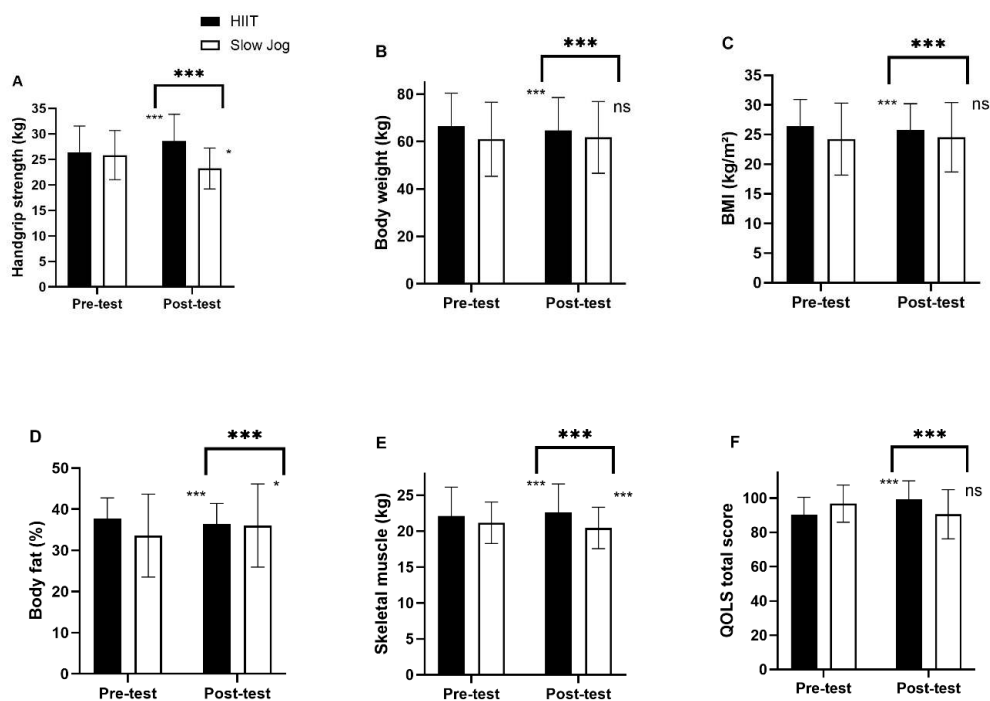


Figure 2. Pre-to-post changes in divergent outcomes. HIIT (black) and slow jogging (white), mean $\pm$ SD, $n = 15$ per group. * $p < .05$, *** $p < .001$ (within-group); ns, not significant. Brackets denote between-group significance (*** $p < .001$, all six panels).

Discussion

This six-week randomised controlled trial compared HIIT and slow jogging on physical fitness and mental health in sedentary Malaysian women aged 24–34 years. Three findings emerge. First, both modalities produced significant within-group improvements in cardiorespiratory endurance, muscular endurance, flexibility and self-esteem, with no between-group differences. Either modality at the prescribed dose is sufficient for these outcomes. Second, HIIT was significantly superior to slow jogging on five outcomes: handgrip strength, all four body-composition variables and quality of life, with body-composition effect sizes ranging from $d = 1.44$ to 2.66 . Third, slow jogging produced statistically significant adverse changes in handgrip strength, body fat percentage and skeletal muscle mass, and a non-significant decline in quality of life. HIIT therefore delivers a comprehensive positive profile across physical and psychological domains, whereas slow jogging produces a mixed profile of benefits and detriments over six weeks.

Cardiorespiratory and Muscular Endurance

Both interventions improved VO_2 max by approximately 10%, consistent with evidence that high- and moderate-intensity aerobic exercise both improve cardiorespiratory fitness in sedentary populations (Morcillo-Losa et al., 2024; Weston et al., 2014). The observed gain ($\approx 2.2 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$, $\approx 0.6 \text{ MET}$) corresponds to an estimated 7–9% reduction in all-cause and cardiovascular disease mortality risk based on epidemiological exposure–response data (Myers et al., 2002). Head-to-head comparisons of HIIT with moderate-intensity continuous training in inactive adults have likewise reported equivalent or superior cardiorespiratory adaptations for HIIT despite shorter total exercise duration (Suhaimi et al., 2025; Syamsudin et al., 2023). The mechanisms differ: HIIT acts primarily through increased stroke volume and cardiac output during repeated near-maximal efforts (Gibala & Jones, 2013), whereas sustained moderate-intensity exercise drives oxidative-enzyme adaptation and capillarisation in working musculature. The convergent VO_2 max outcomes therefore indicate that, for sedentary adults beginning structured exercise, either approach is effective. The $\approx 39\%$ muscular-endurance gain in both groups likely reflects different proximate stimuli: dynamic core engagement during HIIT exercises in one group, and repetitive trunk stabilisation during sustained jogging in the other.

Handgrip Strength and the Specificity of Training Adaptation

The divergent handgrip outcomes directly illustrate the SAID (specific adaptation to imposed demands) principle. HIIT produced a measurable gain, whereas slow jogging produced a significant loss. The HIIT protocol included multiple upper-extremity-loaded exercises (burpees, push-ups, plank variations) sufficient to drive a measurable +8.5% strength gain over six weeks. Slow jogging isolates loading to the lower kinetic chain

and provides no concentric or isometric stimulus to grip musculature; the 10.1% decline among slow joggers is therefore consistent with mild detraining of an unstimulated motor system and reinforces the principle that aerobic training does not maintain upper-body strength without supplementary resistance loading (Donnelly et al., 2009). The practical implication is direct: sedentary women adopting low-intensity aerobic exercise as their primary modality should incorporate supplementary upper-body resistance work.

Body Composition

The body-composition results constitute the most clinically striking divergence in this study. HIIT produced favourable changes across all four indicators (weight -1.81 kg, BMI -0.67 kg·m⁻², body fat -1.34% , skeletal muscle $+0.43$ kg), whereas slow jogging produced no change in weight or BMI, a significant increase in body fat ($+2.44\%$) and a significant decrease in skeletal muscle (-0.73 kg). The change-score analysis confirms these differences as statistically and clinically meaningful (all $d > 1.40$, all $p < .001$). The HIIT profile aligns with the established mechanistic basis of high-intensity interval exercise: elevated post-exercise oxygen consumption, enhanced fat oxidation capacity and preservation or augmentation of lean mass through repeated dynamic loading (Maillard et al., 2018; Martins et al., 2016; Vigriawan et al., 2024).

The adverse profile in the slow-jogging group warrants careful interpretation. Three factors are likely. First, the InBody 270 has a documented test–retest variability of approximately 2–3% for body fat percentage, so part of the $+2.44\%$ body-fat change may reflect measurement noise rather than true physiological change; the parallel and statistically significant loss of skeletal muscle ($d = -1.35$) is, however, unlikely to be wholly attributable to measurement error (Larsen et al., 2021). Second, the prescribed 60–65% maximal heart rate dose may have been insufficient to elicit substantial fat oxidation, as intensities above 70% VO₂ max are typically required to produce a meaningful lipolytic response in untrained populations (Irving et al., 2008). Furthermore, the estimated cumulative energy expenditure of the protocol ($\approx 4,860$ kcal across 18 sessions, computed from Ainsworth et al., 2011) is theoretically inadequate for meaningful fat-mass reduction without concurrent dietary restriction, given that exercise-induced weight loss generally requires more than 150 minutes per week of moderate-intensity activity sustained for at least 12 weeks (Donnelly et al., 2009). Third, in the absence of dietary monitoring, compensatory increases in energy intake and reductions in non-exercise activity thermogenesis may have neutralised any negative energy balance. Both responses are well documented following exercise initiation, particularly in lower-intensity protocols (King et al., 2007). The loss of skeletal muscle mass is most plausibly attributable to insufficient mechanical and metabolic stimulus for muscle protein synthesis combined with potentially inadequate dietary protein intake. Collectively, these findings indicate that low-intensity aerobic exercise, when prescribed without resistance training and dietary support, may be insufficient and potentially counterproductive for body-composition improvement in sedentary women over short intervention periods.

Mental Health: Self-Esteem and Quality of Life

Both interventions produced significant improvements in self-esteem with no between-group difference, indicating that regular structured exercise, irrespective of intensity, confers measurable psychological benefit in previously inactive women. These improvements are consistent with the established mood-elevating effects of exercise, mediated by endorphin and neurotransmitter modulation, reduced systemic inflammation and increased self-efficacy arising from completion of a structured programme (Basso & Suzuki, 2017; Schuch et al., 2018). The quality-of-life findings, however, diverged sharply between modalities. HIIT produced a 9.8% improvement in QOLS scores, plausibly reflecting the convergence of substantial fitness gains, favourable body-composition change and the sense of accomplishment associated with demanding high-intensity sessions, a pattern consistent with meta-analytic evidence that HIIT produces small-to-moderate improvements in mental and overall quality of life across clinical and non-clinical populations (Edwards et al., 2024).

Slow joggers, by contrast, showed a 6.4% decline ($p = .061$ within-group; $p < .001$, $d = 1.53$ between-group). The within-group decline did not reach conventional significance, but its magnitude and direction warrant interpretation: plausible contributors include the monotony of sustained low-intensity continuous exercise, the absence of immediate performance feedback that characterises interval training, the time commitment without commensurate physical reward (particularly given the loss of grip strength and muscle mass), and the narrow daily schedule window. Whether these psychological responses generalise to other slow-jogging protocols or longer durations remains open, but the present finding signals that exercise modalities are not psychologically interchangeable and that low-intensity aerobic prescriptions without attention to perceived enjoyment and visible outcomes may compromise broader well-being.

Clinical and Practical Implications

These findings have direct implications for practitioners working with sedentary working-age women. HIIT should be prescribed as the primary modality, since three 30-minute sessions per week deliver comprehensive cardiorespiratory, muscular, body-composition and psychological adaptation within six weeks while addressing the time-availability barrier (Reljic et al., 2019). Low-intensity slow-jogging programmes, when used as the sole intervention, should be treated with caution given the observed adverse body-composition and quality-of-life trajectory; women who prefer lower-intensity modalities should not be prescribed slow jogging alone, but should supplement with at least two upper-body resistance sessions per week and explicit

dietary guidance to prevent net loss of skeletal muscle and elevated body fat. An integrated weekly schedule with two HIIT sessions, one slow-jogging session for low-impact volume and psychological recovery, and one resistance session for upper-body strength preservation represents a more defensible default prescription than either modality used alone.

Strengths and Limitations

Study strengths include the randomised design with confirmed baseline equivalence, use of a directly applicable comparator (slow jogging) rather than a non-exercise control, integration of physical and psychological outcomes, supervised delivery with 100% session attendance, and change-score analysis for between-group inference. Several limitations require explicit acknowledgement, each with its likely direction of bias. First, convenience sampling from a single residential training institute limits external validity. Findings should not be assumed to generalise to community-dwelling women, older women or other ethnic populations. Second, no a priori sample size calculation was performed. Non-significant between-group findings, notably self-esteem ($d = 0.60$ [$-0.13, 1.33$]), are likely Type II errors that bias the conclusions toward apparent equivalence where true differences may exist. Third, the absence of a non-exercise control precludes inference about absolute intervention effects relative to time and learning effects. The comparative-effectiveness design, however, still supports valid inference about HIIT's relative superiority. Fourth, dietary intake was not monitored. Compensatory eating and changes in non-exercise activity thermogenesis may have inflated the between-group body-composition divergence. Finally, menstrual cycle phase was not controlled, introducing random variability in body composition and performance but not systematic bias in group means.

Priority directions for future research include longer-duration trials (≥ 12 weeks) to test whether body-composition changes from slow jogging emerge over more extended windows, particularly when combined with dietary intervention. Three-arm designs comparing HIIT, slow jogging and a combined modality would clarify the optimal exercise prescription for sedentary women. Objective physical-activity monitoring (accelerometry) outside supervised sessions would allow examination of compensatory inactivity. Finally, cost-effectiveness analyses are needed to support translation of these findings into public-health programmes in Malaysia and comparable settings.

Conclusion

This study provided direct comparative evidence on two exercise modalities widely recommended for sedentary women, namely high-intensity interval training and slow jogging. It demonstrated that these modalities are not interchangeable in their effects on physical fitness and mental health. Both modalities produced comparable, significant improvements in cardiorespiratory endurance, muscular endurance, sit-and-reach flexibility, and self-esteem, indicating that for these specific outcomes either approach is sufficient at the prescribed dose. The results support time-efficient HIIT (three 30-minute sessions weekly) as the preferred primary modality for sedentary women seeking comprehensive benefit. Slow jogging, while psychologically and physically accessible, requires supplementary upper-body resistance training and dietary attention if used as the primary exercise mode; without these, short-term participation may produce net loss of skeletal muscle mass and elevated body fat.

Declaration of generative ai and ai-assisted technologies

During the preparation of this work, the author(s) used Claude (Anthropic) in order to correct sentences grammatically and to refine the language and enhance readability. After using this tool, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

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Conflict of interest statement

The authors declare no conflicts of interest associated with this research. The study received no funding from commercial, public, or not-for-profit organisations.

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