Journal of Human Movement Science (2026)
Clausius Scientific Press, Canada

DOI: 10.23977/jhms.2026.070101
ISSN 2523-5850 Vol. 7 Num. 1

Effects of Recreational Basketball and Tabata Training on Body Composition in Overweight and Obese Young Men

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Keywords: High intensity interval training; Modified Small-Sided games; Recreational basketball; Tabata training; Body composition; Overweight/obesity young men

Abstract: This study aimed to investigate the effects of recreational basketball and Tabata training on body composition in overweight and obese male youth. Forty-five male university students(age 20.2±1.3) were recruited and randomly assigned into three groups consisting of experimental [MSSG (n=12) and HIIT (n=14)] and control groups (n=14). Participants completed a 12-week intervention (3 sessions/week). The MSSG group performed small-sided games on a modified basketball court, whereas the HIIT group completed Tabata training on an outdoor playground. The control group maintained their usual daily routines and no training. Anthropometric measurements were used to assess changes in body mass index (BMI), waist-to-hip ratio (WHR), body fat percentage (BF), and fat mass (FM) before and after the intervention. After 12 weeks, both the MSSG and HIIT groups showed significant lower BMI, WHR, BF% and FM compared to the control group ($p < 0.05$). However, no significant differences were observed between the experimental groups. In conclusion, both recreational basketball and Tabata training effectively improved body composition in overweight and obese male youth, highlighting the comparable effectiveness of these two training modalities. Moreover, recreational basketball demonstrated a slight higher scores than HIIT, MSSG may represent a new exercise strategy for promoting long-term adherence among obese young men.

1. Introduction

Overweight and obesity among adolescents represent one of the most serious public health challenges of the 21st century, affecting countries worldwide [1]. The primary factors contributing to the increased risk of obesity include unhealthy dietary habits, insufficient physical activity, and increased sedentary behavior. Data from the World Health Organization (WHO) indicate that obesity has become a major risk factor for cardiovascular diseases, type 2 diabetes, and metabolic syndrome. Of particular concern is that the majority of adolescents fail to meet recommended levels of physical activity, despite substantial evidence demonstrating the health benefits of regular exercise [4]. For overweight and obese youth, improving body composition, specifically reducing body weight, decreasing body fat percentage (BF), and lowering fat mass (FM), constituted a

primary objective of exercise-based interventions.

Although traditional moderate-intensity continuous training (MICT) has been shown to be effective in improving body composition, its long duration and monotonous nature often result in poor exercise adherence among young populations. In recent years, high-intensity interval training (HIIT) has been widely applied in studies focusing on fat loss and cardiorespiratory fitness due to its time-efficient and high-effectiveness characteristics. One specific form of interval training, known as Tabata training, was established in 1996 and consists of repeated bouts of 20 seconds of high-intensity exercise interspersed with 10 seconds of brief recovery. This innovative training protocol, typically involving functional movements or bodyweight exercises, has been shown to significantly improve physical fitness, aerobic and anaerobic capacity, and body composition [2].

Small-sided basketball games can effectively simulate the intensity of competitive match play while providing meaningful training stimuli, as well as incorporating elements of teamwork and enjoyment. Moreover, basketball requires minimal space and equipment and is relatively easy to implement, making it a potentially ideal exercise option for overweight and obese male youth.

Given the popularity of both Tabata training and basketball among young populations, comparing the effects of team-based recreational basketball and individual-based Tabata training on body composition in overweight and obese male youth is of considerable practical and scientific significance. Although research on HIIT interventions for obese populations is relatively well established, studies directly comparing recreational team sports such as basketball with Tabata-based individual training, particularly with respect to changes in body composition, remain limited. Therefore, the present study aimed to investigate the effects of recreational basketball and Tabata training on body composition in overweight and obese male youth, with the hypothesis that exercise interventions would induce significant improvements in body composition in this population.

2. Methods

2.1 Study Design

This study adopted a 12-week randomized controlled trial design and was conducted on a university basketball court and outdoor playground. The experimental protocol was implemented from October to December 2024, with a total duration of three months (12 weeks). One week prior to the commencement of the intervention (Week 0), baseline anthropometric measurements were collected, including height, body weight, body mass index (BMI), waist circumference, hip circumference, and skinfold thickness.

Following baseline assessments, participants were randomly assigned to one of three groups: the modified small-sided games group (MSSG), the high-intensity interval training group (HIIT), or the control group (CG), which received no additional exercise intervention. The intervention period lasted for 12 weeks. Upon completion of the intervention, all anthropometric measurements were reassessed using the same procedures as those applied at baseline.

2.2 Participants

This randomized study compared the effects of a recreational basketball program and Tabata training on overweight and obese male university students. A total of 45 overweight and obese male undergraduates from different academic classes at Hainan Vocational University of Science and Technology were recruited to participate in the study. Participants were randomly allocated to the MSSG group (n = 15; height: 172.58 ± 3.56 cm; age: 20.16 ± 1.90 years), the HIIT group (n = 15; height: 171.92 ± 7.21 cm; age: 20.25 ± 1.50 years), and the control group (n = 15; height: 173.60 ±

4.46 cm; age: 19.85 ± 1.09 years). All three groups continued to attend one regular physical education class per week.

All participants were free from known medical conditions. Inclusion criteria required participants to be aged between 18 and 22 years, have a body mass index (BMI) greater than 25 $kg \cdot m^{-2}$ according to age- and sex-specific criteria, not be taking any medications that could influence the study outcomes, and not have participated in any structured physical training programs for at least six months prior to the study, with the exception of mandatory university physical education classes (≤90 min per week).

All participants were fully informed of the potential risks associated with the experimental procedures and provided written informed consent prior to participation. Participants were informed of their right to withdraw from the study at any time without penalty. This study was conducted in accordance with the principles of the Declaration of Helsinki and was approved by the Institutional Review Board (Ethics Committee) of the Faculty of Sports Science and Coaching, Sultan Idris Education University (UPSI) (Approval No.: 2024-0525-01).

2.3 Procedures

All body composition measurements were conducted at the same school sports hall during both baseline and post-intervention assessments. Measurements were performed in the early morning, before 10:00 a.m., on both occasions. To ensure consistency, all tests were administered by the same researchers and followed the same measurement sequence at baseline and post-intervention.

Participants were measured barefoot and wearing minimal clothing for the assessment of height and body weight. Prior to testing, participants were instructed to empty their bladder, avoid excessive fluid intake, and maintain their usual breakfast habits without deviation.

Body weight and height were measured using a Xiaomi eight-electrode bioelectrical impedance scale (S800, China) and a calibrated stadiometer (China), with an accuracy of 0.1 kg and 0.1 cm, respectively. Body mass index (BMI) was calculated using the standard formula: body weight divided by height squared ($kg \cdot m^{-2}$).Waist and hip circumferences were measured using a flexible measuring tape with a precision of 0.1 cm. Skinfold thickness was assessed using a Harpenden skinfold caliper (Baty International, West Sussex, UK) at four anatomical sites: triceps, suprailiac, abdominal, and thigh. All skinfold measurements were recorded in millimeters. According to Jackson et al. (1985) 4-point skinfold equation for males (used to calculate % body fat) % body fat = (0.29288 x sum of skinfolds) - (0.0005 x square of sum of skinfolds) + (0.15845 x age) - 5.76377, where the skinfold sites (measured in mm) were the abdomen, triceps, thighs, and suprailiac muscles, the body fat percentage (BF%) and the fat mass (FM)[3].

2.4 Data Collection

It is widely recommended that adolescents engage in at least 60 minutes of moderate-to-vigorous physical activity per day, corresponding to a minimum of 420 minutes per week [4].The intervention protocol consisted of recreational modified small-sided basketball games (MSSG) performed three times per week for the MSSG group and Tabata-based high-intensity interval training conducted three times per week for the HIIT group. The intervention period lasted for 12 weeks. The control group did not participate in any additional training beyond their regular physical education classes.

Each training session began with a standardized 15-minute warm-up, consisting of 5 minutes of light jogging, followed by 5 minutes of dynamic stretching and 5 minutes of sport-specific warm-up activities related to basketball or Tabata exercises. The main training component included a 4-minute Tabata protocol for the HIIT group and a 4-minute 3v3 half-court basketball game for the MSSG group. The duration of each MSSG bout was strictly controlled to match that of the Tabata

protocol [5].

For the MSSG group, games were conducted in a 3v3 format on a half-court basketball court measuring 15 m × 14 m. Participants were randomly assigned to teams composed of guards, forwards, or centers to ensure balanced team composition. Heart rate was continuously monitored during training sessions using FitMao smart wristbands. Each training bout lasted 4 minutes and was followed by a 3-minute passive recovery period.

In the HIIT group, participants completed one Tabata set consisting of eight exercises performed in synchrony with Tabata music. In the MSSG group, participants engaged in a 4-minute 3v3 half-court basketball game, during which the score remained unchanged to maintain continuous play. Coaches provided strong verbal encouragement throughout all training sessions to enhance participant motivation. Each session concluded with a 5-minute cool-down period.

Training intensity was monitored using heart rate data collected via the FitMao smart wristbands in combination with ratings of perceived exertion (RPE) assessed using a 10-point scale. Heart rate and RPE values were recorded within 5–10 seconds after the completion of each training bout. Exercise intensity was regulated to remain between 70% and 90% of maximal heart rate to ensure both training effectiveness and participant safety.Both the HIIT and MSSG interventions followed a progressive overload principle, with training load gradually increasing over time[6]. The intervention was divided into three phases. During Phase 1 (Weeks 1–4), participants completed four training bouts per session, each lasting 4 minutes with 3 minutes of passive recovery between bouts. During Phase 2 (Weeks 5–8), the training volume increased to five bouts per session. During Phase 3 (Weeks 9–12), participants completed six bouts per session, with all bouts maintaining a duration of 4 minutes and 3 minutes of recovery between bouts.

Apart from the structured recreational basketball sessions and regular physical education classes, participants in both intervention groups did not engage in any additional organized physical activities. Throughout the 12-week intervention period, attendance rates exceeded 80%. During the intervention, three participants withdrew from the MSSG group, one from the HIIT group, and one from the control group. Consequently, a total of 40 participants were included in the final statistical analysis, as shown in Table 1.

Table 1: The description of 12-weeks HIIT/MSSG Training Plan

Intervention Group	Week	Duration and Frequency	Intensity
HIIT/MSSG	1-4	4set X 4min/3min rest	70%-80%HRmax
		Train time: 25min/time, 75min/per week	
		Total time: 45min/time, 135min/per week	
	5-8	5set X 4min/3min rest	75%-85%HRmax
		Train time: 32min/time, 96min/per week	
		Total time: 52min/time, 156min/per week	
	9-12	6set X 4min/3min rest	80%-90%HRmax
		Train time: 39min/time, 117min/per week	
		Total time: 59min/time, 177min/per week	

2.5 Statistical Analysis

Statistical analyses were performed using SPSS software (version 27.0; IBM Corp., Armonk, NY, USA). Prior to the main analyses, the data were screened for accuracy, missing values, outliers, and compliance with underlying statistical assumptions. Data normality was assessed using the Shapiro–Wilk test.A mixed-design analysis of variance (ANOVA) was employed to test the study hypotheses and to examine differences in all outcome variables across groups and experimental time points. When significant group × time interaction effects were detected, Bonferroni-adjusted

post hoc tests were conducted for pairwise comparisons. In addition, paired-samples t-tests were used to assess within-group changes in each variable from pre- to post-intervention.Changes in outcome variables were calculated as the difference between post-intervention and baseline values. One-way ANOVA was subsequently applied to compare the magnitude of changes among groups. The level of statistical significance was set at $p < 0.05$. Data are presented as mean ± standard deviation (M ± SD) or mean difference (MD), as appropriate.

3. Results

3.1 Adherence to the Exercise Program

During the intervention period, a total of three participants withdrew from the MSSG group, with two leaving due to scheduling conflicts with academic commitments and one withdrawing due to a finger injury. In the HIIT group, one participant withdrew due to personal family matters, and one participant in the control group (CON) was excluded for failing to complete the final assessment.

The overall mean attendance rate across the intervention was 92%. The primary reasons for non-participation were academic scheduling conflicts, minor injury, and failure to complete post-intervention measurements.

3.2 Body Composition Outcomes

The results of body composition measurements are presented in Table 2, which shows descriptive statistics for the two intervention groups and the control group at baseline and post-intervention. A significant group × time interaction was observed for body mass index (BMI; $p < 0.001$), waist-to-hip ratio (WHR; $p < 0.001$), body fat percentage (BF; $p < 0.001$), and fat mass (FM; $p < 0.001$).

Post hoc analyses indicated that participants in the MSSG group experienced significant improvements in BMI (−5.32%; $p = 0.04$), WHR (−3.26%; $p = 0.01$), BF (−9.40%; $p < 0.001$), and FM (−9.02%; $p = 0.02$). Similarly, participants in the HIIT group demonstrated significant reductions in BMI (−4.67%; $p = 0.04$), WHR (−1.10%; $p = 0.02$), BF (−7.41%; $p < 0.001$), and FM (−8.30%; $p = 0.02$).Overall, both the MSSG and HIIT interventions led to significant improvements in BMI, WHR, body fat percentage, and fat mass compared with the control group. However, no statistically significant differences were observed between the two intervention groups.

Table 2. Results for body composition; results are presented as mean ± standard deviation.

Variables	Group	Pre-test (*M* ±*SD*)	Post-test (*M* ±*SD*)	% Change	Mixed ANOVA	Pair Wise *comparisons*
BMI (kg/m^2)	MSSG(n=12)	30.1 ±2.1	28.5 ±1.9	-5.32	F (2.78, 51.49) = 26.35, p < .001	p = .04 < .05 and p = .04 < .05
	HIIT(n=14)	30.0 ±1.8	28.6 ±1.4	-4.67		
	CG(n=12)	30.2 ±2.6	30.1 ±2.6	-0.33		
WHR	MSSG(n=12)	.92 ±.03	.89 ±.02	-3.26	F (2.91, 54.01) = 19.76, p < .001	p = .01 < .05 and p = .02 < .05
	HIIT(n=14)	.91 ±.02	.90 ±.02	-1.1		
	CG(n=12)	.92 ±.02	.92 ±.01	0		
BF (%)	MSSG(n=12)	29.8 ±3.2	27.0 ±3.5	-9.4	F (4, 74) = 59.09, p < .001	p = .00 < .05 and p = .00 < .05
	HIIT(n=14)	29.7 ±2.8	27.5 ±2.7	-7.41		
	CG(n=12)	30.1 ±2.5	30.5 ±2.4	+1.33		
FM (kg)	MSSG(n=12)	26.6 ±5.1	24.2 ±4.0	-9.02	F (2.57, 47.66) = 56.22, p < .001	p = .02 < .05 and p = .02 < .05
	HIIT(n=14)	26.5 ±5.0	24.3 ±4.6	-8.3		
	CG(n=12)	26.9 ±5.7	28.6 ±5.6	+6.32		

Abbreviations: MSSG, Modified Small sided games; HIIT, high intensity interval training; CG, control group; BMI, body mass index; WHR, waist hip ratio; BF, body fat; FM, fat mass; M = Mean,

SD = Standard Deviation.

4. Discussion and Conclusion

Over the past two decades, the prevalence of overweight and obesity among adolescents has increased dramatically worldwide, partly due to insufficient physical activity and unhealthy dietary habits [7]. The present study aimed to investigate the effects of recreational team-based basketball and individual Tabata training on body composition in overweight and obese young adults. The results of this study demonstrated that, compared with the control group, both the MSSG and HIIT groups experienced significant improvements in body composition. Furthermore, between-group analyses, taking into account the within-group pre-to-post changes, indicated that both recreational basketball and Tabata training produced significant reductions in BMI, WHR, body fat percentage (BF%), and fat mass (FM).

The efficacy of high-intensity interval training in improving body composition has been well-documented in previous studies. For instance, Lu et al. (2023) reported that a 12-week functional Tabata HIIT intervention significantly reduced BF% and improved several cardiometabolic indicators in female university students. These effects are likely attributable to increased energy expenditure, as post-exercise oxygen consumption (EPOC) remains elevated for several hours following high-intensity exercise, contributing to additional caloric burn. Similarly, 3v3 small-sided basketball games involve frequent accelerations, decelerations, directional changes, and jumps, producing a heart rate pattern characterized by rapid oscillations that mimic interval training. Randers et al. (2018) found that a three-month 3v3 street basketball program improved physical fitness and led to broad improvements in health-related markers.

In the present study, reductions in body fat were similar between the MSSG and HIIT groups. BMI decreased by 1.6 and 1.4 units, respectively, and despite the relatively small sample size and a 12-week intervention period, BF% and FM were reduced by −2.8% to −2.2% and −2.4 to −2.2 kg, respectively. In contrast, the control group maintained stable body weight but exhibited an increase in FM. Notably, improvements in the MSSG group were slightly greater than those observed in the HIIT group, suggesting that recreational basketball may be particularly effective for improving body composition in overweight and obese male university students. This finding highlights the potential importance of structured and socially engaging exercise environments, such as recreational team sports, in promoting adherence and producing favorable health outcomes.

This study has several limitations. First, the sample size was small and included only overweight and obese male participants, with no female participants, limiting the generalizability of the findings. Second, no educational components or dietary controls were implemented during the intervention, which may have influenced the results.

In conclusion, the present study demonstrates that overweight and obese inactive young adults can achieve significant improvements in anthropometric and body composition parameters by participating in 12 weeks of recreational basketball and Tabata training. Compared with participants who maintained their usual lifestyle without exercise, these improvements were substantial. Recreational team-based basketball appears to be an effective and feasible strategy for improving body composition in overweight and obese male youth.

5. Practical Applications

Overall, both the MSSG and HIIT interventions elicited comparable improvements in body composition. Although no statistically significant differences were observed between the two groups, the MSSG group demonstrated slightly greater improvements. This suggests that recreational team-based sports may be more effective in increasing overall exercise energy

expenditure. Future studies could further explore the broader effects of recreational team sports on health and physical fitness outcomes in overweight and obese youth.

Conflict of interest

The author declared no conflict of interest

Acknowledgement

Funding: This research received no external funding.

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