2026
02

ORIGINAL ARTICLE

Effectiveness of a 5-week high-intensity interval training on endurance capacities and BMI reduction among overweight female student-athletes

Jet Longakit[1ABCDE], Deljun R. Rodriguez[2ACDE], Jessel Gay Wacan[3ABCD], Jay Carlo Bagayas[3ABCD], Mussar Salamat[3ABCD], Mara Cuya[3ABCD], Leonard John Carrillo[4ABCD], Earl Joshua Christian Andallaza[5ABCD], Yasmina Alag[6ABCD], Rolan Mancha[7ABCD]

[1] *Mindanao State University – Iligan Institute of Technology, Philippines*
[2] *Northwestern Mindanao State College of Science and Technology, Philippines*
[3] *Mindanao State University – General Santos, Philippines*
[4] *Caraga State University Cabadbaran Campus, Philippines*
[5] *Bukidnon State University-Damulog Campus, Philippines*
[6] *MSU Baloi Community High School, Philippines*
[7] *Agusan del Sur State College of Agriculture and Technology, Philippines*

Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

Abstract

Background and Study Aim Overweight among student-athletes can limit performance, endurance, and overall health. High-intensity interval training (HIIT) is a time-efficient approach that has been shown to improve fitness and body composition. This study examined the effectiveness of a 5-week HIIT program in enhancing endurance capacities and reducing body mass index (BMI) among overweight female student-athletes.

Material and Methods A total of 30 participants (BMI ⩾ 25), aged 18–21 years (M = 19.70, SD = 0.95), were randomly assigned to a training group (n = 15), which completed thrice-weekly training sessions, or to a control group (n = 15), which did not undertake structured exercise. Core endurance, strength endurance, cardiorespiratory endurance, and BMI were measured before and after the intervention.

Results The results showed significant improvements in all endurance measures and a decrease in BMI in the training group, while the control group showed minimal changes. These outcomes support evidence that short-term interval training produces rapid physiological gains. These gains include better aerobic capacity, increased muscular endurance, and favorable body composition changes.

Conclusions The findings highlight HIIT as a practical option for student-athletes with limited time, facilities, or weight-management challenges. Overall, the 5-week training protocol was effective in improving endurance and lowering BMI among overweight female student-athletes. Coaches, physical education instructors, and athletic programs are encouraged to incorporate structured training sessions to enhance performance and health. Future research should include longer interventions, larger and more diverse samples, and additional physiological and psychological measures.

Keywords: endurance, body mass index, high-intensity interval training, overweight, body composition

Introduction

Excess body weight and insufficient endurance remain relevant challenges in contemporary physical education and sport, particularly within university settings where academic demands often limit time for systematic training. Among female student-athletes, excess body mass may negatively affect aerobic capacity, muscular endurance, and overall functional readiness, thereby influencing both performance outcomes and health status. This issue is multifactorial and reflects the interaction of training load, lifestyle habits, and physiological characteristics specific to young women engaged in organized physical activity. In this context, the selection of training methods that are efficient, structured, and adaptable to limited time and resources represents an important practical consideration for educational and athletic programs.

In this context, overweight and obesity remain among the most pressing public health concerns worldwide, affecting adolescents and young adults across both general and athletic populations [1, 2, 3]. Rapid urbanization, sedentary lifestyles, academic demands, and irregular physical activity patterns have accelerated weight-related challenges in Asian regions, including Southeast Asia [4, 5, 6]. These trends are increasingly evident among student-athletes, who are typically presumed to possess superior physical fitness due to regular sport participation [7, 8, 9]. Excess body mass among

doi:0.15561/26649837.2026.0204

athletes compromises physiological efficiency, movement economy, and endurance capacity. It also elevates injury risk and limits training quality [10, 11, 12]. Empirical evidence consistently shows that overweight status negatively affects aerobic endurance, muscular endurance, and biomechanical efficiency. This constrains athletic development and long-term sport participation [13, 14, 15].

These concerns are particularly salient among female student-athletes, who face distinct physiological and performance-related constraints. Compared with their male counterparts, female athletes often demonstrate lower absolute strength, reduced aerobic capacity, and greater susceptibility to fatigue. This renders excess body mass a more pronounced barrier to performance [16, 17]. Overweight female athletes exhibit slower movement velocities, reduced muscular endurance, and impaired functional mobility. These factors adversely affect sport-specific skills such as jumping, sprinting, and directional changes [18, 19]. Within Asian collegiate contexts, these challenges are further compounded by nutritional imbalances, congested academic schedules, limited access to sport science support, and constrained training facilities, particularly in public universities [20, 21, 22]. Despite these realities, empirical investigations focusing specifically on overweight female student-athletes, especially within low- to middle-resource academic settings, remain limited. This underscores a critical contextual gap in the literature.

High-intensity interval training (HIIT) has emerged as a time-efficient and evidence-based strategy for improving cardiorespiratory fitness, muscular endurance, and body composition across diverse populations [23, 24]. Numerous studies demonstrate that short-term HIIT interventions can elicit rapid physiological adaptations. These include improved VO_2max, enhanced metabolic efficiency, and reductions in adiposity among overweight youth and adults [25, 26]. However, much of this evidence is derived from recreationally active or non-athlete samples. There is limited focus on overweight female student-athletes, who must simultaneously navigate sport training, academic obligations, and institutional constraints [18, 27, 28].

Existing studies indicate that, although the physiological efficacy of high-intensity interval training (HIIT) is well established, considerable variation remains in how HIIT protocols are structured, progressed, and implemented within real-world collegiate sport environments [7, 13, 29]. Research frequently focuses on singular outcomes, such as VO_2max or BMI, or on isolated endurance components, rather than on integrated endurance adaptations that more accurately reflect the multidimensional demands of sport performance [7, 13, 29]. Moreover, many interventions rely on specialized equipment, extended intervention durations, or laboratory-controlled conditions, which restrict their scalability and practical applicability in typical university athletic programs, particularly in resource-limited contexts.

Beyond HIIT, alternative training modalities, including resistance training, plyometrics, circuit training, and functional conditioning, have demonstrated effectiveness in improving endurance, strength, and body composition [30, 31, 32]. However, these approaches often require longer training periods, higher training volumes, or access to specialized facilities and equipment. Such requirements may reduce their feasibility within academic calendars and competitive schedules, especially for overweight female student-athletes who face concurrent academic, physiological, and institutional constraints.

Analysis of research findings has shown that structured and time-efficient training approaches can positively influence endurance-related performance and body composition in physically active populations. Researchers emphasize that training effectiveness is determined not only by exercise intensity, but also by how training protocols are organized, integrated, and adapted to educational and sporting contexts. Authors highlight that these considerations are particularly relevant for overweight female student-athletes, for whom excess body mass, limited resources, and academic demands interact and shape performance outcomes. At the same time, unresolved aspects related to the integrated development of multiple endurance components within short-term and systematically progressed training frameworks continue to limit their practical implementation in collegiate sport settings.

Within this framework, structured high-intensity interval training (HIIT) protocols that combine physiological effectiveness with practical feasibility may represent a relevant approach for addressing endurance development and body composition management among overweight female student-athletes under real-world university conditions.

The aim of this study was to examine the effectiveness of a 5-week high-intensity interval training (HIIT) program on endurance capacities and body mass index (BMI) among overweight female student-athletes.

Materials and Methods

Participants

A priori power analysis using G*Power (version 3.1.9.7) indicated that a minimum of 30 participants (15 per group) was required to detect a medium-to-large effect size (d = 0.65) with α = .05 and 80% power for an independent samples t-test. Thirty overweight female student-athletes (BMI ⩾ 25), aged 18–21 years (M = 19.70, SD = 0.95), enrolled during the 2025–2026 academic year, took part in the study. A purposive sampling strategy was used to identify eligible participants based on predetermined criteria: (a) BMI classification as overweight according to World Health Organization standards; (b) full-time college enrollment; (c) medical clearance for moderate-to-vigorous physical activity; (d) a minimum of three years of competitive experience as a student-athlete; and (e) provision of written informed consent. Participants with chronic illnesses, cardiovascular or metabolic disorders, or orthopedic injuries that could be aggravated by high-intensity exercise were excluded. Eligible participants were randomly assigned, using a computer-generated allocation process, to either the training group (n = 15) or the control group (n = 15). Baseline demographic characteristics of both groups are presented in Table 1.

Research Design

This study employed a quasi-experimental pretest–posttest control group design. Outcome variables were measured before and after a five-week intervention period. Testing sessions were conducted at the same time of day, under identical environmental conditions, and were supervised by the same evaluators to minimize measurement bias and procedural variability.

Procedures

The study adhered to institutional ethical standards and the Data Privacy Act of 2012. All participants were informed of the study's purpose, potential risks and benefits, confidentiality measures, and the right to withdraw without penalty. Written informed consent was obtained prior to participation. All procedures were reviewed and approved by the institutional ethics committee, and personally identifiable data were removed during coding, analysis, and reporting.

All outcome variables were assessed using standardized operational definitions and scoring criteria.

Core endurance was assessed using the forearm plank test. The test was defined as the duration (in seconds) for which the participant maintained a prone position supported on the forearms and toes, with the body forming a straight line from head to heels. The test was terminated when the participant could no longer maintain proper alignment or voluntarily stopped due to fatigue. One trial was recorded, and performance time was scored to the nearest second.

Strength endurance was measured using the maximum push-up test. Performance was defined as the total number of correctly executed push-ups performed continuously until volitional fatigue. A valid repetition required full elbow extension in the upper position and a 90° elbow bend in the lower position, with the body maintained in a straight line. The test ended when proper form could no longer be maintained for two consecutive repetitions.

Cardiorespiratory endurance was assessed using a step-based continuous movement test, as outlined in Table 2. Performance was scored based on the total number of correctly executed repetitions completed within the standardized test duration, following uniform verbal pacing cues.

Body mass index (BMI) was calculated as body

Table 1. Demographic characteristics of the participants

Demographic variable	Training group (n = 15)	Control group (n = 15)	Total (n = 30)
Age (years)	19.67 ± 0.98	19.73 ± 0.96	19.70 ± 0.95
Height (cm)	161.06 ± 3.41	162.67 ± 4.32	161.86 ± 3.91
Weight (kg) before training	68.73 ± 3.28	69.27 ± 3.92	69.00 ± 3.56
BMI (kg/m^2) before training	26.49 ± 1.07	26.18 ± 1.27	26.34 ± 1.17

Table 2. Endurance exercises

Test variable	Specific exercise	How to execute	Primary strength–endurance target
Core endurance	Plank	Maintain a straight body line on forearms	Core stability endurance
	Russian twists	Seated rotation side to side	Oblique endurance
	Leg raises	Raise legs to 90°, lower slowly	Lower abdominal endurance
Strength endurance	Squats	Bodyweight squat to 90°	Quadriceps and glute endurance
	Lunges	Alternating forward lunges	Unilateral leg endurance
	Step-ups	Step on platform; alternate legs	Lower body power–endurance
Cardiorespiratory endurance	Push-ups	Continuous push-ups at moderate tempo	Chest and arm endurance contributing to aerobic demand
	High knees	Rapid knee lifts to chest level	Aerobic capacity and heart rate elevation
	Jumping jacks	Full-body rhythmic jumps	Full-body aerobic endurance

mass (kg) divided by height squared (m²). Body mass was measured using a calibrated digital scale, and height was measured using a wall-mounted stadiometer. Participants were barefoot and wore light athletic clothing during all measurements.

Participants in the training group completed a structured five-week HIIT program, delivered three times per week (30–45 minutes per session). Each session consisted of a standardized 5-minute dynamic warm-up, the prescribed interval training protocol, and a 5-minute cool-down. All HIIT sessions were supervised by a certified physical education instructor with a minimum of five years of experience in athletic conditioning. Prior to the intervention, the instructor underwent protocol familiarization and standardization training to ensure consistency across sessions.

Training intensity was prescribed relative to maximum heart rate (MHR), estimated using the formula 220 − age. Heart rate was monitored using wearable heart-rate monitors during sessions to ensure participants remained within the prescribed intensity zones (70–95% MHR, depending on the week).

Rest intervals between work bouts were passive. During these intervals, participants stood or walked slowly in place without engaging in additional exercise. This rest modality was kept consistent across all sessions to ensure uniform physiological loading.

Adherence to the training protocol was monitored using session checklists completed by the supervising instructor. These checklists documented exercise order, work–rest ratios, and participant compliance. Any deviations were recorded and addressed immediately.

Participants assigned to the control group were instructed to maintain their usual daily routines and refrain from engaging in structured exercise programs. To monitor compliance, control group participants submitted weekly physical activity logs and step-count records, collected via mobile phone applications, for three nonconsecutive days including one weekend day. Submitted logs were reviewed weekly by the research team to verify adherence to low-to-moderate activity levels. Participants who reported engagement in new structured exercise were contacted for clarification. No participants were excluded due to noncompliance.

Training attendance was recorded for every HIIT session. Participants were required to attend at least 85% of sessions to be included in the final analysis. No dropouts occurred during the intervention period, resulting in a 100% retention rate. Mean session attendance was 96.4%.

The detailed structure and progression of the five-week HIIT program are presented in Table 3.

Statistical Analysis

Data were analyzed using JASP version 19.3.

Table 3. High-intensity interval training program

Week / Phase	**Description**	**Interval structure**	**Exercises used**	**Targeted structure**	**Intensity & rest**
Week 1 – Foundation circuit	Light-to-moderate load; introduction of all endurance components	20 s work : 40 s rest (8 rounds)	Core: Plank Strength: Squats Cardio: High knees	Baseline endurance, neuromuscular adaptation	70–75% MHR; 1:2 ratio
Week 2 – Integrated endurance circuit	Balanced circuits using all three test variables	30 s work : 30 s rest (10 rounds)	Core: Russian twists Strength: Lunges Cardio: Jumping jacks	Improved movement efficiency across endurance types	75–80% MHR; 1:1 ratio
Week 3 – High-load mixed endurance	Increased density, shorter rest; full-body stimulus	30 s work : 20 s rest (12 rounds)	Core: Leg raises Strength: Step-ups Cardio: High knees	Local muscular endurance and aerobic stamina	80–85% MHR; 3:2 ratio
Week 4 – Peak endurance conditioning	Multi-joint, multi-endurance combination sets	40 s work : 20 s rest (12–14 rounds)	Core: Plank → Russian twists Strength: Squats → Lunges Cardio: Jumping jacks	Peak strength and core endurance, higher energy demand	85–90% MHR; 2:1 ratio
Week 5 – Performance endurance circuit	Maximal intensity; preparation for post-tests	45 s work : 15 s rest (14–16 rounds)	Core: Leg raises → Plank Strength: Step-ups → Squats Cardio: High knees → Jumping jacks	Maximal endurance across core, strength, and cardio	90–95% MHR; 3:1 ratio

Descriptive statistics (means and standard deviations) were computed to summarize participant characteristics and test results. Independent-samples t-tests were used to compare differences between the training and control groups, while paired-samples t-tests were used to assess changes within each group from pretest to posttest. Effect sizes (Cohen's d) and 95% confidence intervals were reported to describe the magnitude of observed differences. A significance level of $p < .05$ was applied for all analyses.

Results

At baseline, independent-samples t-tests showed no significant differences between the training group and the control group across all measured variables. As shown in Table 4, core endurance did not differ significantly between groups, $t(28) = 0.43$, $p = .674$, indicating comparable core endurance prior to the intervention. Similarly, no significant differences were observed in strength endurance, $t(28) = 1.39$, $p = .176$, or cardiorespiratory endurance, $t(28) = −1.06$, $p = .299$, suggesting that both groups began with similar muscular and cardiovascular endurance capacities. Body mass index (BMI) was also statistically equivalent between the two groups, $t(28) = −0.69$, $p = .499$. These findings confirm that the two groups were homogeneous before the HIIT intervention, ensuring that post-test changes can be more confidently attributed to the training program rather than to baseline differences.

Post-test results revealed significant improvements in the training group compared to the control group across all endurance and BMI measures. As presented in Table 5, core endurance was significantly higher in the training group than in the control group, $t(28) = 10.76$, $p < .001$. This indicates substantial gains in trunk stability and endurance following the HIIT intervention. Strength endurance also showed a large between-group difference favoring the training group, $t(28) = 9.63$, $p < .001$. Improvements in cardiorespiratory endurance were even more pronounced, $t(28) = 15.09$, $p < .001$, reflecting robust cardiovascular benefits of the five-week HIIT program.

BMI significantly decreased in the training group compared to the control group, $t(28) = 6.07$, $p < .001$. This suggests that the intervention was effective in reducing body mass. Large effect sizes across all variables (Cohen's d = 2.22–5.51) indicate that the observed improvements were not only statistically significant but also practically meaningful, demonstrating the strong efficacy of the HIIT protocol.

Paired-samples t-tests presented in Table 6 showed that the training group improved significantly across all outcome measures. Core endurance increased markedly, $t(14) = 10.33$, $p < .001$, with a large effect size (Cohen's d = 2.67). Strength endurance also demonstrated a substantial increase, $t(14) = 16.84$, $p < .001$, and cardiorespiratory endurance improved to a similar extent, $t(14) = 16.83$, $p < .001$. These changes reflect strong muscular and aerobic adaptations in response to the HIIT program. Body mass index (BMI) decreased significantly from pre- to post-test, $t(14) = −10.55$, $p < .001$, indicating a notable reduction in body mass following the intervention. Very large effect sizes (Cohen's d = 2.72–4.35) further indicate the high effectiveness of the training program in improving fitness and modifying body composition.

In contrast, the control group showed minimal or inconsistent changes. Core endurance did not improve significantly, $t(14) = 1.38$, $p = .189$, and BMI

Table 4. Pre-test scores for the training and control groups

Test variable	Training group (M ± SD)	Control group (M ± SD)	t-value	p-value	Mean difference	95% CI (LL–UL)	Cohen's d
Core endurance	5.73 ± 0.88	5.87 ± 0.83	0.43	.674	0.13	−0.51 to 0.78	0.16
Strength endurance	4.80 ± 0.68	5.13 ± 0.64	1.39	.176	0.33	−0.16 to 0.83	0.51
Cardiorespiratory endurance	4.87 ± 0.74	4.60 ± 0.63	−1.06	.299	0.25	−0.78 to 0.25	−0.39
Body mass index	26.38 ± 0.94	26.10 ± 1.23	−0.69	.499	−0.27	−1.10 to 0.55	−0.25

Table 5. Post-test scores for the training and control groups

Test variable	Training group (M ± SD)	Control group (M ± SD)	t-value	p-value	Mean difference	95% CI (LL–UL)	Cohen's d
Core endurance	8.67 ± 0.49	6.07 ± 0.80	10.76	< .001	2.60	2.11–3.10	3.93
Strength endurance	8.40 ± 0.91	5.67 ± 0.62	9.63	< .001	2.73	2.15–3.32	3.52
Cardiorespiratory endurance	8.47 ± 0.52	5.07 ± 0.70	15.09	< .001	3.40	2.94–3.86	5.51
Body mass index	23.89 ± 0.77	25.87 ± 0.10	6.07	< .001	1.98	1.31–2.65	2.22

Table 6. Paired-samples t-test results for the training and control groups

Group	Variable	Pre-test (M ± SD)	Post-test (M ± SD)	t-value	Mean difference	p-value	Cohen's d
Training group	Core endurance	5.73 ± 0.88	8.67 ± 0.49	10.33	2.93	< .001	2.67
	Strength endurance	4.80 ± 0.68	8.40 ± 0.91	16.84	3.60	< .001	4.35
	Cardiorespiratory endurance	4.87 ± 0.74	8.47 ± 0.52	16.83	3.60	< .001	4.35
	BMI	26.38 ± 0.94	23.89 ± 0.77	−10.55	−2.50	< .001	−2.73
Control group	Core endurance	5.87 ± 0.83	6.07 ± 0.80	1.38	0.20	.189	0.36
	Strength endurance	5.13 ± 0.64	5.67 ± 0.62	3.23	0.53	.006	0.83
	Cardiorespiratory endurance	4.60 ± 0.63	5.07 ± 0.70	2.43	0.47	.029	0.63
	BMI	26.10 ± 1.23	25.87 ± 0.10	−1.49	−0.24	.158	−0.39

remained statistically unchanged, $t(14) = -1.49$, $p = .158$. However, small but statistically significant increases were observed in strength endurance, $t(14) = 3.23$, $p = .006$, and cardiorespiratory endurance, $t(14) = 2.43$, $p = .029$, with moderate effect sizes (Cohen's d = 0.63–0.83). These changes may be attributable to natural variation, routine academic physical activities, or increased familiarity with the testing procedures rather than structured training.

Discussion

This study examined the effects of a five-week high-intensity interval training (HIIT) program on endurance capacities and body mass index (BMI) among overweight female student-athletes. The findings showed that participants in the training group demonstrated significant improvements in core endurance, strength endurance, and cardiorespiratory endurance, along with a marked reduction in BMI. The study extends existing HIIT research by focusing on the contextual and structural implementation of a short-term, progressively organized training program within a real-world collegiate environment. Unlike interventions that emphasize isolated physiological outcomes, the applied program integrated core endurance, strength endurance, and cardiorespiratory endurance within a single framework. This framework was tailored to the constraints of university training schedules and facilities. The ecological validity of this approach enhances the relevance of the findings for coaches, physical educators, and athletic programs seeking time-efficient and scalable training strategies for overweight female student-athletes. These results provide empirical support for evidence indicating that short-term HIIT interventions are effective in improving physical fitness and body composition among overweight youth and young adults [33, 34].

Consistent with previous studies, the present findings align with research showing that 4–6 weeks of structured HIIT can substantially improve aerobic capacity, muscular endurance, and metabolic efficiency while reducing body mass indicators [35, 36, 37]. These adaptations are commonly attributed to the metabolic and neuromuscular demands imposed by repeated high-intensity bouts. Such demands stimulate mitochondrial biogenesis, enhance oxygen utilization, and elevate post-exercise energy expenditure [38, 39, 40]. While these physiological mechanisms are well established, the present study extends prior work by demonstrating that these adaptations can be achieved through an integrated, multi-endurance HIIT framework delivered within a condensed five-week format tailored to collegiate constraints.

A key contribution of the present study lies in its contextual and logistical relevance to Philippine collegiate institutions, where student-athletes often face limited access to training facilities, minimal sport science support, and congested academic schedules. Unlike laboratory-based or resource-intensive interventions reported in prior studies [40, 41], the HIIT protocol employed in this study relied exclusively on bodyweight-based exercises requiring minimal equipment and space. This allowed training sessions to be implemented in standard gymnasiums, open courts, or multipurpose halls. This design responds directly to institutional realities common in public universities, where equipment availability and dedicated training time are often constrained.

Furthermore, time efficiency represents a critical contextual feature of the present intervention. The five-week duration and thrice-weekly schedule were deliberately structured to align with academic calendars and competitive sport demands. This structure enabled conditioning improvements without excessive training volume. This aspect is particularly relevant for female student-athletes, who frequently balance academic workloads, training obligations, and sociocultural expectations that may limit sustained participation in extended exercise programs [27, 28]. By demonstrating meaningful improvements in endurance and BMI within a short-term and manageable training window, the present study offers a practical approach for institutions seeking to optimize athlete conditioning under time-limited conditions.

In addition to logistical constraints, cultural and participation-related factors further underscore the contextual significance of these findings. In many Asian and Southeast Asian settings, female athletes encounter barriers related to body image concerns, social expectations, and reduced encouragement for high-intensity training [18, 14]. Overweight female student-athletes may be particularly vulnerable to disengagement from training due to discomfort, perceived stigma, or fear of injury. The structured yet accessible nature of the HIIT program emphasized progressive overload, exercise variety, and manageable session lengths. These characteristics may help mitigate such barriers and support sustained engagement among female athletes. Compared with traditional moderate-intensity continuous training (MICT), the present findings further support evidence that HIIT provides comparable or superior benefits for endurance and body composition within shorter timeframes [39, 42]. Importantly, the integration of core endurance, strength endurance, and cardiorespiratory endurance within a single program reflects the multidimensional physical demands of sport rather than targeting isolated fitness components. This integrated approach distinguishes the present intervention from prior HIIT studies that predominantly focused on singular outcomes such as VO_2max or fat mass reduction [25, 43].

The practical implications of these findings for coaches, physical educators, and athletic administrators in Philippine and comparable collegiate contexts are noteworthy. The results suggest that structured, short-term HIIT programs can be feasibly embedded within physical education curricula, preseason conditioning, or in-season maintenance training. The observed reductions in BMI further indicate potential benefits for mitigating weight-related constraints on movement efficiency, fatigue, and injury risk among overweight female athletes [8, 10]. Thus, the present study supports HIIT not only as a performance-enhancing modality but also as an inclusive and context-sensitive strategy for promoting health and participation among female student-athletes.

Notwithstanding the promising outcomes, it is important to acknowledge several limitations of the present investigation. The sample size was small and limited to overweight female student-athletes from a single university. This restricts the generalizability of the findings to other populations, sports, or age groups. The intervention lasted five weeks, which reflects short-term adaptations but does not address long-term maintenance or potential plateaus in endurance or BMI improvements. In addition, BMI was used as the primary indicator of body composition. This measure does not distinguish between fat mass and lean mass, and more precise assessments, such as skinfold measurements, bioelectrical impedance, or dual-energy X-ray absorptiometry, would provide a clearer understanding of body composition changes. The study also did not assess psychological factors, including motivation, enjoyment, or perceived exertion, which are increasingly recognized as important determinants of adherence and performance in HIIT programs. Finally, variables such as dietary intake, sleep patterns, and external physical activity were not controlled, which may have influenced the results. Future research should include larger and more diverse samples, longer intervention periods, more comprehensive body composition assessments, and the inclusion of psychological and lifestyle factors to further clarify the effectiveness of HIIT in overweight young athletes.

Conclusions

This study provides empirical evidence that a 5-week high-intensity interval training (HIIT) program is an effective and time-efficient method for enhancing endurance capacities and reducing BMI in overweight female student-athletes. The substantial improvements in core endurance and cardiorespiratory endurance, together with marked changes in weight-related parameters, demonstrate that short-term HIIT can induce meaningful physiological adaptations despite a limited training duration. These findings are consistent with the growing body of literature supporting the effectiveness of HIIT in improving physical fitness and metabolic health in young overweight populations. The results also highlight the practical utility of HIIT in athletic and educational settings, given its minimal equipment requirements and suitability for individuals with limited training time. Although further research is needed to examine long-term effects, psychological responses, and broader population applicability, the present study supports the use of HIIT as an effective conditioning approach for improving athletic performance and health-related fitness in overweight female athletes.

Acknowledgements

The authors would like to express their sincere gratitude to the female student-athletes who participated in this study.

Conflict of Interest

The authors declare no conflict of interest.

References

1. Nicolucci A, Maffeis C. The adolescent with obesity: what perspectives for treatment? *Italian Journal of Pediatrics*, 2022;48(1): 9. https://doi.org/10.1186/s13052-022-01205-w
2. Hu J, Liu J, Wang J, Shen M, Ge W, Shen H, et al. Unfavorable progression of obesity in children and adolescents due to COVID-19 pandemic: A school-based survey in China. *Obesity*, 2021;29(11): 1907–1915. https://doi.org/10.1002/oby.23276
3. Deusdará R, De Moura Souza A, Szklo M. Association between Obesity, Overweight, Elevated Waist Circumference, and Insulin Resistance Markers among Brazilian Adolescent Students. *Nutrients*, 2022;14(17): 3487. https://doi.org/10.3390/nu14173487
4. Riaz M, Lodhi S. Beyond BMI: Exploring obesity trends in the south Asian region. *Obesity Pillars*, 2025;13: 100156. https://doi.org/10.1016/j.obpill.2024.100156
5. Awasthi A, Panduranga AB, Deshpande A. Prevalence of overweight/obesity in South Asia: A narrative review. *Clinical Epidemiology and Global Health*, 2023;22: 101316. https://doi.org/10.1016/j.cegh.2023.101316
6. Crouch E, Abshire DA, Wirth MD, Hung P, Benavidez GA. Rural–Urban Differences in Overweight and Obesity, Physical Activity, and Food Security Among Children and Adolescents. *Preventing Chronic Disease*, 2023;20: 230136. https://doi.org/10.5888/pcd20.230136
7. Matias CN, Campa F, Nunes CL, Francisco R, Jesus F, Cardoso M, et al. Phase Angle Is a Marker of Muscle Quantity and Strength in Overweight/Obese Former Athletes. *International Journal of Environmental Research and Public Health*, 2021;18(12): 6649. https://doi.org/10.3390/ijerph18126649
8. Baillot A, Chenail S, Barros Polita N, Simoneau M, Libourel M, Nazon E, et al. Physical activity motives, barriers, and preferences in people with obesity: A systematic review. Kumar S (ed.) *PLOS ONE*, 2021;16(6): e0253114. https://doi.org/10.1371/journal.pone.0253114
9. Hamer O, Larkin D, Relph N, Dey P. Fear-related barriers to physical activity among adults with overweight and obesity: A narrative synthesis scoping review. *Obesity Reviews*, 2021;22(11): e13307. https://doi.org/10.1111/obr.13307
10. Cavaggioni L, Gilardini L, Croci M, Formenti D, Merati G, Bertoli S. The usefulness of Integrative Neuromuscular Training to counteract obesity: a narrative review. *International Journal of Obesity*, 2024;48(1): 22–32. https://doi.org/10.1038/s41366-023-01392-4
11. Kimura T, Mącznik AK, Kinoda A, Yamada Y, Muramoto Y, Katsumata Y, et al. Prevalence of and Factors Associated with Sports Injuries in 11,000 Japanese Collegiate Athletes. *Sports*, 2023;12(1): 10. https://doi.org/10.3390/sports12010010
12. Moschonis G, Trakman GL. Overweight and Obesity: The Interplay of Eating Habits and Physical Activity. *Nutrients*, 2023;15(13): 2896. https://doi.org/10.3390/nu15132896
13. Jamka M, Mądry E, Krzyżanowska-Jankowska P, Skrypnik D, Szulińska M, Mądry R, et al. The effect of endurance and endurance-strength training on body composition and cardiometabolic markers in abdominally obese women: a randomised trial. *Scientific Reports*, 2021;11(1): 12339. https://doi.org/10.1038/s41598-021-90526-7
14. Makarewicz A, Jamka M, Geltz J, Śmidowicz A, Kokot M, Kaczmarek N, et al. Comparison of the Effect of Endurance, Strength, and Endurance-Strength Training on Inflammatory Markers and Adipokines Levels in Overweight and Obese Adults: Systematic Review and Meta-Analysis of Randomised Trials. *Healthcare*, 2022;10(6): 1098. https://doi.org/10.3390/healthcare10061098
15. Longakit J, Fajardo R, Coming L, Toring-Aque L, Aque FJr, Villaganas EJr, et al. Evaluating the effect of a 6-week progressive running interval training program on endurance and body mass index in overweight college students. *Pedagogy of Physical Culture and Sports*, 2025;29(4): 253–262. https://doi.org/10.15561/26649837.2025.0403
16. Jamka M, Makarewicz-Bukowska A, Bokayeva K, Śmidowicz A, Geltz J, Kokot M, et al. Comparison of the Effect of Endurance, Strength and Endurance-Strength Training on Glucose and Insulin Homeostasis and the Lipid Profile of Overweight and Obese Subjects: A Systematic Review and Meta-Analysis. *International Journal of Environmental Research and Public Health*, 2022;19(22): 14928. https://doi.org/10.3390/ijerph192214928
17. Jamka M, Piotrowska-Brudnicka SE, Karolkiewicz J, Skrypnik D, Bogdański P, Cielecka-Piontek J, et al. The Effect of Endurance and Endurance-Strength Training on Bone Health and Body Composition in Centrally Obese Women—A Randomised Pilot Trial. *Healthcare*, 2022;10(5): 821. https://doi.org/10.3390/healthcare10050821
18. Azmy U, Rahmaniah N, Renzytha AR, Atmaka DR, Pratiwi R, Rizal M, et al. Comparison of Body Compositions among Endurance, Strength, and Team Sports Athletes. *Sport Mont Journal*. 2023;21(3):45–50. https://doi.org/10.26773/smj.231007
19. Wang Z, Ma H, Zhang W, Zhang Y, Youssef L, Carneiro MAS, et al. Effects of Functional Strength Training Combined with Aerobic Training on Body Composition, Physical Fitness, and Movement Quality in Obese Adolescents. *Nutrients*, 2024;16(10): 1434. https://doi.org/10.3390/nu16101434
20. Qin G, Qin Y, Liu B. Association between BMI and health-related physical fitness: A cross-sectional study in Chinese high school students. *Frontiers in Public Health*, 2022;10: 1047501. https://doi.org/10.3389/fpubh.2022.1047501
21. Hermassi S, Chelly MS, Michalsik LB, Sanal NEM, D. Hayes L, Cadenas-Sanchez C. Relationship between fatness, physical fitness, and academic performance in normal weight and overweight schoolchild handball players in Qatar State. Ardigò LP (ed.) *PLOS ONE*, 2021;16(2): e0246476. https://doi.org/10.1371/journal.pone.0246476
22. Hermassi S, Van Den Tillaar R, Bragazzi NL,

Schwesig R. The Associations Between Physical Performance and Anthropometric Characteristics in Obese and Non-obese Schoolchild Handball Players. *Frontiers in Physiology*, 2021;11: 580991. https://doi.org/10.3389/fphys.2020.580991
23. Atakan MM, Li Y, Koşar ŞN, Turnagöl HH, Yan X. Evidence-Based Effects of High-Intensity Interval Training on Exercise Capacity and Health: A Review with Historical Perspective. *International Journal of Environmental Research and Public Health*, 2021;18(13): 7201. https://doi.org/10.3390/ijerph18137201
24. Coates AM, Joyner MJ, Little JP, Jones AM, Gibala MJ. A Perspective on High-Intensity Interval Training for Performance and Health. *Sports Medicine*, 2023;53(S1): 85–96. https://doi.org/10.1007/s40279-023-01938-6
25. Guo Z, Li M, Cai J, Gong W, Liu Y, Liu Z. Effect of High-Intensity Interval Training vs. Moderate-Intensity Continuous Training on Fat Loss and Cardiorespiratory Fitness in the Young and Middle-Aged a Systematic Review and Meta-Analysis. *International Journal of Environmental Research and Public Health*, 2023;20(6): 4741. https://doi.org/10.3390/ijerph20064741
26. Sabag A, Little JP, Johnson NA. Low-volume high-intensity interval training for cardiometabolic health. *The Journal of Physiology*, 2022;600(5): 1013–1026. https://doi.org/10.1113/JP281210
27. Borowiec J, Banio-Krajnik A, Malchrowicz-Mośko E, Kantanista A. Eating disorder risk in adolescent and adult female athletes: the role of body satisfaction, sport type, BMI, level of competition, and training background. *BMC Sports Science, Medicine and Rehabilitation*, 2023;15(1): 91. https://doi.org/10.1186/s13102-023-00683-7
28. Saenz C, Jordan A, Loriz L, Schill K, Colletto M, Rodriguez J. Low Energy Intake Leads to Body Composition and Performance Decrements in a Highly-Trained, Female Athlete: The WANDER (Woman's Activity and Nutrition during an Extensive Hiking Route) Case Study. *Journal of the American Nutrition Association*, 2024;43(3): 296–303. https://doi.org/10.1080/27697061.2023.2282614
29. Alizadeh S, Daneshjoo A, Zahiri A, Anvar SH, Goudini R, Hicks JP, et al. Resistance Training Induces Improvements in Range of Motion: A Systematic Review and Meta-Analysis. *Sports Medicine*, 2023;53(3): 707–722. https://doi.org/10.1007/s40279-022-01804-x
30. Longakit J, Aque FJr, Toring-Aque L, Lobo J, Ayubi N, Mamon R, et al. The effect of a 4-week plyometric training exercise on specific physical fitness components in U21 novice volleyball players. *Pedagogy of Physical Culture and Sports*, 2025;29(2): 86–95. https://doi.org/10.15561/26649837.2025.0202
31. Fu J, Zhang W, Xu X, Mao X, Wang L, Cai M, et al. The impact of 4-week high-intensity interval training on mental health and sleep quality in female college students with normal weight obesity: a randomized controlled trial. *Journal of Translational Medicine*, 2025;23(1): 1234. https://doi.org/10.1186/s12967-025-07276-7
32. Nugroho S, Nasrulloh A, Hadi Karyono T, Dwihandaka R, Kukuh W, Pratama. Effect of intensity and interval levels of trapping circuit training on the physical condition of badminton players. *Journal of Physical Education and Sport,* 2021;21(3):1981–7. https://doi.org/10.7752/jpes.2021.s3252
33. De Mello MB, Righi NC, Schuch FB, Signori LU, Da Silva AMV. Effect of high-intensity interval training protocols on VO2max and HbA1c level in people with type 2 diabetes: A systematic review and meta-analysis. *Annals of Physical and Rehabilitation Medicine*, 2022;65(5): 101586. https://doi.org/10.1016/j.rehab.2021.101586
34. Petersen MH, De Almeida ME, Wentorf EK, Jensen K, Ørtenblad N, Højlund K. High-intensity interval training combining rowing and cycling efficiently improves insulin sensitivity, body composition and VO2max in men with obesity and type 2 diabetes. *Frontiers in Endocrinology*, 2022;13: 1032235. https://doi.org/10.3389/fendo.2022.1032235
35. Santos A, Braaten K, MacPherson M, Vasconcellos D, Vis-Dunbar M, Lonsdale C, et al. Rates of compliance and adherence to high-intensity interval training: a systematic review and Meta-analyses. *International Journal of Behavioral Nutrition and Physical Activity*, 2023;20(1): 134. https://doi.org/10.1186/s12966-023-01535-w
36. Atakan MM, Guzel Y, Shrestha N, Kosar SN, Grgic J, Astorino TA, et al. Effects of high-intensity interval training (HIIT) and sprint interval training (SIT) on fat oxidation during exercise: a systematic review and meta-analysis. *British Journal of Sports Medicine*, 2022;56(17): 988–996. https://doi.org/10.1136/bjsports-2021-105181
37. Zeng J, Xu J, Xu Y, Zhou W, Xu F. Effects of 4-week small-sided games vs. high-intensity interval training with changes of direction in female collegiate basketball players. *International Journal of Sports Science & Coaching*, 2022;17(2): 366–375. https://doi.org/10.1177/17479541211032739
38. Yu H, Zhao X, Wu X, Yang J, Wang J, Hou L. High-intensity interval training versus moderate-intensity continuous training on patient quality of life in cardiovascular disease: a systematic review and meta-analysis. *Scientific Reports*, 2023;13(1): 13915. https://doi.org/10.1038/s41598-023-40589-5
39. Wang Z, Wang J. The effects of high-intensity interval training versus moderate-intensity continuous training on athletes' aerobic endurance performance parameters. *European Journal of Applied Physiology*, 2024;124(8): 2235–2249. https://doi.org/10.1007/s00421-024-05532-0
40. Milioni F, Millet GY, De Poli RAB, Brisola GMP, De Souza Malta E, Redkva PE, et al. Effects of 4-week high intensity interval training on anaerobic capacity, repeated-sprints performance and neuromuscular function. *Sport Sciences for Health*, 2024;20(3): 1109–1118. https://doi.org/10.1007/s11332-024-01214-8
41. Khalafi M, Mojtahedi S, Ostovar A, Rosenkranz SK, Korivi M. High-intensity interval exercise versus moderate-intensity continuous exercise on postprandial glucose and insulin responses: A systematic review and meta-

analysis. *Obesity Reviews*, 2022;23(8): e13459. https://doi.org/10.1111/obr.13459

42. Steele J, Plotkin D, Van Every D, Rosa A, Zambrano H, Mendelovits B, et al. Slow and Steady, or Hard and Fast? A Systematic Review and Meta-Analysis of Studies Comparing Body Composition Changes between Interval Training and Moderate Intensity Continuous Training. *Sports*, 2021;9(11): 155. https://doi.org/10.3390/sports9110155
43. Marcotte-Chénard A, Tremblay D, Mony MM, Boulay P, Brochu M, Morais JA, et al. Acute and Chronic Effects of Low-Volume High-Intensity Interval Training Compared to Moderate-Intensity Continuous Training on Glycemic Control and Body Composition in Older Women with Type 2 Diabetes. *Obesities*, 2021;1(2): 72–87. https://doi.org/10.3390/Obesities1020007

Information about the authors:

Jet Longakit; (Corresponding author); Asst. Prof; https://orcid.org/0000-0002-6193-7492; jet.longakit@g.msuiit.edu.ph; Department of Physical Education, College of Education, Mindanao State University-Iligan Institute of Technology; Iligan City, Philippines.

Deljun Rodriguez, PhD; https://orcid.org/0009-0006-2810-9894; deljun.rodriguez@nmsc.edu.ph; College of Education, Northwestern Mindanao State College of Science and Technology; Misamis Occidental, Philippines.

Jessel Gay Wacan; https://orcid.org/0009-0001-2685-4376; jesselgay.wacan@msugensan.edu.ph; Bachelor of Physical Education Department, College of Education, Mindanao State University - General Santos; General Santos, Philippines.

Jay Carlo Bagayas; Asst. Prof; https://orcid.org/0009-0005-4139-4418; jaycarlo.bagayas@msugensan.edu.ph; Bachelor of Physical Education Department, College of Education, Mindanao State University - General Santos; General Santos, Philippines.

Mussar Salamat; Asst. Prof; https://orcid.org/0009-0004-3635-7711; mussar.salamat@msugensan.edu.ph; Bachelor of Physical Education Department, College of Education, Mindanao State University - General Santos; General Santos, Philippines.

Mara Cuya; Asst. Prof; https://orcid.org/0009-0003-5574-0321; mara.cuya@msugensan.edu.ph; Bachelor of Physical Education Department, College of Education, Mindanao State University - General Santos; General Santos, Philippines.

Leonard John Carrillo; https://orcid.org/0009-0008-3792-1766; lvcarrillo@csucc.edu.ph; College of Industrial Technology and Teacher Education, Caraga State University Cabadbaran Campus; Cabadbaran City, Philippines.

Earl Joshua Christian Andallaza; https://orcid.org/0009-0001-7730-4024; earljoshuachristianandallaza@buksu.edu.ph; College of Education; Bukidnon State University-Damulog Campus; Don Carlos, Bukidnon, Philippines.

Yasmina Alag; PhD; https://orcid.org/0009-0002-9180-003X; yasmina.alag@g.msuiit.edu.ph; Mindanao State University - Baloi Community High School; Baloi, Lanao Del Norte, Philippines.

Rolan Mancha; PhD; https://orcid.org/0009-0004-2601-1899; rlmancha@asscat.edu.ph; College of Arts and Sciences, Agusan del Sur State College of Agriculture and Technology; Agusan del Sur, Philippines.

Cite this article as:

Longakit J, Rodriguez DR, Wacan JG, Bagayas JC, Salamat M, Cuya M, Carrillo LJ, Andallaza EJC, Alag Y, Mancha R. Effectiveness of a 5-week high-intensity interval training on endurance capacities and BMI reduction among overweight female student-athletes. *Pedagogy of Physical Culture and Sports,* 2026;30(2):111–120. https://doi.org/10.15561/26649837.2026.0204

Received: 15.12.2025
Accepted: 20.01.2026; Published: 30.04.2026