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THE EFFICACY OF MODERATE-INTENSITY TRAINING FOR OVERWEIGHT AND OBESE UNIVERSITY MALE STUDENTS

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Abstract: **Objective**: The purpose of this study was to examine the effectiveness of an eight-week moderate-intensity continuous training (MICT) intervention on body composition, cardiovascular fitness, and lower extremity (LE) muscle strength in overweight and obese young men. **Methods**: A total of fifty participants completed a supervised 8-week MICT program, which was conducted three times per week, with each training session consisting of 33-minute jogging or brisk walking at 65%-75% of their maximum heart rate (HRmax), a 10-minute warm-up, and a 5-minute cool-down. Body composition, the Cooper 12-minute run test (12CR), and the 30-second Chair Stand Test (30CST) were assessed before and after the intervention. **Results**: Following the intervention, participants showed significant reductions in body mass, BMI, waist circumference (WC), and waist-to-hip ratio (WHR) ($p < 0.001$). Additionally, there were significant improvements in both aerobic capacity, as measured by the Cooper 12-minute run distance ($p < 0.001$), and functional LE muscle strength, as measured by the 30CST ($p = 0.002$). **Conclusion**: The eight-week MICT program effectively improved body composition, cardiovascular fitness, and functional LE muscle strength in overweight and obese young men. These findings support the potential of MICT as a viable exercise strategy for weight management and health improvement in university settings.
Keywords: Exercise training; Weight loss; Physical fitness; Young adult; 30-second Chair Stand Tests

1 INTRODUCTION

The global prevalence of obesity among young adults has risen rapidly in recent years, becoming a serious public health challenge. Obesity not only significantly increases the risk of chronic diseases such as cardiovascular disease, type 2 diabetes, and metabolic syndrome, but also has detrimental impacts on their psychological well-being, social life, and future quality of life [1,2]. A previous study has shown that obesity during young adulthood often continues into later life, further exacerbating the incidence rates of chronic diseases and mortality[3]. Therefore, Efficient interventions for preventing obesity and enhancing long-term health outcomes are essential in this pivotal life stage.

Moderate-intensity continuous training (MICT) not only improves adipose tissue metabolism but also boosts aerobic capacity by improving oxygen utilization efficiency[4,5]. MICT has been proven to be a more sustainable exercise modality, especially for those who are overweight and obese, as it is suitable for maintaining long-term adherence. Furthermore, apart from its cardiovascular benefit, MICT also has a positive effect on muscle fitness.[6]. Enhanced LE muscle strength can improve mobility and help prevent functional impairments caused by obesity, which is critical for obese individuals' quality of life.

Previous studies have confirmed the physical and mental health benefits of MICT for obese populations. Still, its impact on LE functional muscle strength in obese individuals remains unthoroughly explored. This study applies the 30-Second Chair Stand Test (30CST) to measure LE strength, which reflects functional fitness in daily activities among obese individuals. By testing body composition, cardiorespiratory fitness, and muscular fitness, this study aims to investigate the impacts of an eight-week MICT intervention on obese university students to provide effective strategies for weight management programs in university settings.

2 MATERIALS AND METHODS

2.1 Participants

The participants of this study were overweight and obese male university students recruited from a local university. The inclusion criteria were as follows: 1) age 18-23 years; 2) BMI $\geqslant$ 24 kg/m²; 3) lack of regular physical activity; 4) self-reported consistent weight (±2 kg) throughout the previous three months; and 5) non-smoker. Participants who reported any symptoms identified by the Physical Activity Readiness Questionnaire (PAR-Q) were excluded. Following a thorough comprehension of the study's objectives and requirements, all participants provided written informed consent.

2.2 Study Procedure

Following the screening, 50 eligible individuals were enrolled to evaluate the efficacy of eight-week moderate-intensity continuous training (MICT) on weight loss and fitness parameters in overweight and obese university students. Participants engaged in three supervised MICT sessions per week, each session consisting of a standardized 33-minute

jogging or brisk walking exercise at 65%–75% of their maximum heart rate (HRmax), which was monitored by Polar Team Pro heart rate monitors and the Rate of Perceived Exertion (RPE) scale to ensure adherence to the prescribed intensity. Additionally, each session included a 10-minute warm-up and a 5-minute cool-down. Prior to the intervention, participants also attended a single educational session on healthy diet and sleep patterns.

2.3 Testing Protocol

Baseline and post-intervention evaluations were conducted under standardized conditions. The assessments included body mass, body mass index (BMI), waist circumference, the Cooper 12-minute run, and the 30-second chair stand test. Prior to baseline measurements, participants were invited to the laboratory in order to familiarize them with all the tests and training protocols and provided informed consent. Baseline assessments were conducted on two separate days, ensuring a minimum interval of 24 hours between each test and completed at least 72 hours before the commencement of the training program. The testing procedures were as follows:

2.3.1 Measurement of body composition

Anthropometric measurements included height, weight, BMI, waist circumference (WC), hip circumference (HC), and the waist-to-hip ratio (WHR). Participants were instructed to arrive at the laboratory in the morning on the day of the test, fast for at least 12 hours, and refrain from vigorous physical activity for 48 hours. Height and weight were measured with participants wearing light clothing and without shoes, using a standard stadiometer (accurate to 0.1 cm) and a digital scale (accurate to 0.1 kg). The BMI was calculated by dividing body weight (kg) by the square of height (m2). WC and HC were measured using a flexible tape measure, with WC taken at the level of the umbilicus and HC taken from the femur trochanter major. Both measurements were recorded in centimeters (accurate to 0.1 cm), and the WHR was calculated by dividing WC by HC. All measurements were conducted during the exhalation phase, with participants standing on both feet.

2.3.2 Physical fitness test

30-Second Chair Stand Test: Before the pre-test, participants were provided with detailed instructions, followed by a 10-second practice session. Participants began the test sitting in a 45-cm-high armless chair positioned against a wall. The investigator instructed participants to perform sit-to-stand movements as quickly and fully as possible within 30 seconds, while keeping their feet flat on the floor and their arms crossed over their chests. To ensure chair stability, an investigator braced the front leg of the chair with a foot and provided guidance and encouragement throughout the test. Another investigator counted the number of sit-to-stand cycles and timed the test. Each participant performed two trials, with the best result recorded. A 60-second rest period was provided between trials, with an additional 30-second rest period allowed between the familiarization trial and the first trial.

Cooper test: The Cooper 12-minute run test took place on a standard 400-meter track. Participants were encouraged to run or jog to complete as much distance as possible within the 12 minutes. At the end of 12 minutes, the total distance was immediately recorded by the investigator (in meters), and this distance was used to evaluate the participant's aerobic capacity.

2.4 Statistical Analysis

Data are presented as mean ± standard deviation and were analyzed using SPSS version 26.0 (Chicago, IL, USA). The normality of the data distribution was assessed using the Shapiro-Wilk test. Paired *t*-tests were conducted to examine the statistical significance of the outcomes for pre- and post-intervention results. A significance level of $p < 0.05$ was set for all statistical tests.

3 RESULTS

3.1 Body Composition

As shown in Table 1, participants experienced a significant reduction in body mass following the intervention (pre: 87.3 ± 13.3 kg, post: 83.6 ± 13.1 kg, $p < 0.001$). Similarly, BMI decreased from 28.7 ± 3.3 kg/m² at baseline to 27.5 ± 3.4 kg/m² post-intervention ($p < 0.001$). Additionally, there was a noticeable improvement in waist circumference (WC), which dropped from 97.9 ± 9.9 cm to 93.8 ± 10.2 cm ($p < 0.001$), suggesting a reduction in central adiposity. Hip circumference (HP) followed a similar trend, decreasing from 109.2 ± 7.01 cm to 106.6 ± 7.2 cm ($p < 0.001$). Moreover, the waist-to-hip ratio (WHR) exhibited a significant decrease from 0.89 ± 0.04 to 0.87 ± 0.04 ($p < 0.001$), further highlighting the reduction in central fat distribution. These results suggest that MICT is effective in promoting weight loss and reducing both overall and central adiposity, including improvements in fat distribution, as reflected by the decrease in WHR.

Table 1 Results of Body Composition and Physical Fitness

	Pre	Post	*p*
Body mass(kg)	87.3±13.3	83.6±13.1	<0.001
BMI(kg/m^2)	28.7±3.3	27.5±3.4	<0.001

WC(cm)	97.9±9.9	93.8±10.2	<0.001
HP(cm)	109.2±7.01	106.6±7.2	<0.001
WHR	0.89±0.04	0.87±0.04	<0.001

Observed values are expressed as means ± standard deviation. BMI: body mass index, WC: Waist circumference, HP: Hip circumference, WHR: Waist Hip Ratio

3.2 Physical Fitness

After the eight-week MICT intervention, Significant enhancements in both aerobic capacity and LE muscle strength were observed among the participants. Firstly, the Cooper 12-minute run (12CR) distance increased(pre: 1972 ± 232.6 m, post: 2204 ± 257.0 m, $p < 0.001$), highlighting improved cardiovascular fitness. Additionally, the number of repetitions in the 30-Second Chair Stand Test (30CST) increased from 27.2 ± 4.7 to 29.9 ± 5.7 ($p = 0.002$), indicating a notable improvement in functional LE muscular strength (Table 2).

Table 2 Results of the Functional Capacity

	Pre	Post	*p*
12CR (m)	1972±232.6	2204±257.0	<0.001
30CST(repetitions)	27.2±4.7	29.9±5.7	0.002

Observed values are expressed as means ± standard deviation. 12CR: Cooper 12-minute run, 30CST: 30-Second ChairStand Test.

4 DISCUSSION

Significant improvements in both body composition and physical fitness were observed among overweight and obese young men following the eight-week moderate-intensity continuous training (MICT) intervention.These findings are consistent with previous studies, further supporting the efficacy of MICT in reducing body weight, BMI, waist circumference, hip circumference, and waist-to-hip ratio (WHR), as well as enhancing cardiovascular fitness and functional LE muscular strength [3,7]. MICT has been proven to be an effective, safe, and practical exercise modality, particularly suitable for populations with a lack of physical activity experience, such as overweight and obese university students.

Waist circumference (WC) and waist-to-hip ratio (WHR), both important markers of central obesity, are closely associated with cardiovascular risk and metabolic disorders [8]. The reductions in waist circumference and WHR observed in this study suggest that MICT is effective in reducing central fat distribution. Regular moderate-intensity exercise promotes sustained fat oxidation, leading to a gradual reduction in visceral fat [9]. This is particularly important for overweight and obese individuals, as central obesity is a major predictor of cardiovascular morbidity and mortality [8].

After the intervention, the increse in Cooper 12-minute run distance demonstrated significantly enhanced aerobic capacity in participants. This is a crucial outcome, as improvements in aerobic fitness are strongly associated with better health outcomes in overweight and obese populations. Studies have shown that even moderate improvements in aerobic capacity can lower the risk of cardiovascular disease, diabetes, and overall mortality [10]. Additionally, the significant increase in the number of repetitions in the 30-Second Chair Stand Test reflects improved functional LE muscular strength, which is essential for functional mobility and daily activities. Overweight and obese individuals often experience lower LE muscular fitness due to excess body weight, making these improvements particularly valuable for enhancing quality of life [11].

5 LIMITATION

The 8-week moderate-intensity continuous training intervention, while demonstrating significant benefits for overweight and obese young men, has several limitations. Firstly, the study sample were young male university students, which restricts the generalizability of the findings to other populations, such as females, older adults, or individuals with more diverse health conditions. Future research should include a more diverse population in order to evaluate the impacts of MICT among various age cohorts and genders. Second, the study primarily focused on body composition and basic fitness measures, such as aerobic capacity and muscular endurance. While these are important health indicators, more comprehensive assessments, including metabolic markers (e.g., insulin sensitivity, lipid profiles), psychological outcomes (e.g., motivation, mental well-being), and long-term follow-up data, would provide a more holistic view of the benefits of MICT. By addressing these limitations, future research can further validate and expand upon the findings, providing a deeper understanding of the role of MICT in managing obesity and enhancing health outcomes in diverse populations [12].

6 CONCLUSION

In conclusion, the 8-week moderate-intensity continuous training (MICT) intervention demonstrated significant benefits in improving body composition, cardiorespiratory fitness, and muscular fitness, verifying its effectiveness as a weight management strategy to enhance physical fitness in overweight and obese young men.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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