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The effect of 12-week step and floor aerobic exercise programs on physical and psychophysiological health parameters in obese men

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Wpływ 12-tygodniowych programów ćwiczeń aerobowych na fizyczne i psychofizjologiczne parametry zdrowotne otyłych mężczyzn

Streszczenie

Ćwiczenia aerobowe zalecane są w celu zapobiegania i kontrolowania nadwagi i otyłości. Niniejsze badanie miało na celu ocenę skuteczności dwóch 12-tygodniowych programów ćwiczeń aerobowych w poprawie stanu zdrowia fizycznego i psychofizjologicznego otyłych mężczyzn. Sześćdziesięciu dorosłych mężczyzn w średnim wieku 18,92 (SD 1,54 lat) i wskaźniku masy ciała (BMI) ≥ 30 kg/m^2 zostało losowo przydzielonych do trzech równych (n = 20) grup: trening aerobowy z wykorzystaniem stepów (SAET), trening aerobowy bez stepów (FAET) lub grupa kontrolna (która nie podejmowała aktywności fizycznej). Procedury treningowe SAET i FAET wykonywano trzy dni w tygodniu przez 12 tygodni. Wybrane parametry zdrowotne (fizyczne i psychofizjologiczne) oceniono na początku badania i po 12 tygodniach. Stwierdzono istotne różnice w zakresie parametrów zdrowia fizycznego i psychofizjologicznego u uczestników, którzy przeszli trening SAET i FAET w porównaniu z grupą kontrolną (p < 0,05). SAET i FAET okazały się pomocne w poprawie zdrowia fizycznego i psychicznego otyłych mężczyzn. Aby uzyskać lepsze perspektywy zdrowotne, szkoły i uczelnie wyższe powinny organizować sesje ćwiczeń aerobowych dla dorosłych.

Słowa kluczowe: aerobik, siła, wytrzymałość, ćwiczenia fizyczne, cholesterol.

Abstract

Aerobic exercise training is recommended to prevent and control obesity. The present study aimed to evaluate the effectiveness of a twelve-week step aerobics or floor aerobics exercise program in improving the physical and psychophysiological health of obese men. Sixty male adults of mean age 18.92 (SD 1.54 years) and Body Mass Index (BMI) ≥ 30 kg/m^2 were randomly allocated into three equal (n = 20) groups: Step Aerobics Exercise Training (SAET), Floor Aerobic Exercise Training (FAET), and a control group (which did not perform any exercise). The SAET and FAET training protocols were performed three days per week for 12 weeks. Health-related physical fitness, biochemical, physiological, and psychological variables were used as outcome measures and measured at baseline and at 12 weeks. There were significant differences in terms of physical and psychophysiological health parameters in participants who underwent SAET and FAET training compared with the control group (p < 0.05). SAET and FAET proved to be helpful in managing the physical and psychological health of obese adults. Schools and colleges should administer aerobic exercise sessions to adults for better health perspectives.

Keywords: aerobics, strength, endurance, physical exercise, cholesterol.

Introduction

Obesity is a chronic disease affecting food habits, exercise levels, and sleep schedules. Genetics, social factors of health, and the use of specific medications, all of them have an impact on body fat. Machines have changed human life and humans now enjoy a maximum level of physical comfort. Modern technology is working hard to make our lives easier, more luxurious, and more pleasant while also reducing physical exertion. Consequently, humans are becoming increasingly inactive globally. People now ride instead of walking, sit instead of standing, and watch instead of participating. These lifestyle changes have reduced physical labor and increased mental stress and strain. As a result, it is critical to affect positive changes in today's lifestyles through involvement in sports and physical education programs. The development of physical fitness among the public or participants should be one of the major goals of every physical education and sports program. Physical education should try to make all child physically, cognitively, and emotionally healthy, as well as develop personal and social traits in them, allowing them to live happily with others and develop as good citizens. Consequently, an individual's physical fitness can be improved through a variety of programs or activities [7].

Obesity was once considered a developed world issue; nevertheless, its incidence is increasing in both developed and developing countries. It is a life-threatening condition caused by a sedentary lifestyle that affects millions of people in both developed and developing countries. Both obesity and overweight contribute the most to non-communicable disease morbidity and mortality [14]. In 2008, the World Health Organization estimated that over 1.4 billion adults were overweight, with more than half of them being obese [15]. According to the National Health and Nutrition Examination Survey, the prevalence of obesity was 39.6 percent among rural people in 2005–2008, compared to 33.4 percent among urban adults [1]. The prevalence of generalized obesity ranged from 11.8 percent to 33.6 percent among people in a recent ICMR-INDIAB study conducted in three Indian states: Tamil Nadu, Maharashtra, and Jharkhand, as well as in one Union Territory, Chandigarh [13]. The prevalence of obesity among Indian women has increased from 10.6% to 12.6 percent, according to a comparison of two major surveys conducted by the National Family Health Survey (NFHS-2) in 1998–1999 and NFHS-3 in 2005–2006 [5]. According to the Chennai Urban Rural Epidemiology Study, the age-standardized prevalence of generalized obesity is 45.9% [3].

Anaerobic exercise, which includes strength training and short-distance running, can be compared to aerobic exercise and fitness. The duration and intensity of muscular contractions as well as how energy is created within the muscle differ between the two types of exercise. Recent research on the endocrine functions of contracting muscles has found that both aerobic and anaerobic exercise promote the secretion of myokines, which has a variety of benefits, including new tissue growth, tissue repair, and anti-inflammatory functions, lowering the risk of developing inflammatory diseases. The quantity of muscle contraction, as well as the duration and severity of contractions, all influence myokine secretion. Count is used in floor aerobics. Floor aerobics was created to eliminate the need for open-air exercise. Women took advantage of the opportunities presented to them daily. Many gyms and fitness facilities with a group workout program offer step-aerobic programs. Gin Miller introduced the concept of step aerobics in 1989. Gin visited an orthopaedic doctor after suffering a knee injury, who advised her to strengthen the muscles supporting the knee by stepping up and down on a milk crate, which she did, and from which she devised step aerobics [8]. The present study aimed to analyze the changes in physical and psychological health among obese adults after participating in 12 weeks of step-aerobic or floor-aerobic exercise protocols.

Methods

Participants and Study Design

Sixty obese male adults were recruited from the SRM Institute of Science and Technology (Kattankulathur, Tamil Nadu, India). The participants were randomly selected from various family backgrounds and participated in similar academic activities. The age range of the patients was 18–24 years. The following inclusion criteria were met by each participant for them to be part of this study: age of 18–24 years old, healthy sedentary obese men with a Body Mass Index (BMI) of ≥ 30 kg/m^2, and each participant had a sedentary lifestyle (less than 1 h of physical activity per week during the last year). The exclusion criteria were being female, having a BMI of less than 25–30 kg/m^2, undergoing any prior open surgery during the previous 8 months, having cardiovascular disease, and both the lower and upper extremities amputated. All the participants read and signed an informed consent form. Before the measurements started, the *SRM* Medical College Hospital and Research Centre (SRM CHRC, Kattankulathur, Tamil Nadu, India, Number 8484/IEC/2022) evaluated and approved the study procedures. The most recent revision of the Declaration of Helsinki was followed for all procedures.

Males with a BMI of 30 kg/m^2 or higher were considered obese for the purposes of this study. All participants were randomly divided into three groups, with 20 participants in each group: step aerobics exercise training (SAET), floor aerobics exercise training (FAET), and control group (CG). The aerobic and floor aerobic groups were subjected to respective exercises for 12 weeks, whereas the control group did not perform any exercise. Physical and psychological health were compared at baseline and endpoint in all groups. The requirements of the experimental procedures, testing, and exercise schedule were explained to the participants prior to the administration of the study to obtain full cooperation in the effort required on their part. The subjects completed training three days a week, except for Saturdays and Sundays, from 6.30 to 7.30 a.m. The exercises were gradually introduced. A simple to complex procedure was used.

Outcome Measures

Health Related Physical Fitness Measures

Following a review of the literature and consultation with professionals and experts, the following variables were chosen as criteria for this study: cardiovascular endurance (CRE) was measured using Cooper's 12 Minute Run / Walk test [20]. Muscular flexibility (F) was measured through Sit and Reach test [21]. Muscular Strength (MS) was measured using push-ups [11]. Muscular Endurance (ME) was measured using the half-squat jump test [23]. Body Composition (BC) was calculated based on the following formula: percent body fat = 0.41563 x (sum of three sites) - 0.00112 x (sum of three sites) 2 + 0.36661 x (age) + 4.03653, where the sum of the three sites were skinfold caliber measures at the triceps, medial region of the navel part, and suprailium [22].

Physiological Measures

The vital capacity (VC) was measured using a Spirometer [6]. Resting Heart (RHR) rate was measured using a digital heart rate measuring machine (Model No. EW 243, National Company, Japan) [16]. Mean arterial blood pressure (MABP) was measured using systolic and diastolic blood pressure, as suggested by Mathews and Fox [4]. Breath-holding (BH) time was measured using a nose clip and a stopwatch, as suggested by Mathew [10]. Respiratory Rate (RR) was measured using a bio-monitor, as suggested by Saroja [19].

Biochemical Measures

To conduct a hematological analysis, blood was immediately transferred into tubes of Vacationer (Becton Dickinson, Rutherford, NJ, USA) with or without 0.1% EDTA as an anticoagulant. Serum and plasma were separated by centrifugation at 2500 rpm for 15 minutes at four °C, and the separated components were stored at 80°C until assessment. After sitting for 20 minutes, following a fast of 12-hour overnight, blood was taken from an antecubital vein between 7:00 and 9:00 a.m. at Week 0 and Week 12 for analysis. The sample size was 15 ml. Fasting glucose, total triglyceride levels (TG), total cholesterol (TC), high-density lipids (HDL), and low-density lipids (LDL) were examined using an automated biochemical analyzer and measured using standard laboratory methods [17].

Psychological Measures

Self-confidence (SC) scale used in the current study was to rate self-confidence levels within the selected sample using a 5-point Likert scale ranging from totally disagree (1) to totally agree (5), Emotional Adjustment (EA) was quantified using a 5-point Likert scale ranging from totally disagree (1) to totally agree (5). Assertiveness (A) 19-item scale version demonstrated good psychometric characteristic regarding reliability. Interpersonal Relationship (IR) 5-point scale ranged from "strongly agree" to "strongly disagree," and Stress Management (SM) was measured using Personality Development Index Questionnaire developed by Kaliappan [9].

Interventions

The investigator constructed a 12-week training schedule for FAET and SAET, with much focus on the progression of the training load. The FAET group was allotted to Experimental group I, SAET was allotted to Experimental group II, and another group called the control group was allotted no training except for their regular activities. The training period for the experimental groups was restricted to 12 weeks, thrice a week. The duration of each training session was 60 min, which included warm-up and cool-down. The investigator personally supervised and ensured the appropriate execution of training, along with assistance from a trained expert. The Floor Aerobic Exercise Training group performed for 60 minutes per session, 3 times per week for 12 weeks. Each session started with a 10-minute warm-up exercise for weeks 1–4 (32 counts, 8 sets), weeks 5–8 (32 counts, 10 sets), and weeks 9 – 12 (32 counts, 12 sets). The aerobic exercise training group performed for 60 min per session, 3 times per week for 12 weeks. For weeks 1- 4 (32 counts, 4 sets), weeks 5–8 (32 counts, 10 sets), and weeks 9 – 12 (32 counts, 12 sets), at the end of each training session, a 10-minute cool-down exercise was given.

Data analysis

Means and standard deviations (±) were used to describe all data, and Kolmogorov-Smirnov and Shapiro-Wilk tests were used to determine if the data were normal. We ensured that there was no significant difference between the groups. The intraclass correlations (ICCs) and test and retest accuracies for all tests were analyzed. The effects of exercise were also examined using a two-way analysis of variance (ANOVA) and repeated measurements (three groups, twice). If group-by-time connections were found to be important, Bonferroni post-hoc tests were performed. Statistical significance was set at $p<0.05$.

Results

There were no significant differences ($p > 0.05$) in any baseline parameters between groups (Table 1).

Table 1. Participant characteristics (mean ± SD)

Characteristics	SAET	FAET	CG
Age (years)	18.41 ± 1.61	18.72 ± 1.92	18.89 ± 1.40
Height (cm)	170.5 ± 4.51	172.8 ± 4.69	173.4 ± 5.19
Weight (kg)	88.26 ± 4.30	88.60 ± 5.49	90.20 ± 6.10
BMI (kg/m^2)	30.10 ± 1.11	30.00 ± 1.30	30.20 ± 1.41

SD: Standard Deviation; BMI: Body Mass Index; SAET: Step Aerobics Exercise Training; FAET: Floor Aerobic Exercise Training; CG: Control Group.

Health Related Physical fitness

The main influence of time on some outcomes has been found to be CRE ($F = 27.37$, $\eta p^2 = 0.32$, power value: 0.99, $p < 0.001$), MS ($F = 31.27$, $\eta p^2 = 0.35$, power value: 0.99, $p < 0.001$), ME ($F = 56.35$, $\eta p^2 = 0.49$, power value: 0.99, $p < 0.001$), Flex (F = 1.40, $\eta p^2 = 0.71$, power value: 0.99, $p < 0.001$), and BC ($F = 35.95$, $\eta p^2 = 0.38$, power value: 0.99, $p < 0.001$). Significant group (three) and time (pre and post) interactions were seen for CRE ($F = 2.67$, $\eta p^2 = 0.09$, power = 0.51, $p = 0.08$), MS ($F = 0.67$, $\eta p^2 = 0.23$, power value: 0.15, $p = 0.51$), ME ($F = 6.90$, $\eta p^2 = 0.19$, power value: 0.99, $p < 0.002$), Flex ($F = 11.82$, $\eta p^2 = 0.29$, power value: 0.99, $p < 0.001$), and BC ($F = 2.06$, $\eta p^2 = 0.07$, power value: 0.40, $p = 0.14$).

A post-hoc analysis showed considerable pre-to-post improvement ($p < 0.001$) in both step aerobic exercise training and floor aerobic exercise training for cardiorespiratory endurance ($\eta p^2 = 0.07$; $\eta p^2 = 0.20$, respectively), muscular strength ($\eta p^2 = 0.08$; $\eta p^2 = 0.15$, respectively), and muscular endurance ($\eta p^2 = 0.04$; $\eta p^2 = 0.12$, respectively) compared to the control group. The post-hoc analysis showed a considerable pre-to-post decrease ($p < 0.001$) in both step aerobic exercise training and floor aerobic exercise training for body composition ($\eta p^2 = 0.04$; $\eta p^2 = 0.14$, respectively) compared to the control group. The participants engaged in step aerobics aerobic training and floor aerobics aerobic fitness showed no significant improvement in any of the training protocols tested in terms of cardiovascular endurance, muscular endurance, muscular strength flexibility, or body composition, whereas the control group showed no significant improvement in any of the training protocols tested (Table 2).

Table 2. Mean (± SD) values of health-related physical fitness parameters for the three groups

Variables	Group	Before	After	Partial eta-squared (ηp^2)		
				Main effect group	Main effect time	Interaction group x time
CRE (ml/kg/min)	SAET	28.89 ± 2.13	30.95 ± 1.09 [ac]	0.06 (p = 0.16)	0.32 (p < 0.001)	0.09 (p = 0.08)
	FAET	28.58 ± 0.84	30.54 ± 1.01 [a]			
	CG	28.97 ± 2.15	29.54 ± 1.64			
MS (numbers)	SAET	19.10 ± 1.37	20.45 ± 1.43 [a]	0.03 (p = 0.40)	0.35 (p < 0.001)	0.02 (p = 0.52)
	FAET	19.15 ± 2.18	20.90 ± 1.41 [ac]			
	CG	18.90 ± 1.86	19.95 ± 1.76			
ME (numbers)	SAET	22.85 ± 2.30	25.40 ± 1.27 [ac]	0.01 (p = 0.80)	0.50 (p < 0.001)	0.19 (p = 0.002)
	FAET	22.95 ± 1.82	25.00 ± 1.16 [a]			
	CG	23.55 ± 1.63	24.10 ± 1.51			
F (cm)	SAET	22.85 ± 1.75	24.85 ± 1.26 [ac]	0.03 (p = 0.37)	0.79 (p < 0.001)	0.41 (p < 0.001)
	FAET	22.00 ± 2.55	24.25 ± 1.99 [a]			
	CG	22.80 ± 1.90	23.45 ± 1.70			
BC (%)	SAETG	39.33 ± 0.35	38.67 ± 0.60 [a]	0.05 (p = 0.24)	0.39 (p < 0.001)	0.07 (p = 0.14)
	FAETG	39.33 ± 0.61	38.72 ± 0.72 [a]			
	CG	39.33 ± 0.15	39.06 ± 0.43			

SAET: Step Aerobics Exercise Training; FAET: Floor Aerobic Exercise Training; CG: Control Group; CRE: Cardiorespiratory Endurance; MS: Muscular Strength; ME: Muscular Endurance; F: Flexibility; BC: Body Composition; [a]significant difference before and after the intervention; [c]significant interaction between SAET and FAET.

Physiological variables

The main influence of time on some outcomes have been found to be VC (F = 1.84, $\eta p^2 = 0.76$, power value: 0.99, $p<0.001$), RHR ($F = 91.30$, $\eta p^2 = 0.61$, power value: 0.99, $p < 0.001$), MABP ($F = 0.01$, $\eta p^2 = 0.88$, power value: 0.50, $p = 0.982$), BHT ($F = 73.55$, $\eta p^2 = 0.56$, power value: 0.99, $p < 0.001$), RR, ($F = 21.51$, $\eta p^2 = 0.27$, power value: 0.99, $p < 0.001$). Significant group (three) and time (pre and post) interactions were seen for VC ($F = 18.33$, $\eta p^2 = 0.39$, power = 0.51, $p < 0.001$), RHR ($F = 9.60$, $\eta p^2 = 0.25$, power = 0.97, $p < 0.001$), MABP ($F = 1.87$, $\eta p^2 = 0.19$, power = 0.62, $p = 0.163$), BHR ($F = 4.90$, $\eta p^2 = 0.14$, power = 0.78, $p < 0.011$), RR ($F = 4.58$, $\eta p^2 = 0.14$, power = 0.75, $p = 0.014$).

A post-hoc analysis showed a considerable pre-to-post decrease ($p < 0.001$ value) in both step aerobic exercise training and floor aerobic exercise training for resting heart rate ($\eta p^2 = 0.08$; $\eta p^2 = 0.16$, respectively), and respiratory rate ($\eta p^2 = 0.07$; $\eta p^2 = 0.18$, respectively) compared to the control group. The post-hoc analysis showed a considerable pre-to-post improvedment ($p < 0.001$ value) in both step aerobic exercise training and floor aerobic exercise training for breath holding time ($\eta p^2 = 0.04$; $\eta p^2 = 0.11$, respectively) compared to the control group. No training protocols showed significant improvement in vital capacity, breath-holding time, and decreased resting heart rate, mean arterial blood pressure, and respiratory rate in participants performing step aerobics exercise training and floor aerobics exercise training, whereas no significant improvement was observed in the control group (Table 3).

Table 3. Mean (± SD) values of the physiological parameters in the three groups

Variables	Group	Before	After	Partial eta-squared (ηp^2)		
				Main effect group	Main effect time	Interaction group x time
VC (mL)	SAETG	3.07 ± 275.48	3.32 ± 228.49 [ac]	0.63 ($p = 0.02$)	0.76 ($p < 0.001$)	0.39 ($p < 0.001$)
	FAETG	3.07 ± 233.73	3.29 ± 217.40 [a]			
	CG	3.07 ± 451.16	3.14 ± 425.99			
RHR (bpm)	SAETG	75.20 ± 3.73	72.40 ± 3.31 [ac]	0.28 ($p = 0.04$)	0.61 ($p < 0.001$)	0.25 ($p < 0.001$)
	FAETG	75.25 ± 1.77	73.30 ± 2.69 [a]			
	CG	75.65 ± 3.01	74.90 ± 3.50			
MABP (mmHg)	SAETG	97.92 ± 2.61	96.76 ± 2.36 [ac]	0.71 ($p = 0.01$)	0.98 ($p < 0.001$)	0.16 ($p = 0.06$)
	FAETG	97.97 ± 2.59	97.87 ± 2.44 [a]			
	CG	97.16 ± 3.45	98.46 ± 4.57			
BHT (s)	SAETG	36.35 ± 3.03	38.40 ± 3.03 [a]	0.79 ($p = 0.01$)	0.56 ($p < 0.001$)	0.15 ($p < 0.01$)
	FAETG	36.90 ± 4.37	39.20 ± 3.86 [ac]			
	CG	36.95 ± 3.97	37.80 ± 3.83			
RR (numbers)	SAETG	17.00 ± 1.48	16.15 ± 1.26 [a]	0.44 ($p = 0.02$)	0.27 ($p < 0.001$)	0.14 ($p = 0.014$)
	FAETG	17.10 ± 1.11	16.15 ± 0.93 [a]			
	CG	17.00 ± 1.29	16.95 ± 0.94			

SAET: Step Aerobics Exercise Training; FAET: Floor Aerobic Exercise Training; CG: Control Group; VC: Vital Capacity; RHR: Resting Heart Rate; MABP: Mean Arterial Blood Pressure; BHR: Breath Holding Time; RR: Respiratory Rate; [s]significant difference before and after the intervention; [c]significant interaction between SAET and FAET.

Biochemical variables

The main influences of time on some outcomes have been found to be HDL ($F = 30.82$, $\eta p^2 = 0.35$, power value: 0.99, $p < 0.001$), LDL ($F = 1.66$, $\eta p^2 = 0.74$, power value: 0.99, $p < 0.001$), TC ($F = 3.82$, $\eta p^2 = 0.63$, power value: 0.48, $p = 0.056$), TG ($F = 7.27$, $\eta p^2 = 0.11$, power value: 0.75, $p = 0.009$). Significant group (three) and time (pre and post) interactions were seen for HDL ($F = 1.21$, $\eta p^2 = 0.41$, power = 0.25, $p = 0.304$), LDL ($F = 25.11$, $\eta p^2 = 0.46$, power = 0.99,

$p < 0.001$), TC ($F = 3.51$, $\eta p^2 = 0.11$, power = 0.63, $p = 0.036$), TG ($F = 0.88$, $\eta p^2 = 0.30$, power = 0.78, $p = 0.417$).

A post-hoc analysis showed considerable pre-to-post improvement ($p < 0.001$ value) in both step aerobic exercise training and floor aerobic exercise training for high density lipoprotein ($\eta p^2 = 0.05$; $\eta p^2 = 0.14$, respectively) compared to the control group. The post-hoc analysis showed a considerable pre-to-post decrease ($p < 0.001$ value) in both step aerobic exercise training and floor aerobic exercise training for total cholesterol ($\eta p^2 = 0.09$; $\eta p^2 = 0.18$, respectively) and triglycerides ($\eta p^2 = 0.07$; $\eta p^2 = 0.19$, respectively) compared to the control group. The participants who engaged in step aerobics activity and floor aerobics exercise training both showed no significant improvement in any of the training protocols when it came to highly dense lipoprotein, decreased low density lipoprotein, lipid profile, and triglycerides, while no significant improvement was seen in the control group (Table 4).

Table 4. Mean (± SD) values of the biochemical parameters in the three groups

Variables	**Group**	**Before**	**After**	**Partial eta-squared (ηp^2)**		
				Main effect group	Main effect time	Interaction group x time
HDL (mg/dl)	SAETG	53.95 ± 3.83	55.60 ± 2.13 [a]	0.02 ($p = 0.58$)	0.35 ($p < 0.001$)	0.04 ($p = 0.30$)
	FAETG	52.60 ± 3.06	55.80 ± 2.06 [a]			
	CG	53.85 ± 2.96	55.95 ± 2.08			
LDL (mg/dl)	SAETG	123.78 ± 6.04	120.94 ± 5.63 [a]	0.04 ($p = 0.89$)	0.74 ($p < 0.001$)	0.47 ($p < 0.001$)
	FAETG	123.96 ± 3.86	120.62 ± 3.51 [a]			
	CG	123.49 ± 9.98	122.96 ± 10.37			
TC (mg/dl)	SAETG	214.65 ± 5.19	212.70 ± 4.89 [a]	0.04 ($p = 0.89$)	0.06 ($p = 0.056$)	0.110 ($p = 0.04$)
	FAETG	215.74 ± 5.93	212.85 ± 5.92 [a]			
	CG	214.12 ± 6.83	215.20 ± 11.57			
TG (mg/dl)	SAETG	181.52 ± 11.31	179.30 ± 10.23 [a]	0.008 ($p = 0.79$)	0.11 ($p = 0.009$)	0.03 ($p = 0.42$)
	FAETG	183.88 ± 7.88	180.20 ± 10.09 [a]			
	CG	180.35 ± 11.79	179.42 ± 13.45			

SAET: Step Aerobics Exercise Training; FAET: Floor Aerobic Exercise Training; CG: Control Group; HDL: High Density Lipoprotein; LDL: Low Density Lipoprotein; TC: Total Cholesterol; TG: Triglycerides; [a]significant difference before and after the intervention.

Psychological variables

The main influences of time on some outcomes have been found to be SC ($F = 24.80$, $\eta p^2 = 0.42$, power value: 0.99, $p < 0.001$), EA ($F = 1.66$, $\eta p^2 = 0.74$, power value: 0.99, $p < 0.001$), A ($F = 3.82$, $\eta p^2 = 0.63$, power value: 0.48,

p = 0.056), IR (F = 7.27, ηp^2 = 0.11, power value: 0.75, p = 0.009). Significant group (three) and time (pre and post) interactions were seen for SC (F = 1.21, ηp^2 = 0.41, power value: 0.25, p = 0.304), EA (F = 25.11, ηp^2 = 0.46, power value: 0.99, p < 0.001), A (F = 3.51, ηp^2 = 0.11, power value: 0.63, p = 0.036), IR (F = 0.88, ηp^2 = 0.30, power value: 0.78, p = 0.417).

A post-hoc analysis showed considerable pre-to-post improvement (p < 0.001 value) in both step aerobic exercise training and floor aerobic exercise training for self-confidence (ηp^2 = 0.05; ηp^2 = 0.14, respectively) compared to the control group. The post-hoc analysis showed a considerable pre-to-post decrease (p<0.001 value) in both step aerobic exercise training and floor aerobic exercise training for assertiveness (ηp^2 = 0.09; ηp^2 = 0.18, respectively) and interpersonal relationships (ηp^2 = 0.07; ηp^2 = 0.19, respectively) compared to the control group. The participants who engaged in both step aerobics activity and floor aerobics exercise training showed no significant improvement in any of the training protocols in terms of self-confidence, decreased emotional adjustment, psychological profile, interpersonal relationships, and stress management, while no significant improvement was seen in the control group (Table 5).

Table 5. Mean (± SD) values of psychological parameters in the three groups

Variables	**Group**	**Before**	**After**	**Partial eta-squared (ηp^2)**		
				Main effect group	Main effect time	Interaction group x time
SC (scores)	SAETG	21.22 ± 1.41	22.16 ± 1.80 [a]	0.02 (p = 0.67)	0.421 (p<0.001)	0.04 (p = 0.310)
	FAETG	20.60 ± 1.82	21.23 ± 1.20 [a]			
	CG	21.86 ± 1.16	21.40 ± 1.45			
EA (scores)	SAETG	46.52 ± 4.31	47.10 ± 1.35 [a]	0.04 (p = 0.84)	0.654 (p <0.001)	0.51 (p<0.001)
	FAETG	45.17 ± 4.15	46.23 ± 2.34 [a]			
	CG	45.70 ± 3.50	45.14 ± 1.30			
A (scores)	SAETG	23.17 ± 2.40	24.40 ± 4.89 [a]	0.05 (p = 0.87)	0.06 (p = 0.06)	0.21 (p = 0.04)
	FAETG	22.43 ± 1.19	23.18 ± 2.80 [a]			
	CG	23.10 ± 1.10	23.10 ± 1.15			
IR (scores)	SAETG	21.34 ± 3.46	22.32 ± 2.14 [a]	0.08 (p = 0.78)	0.11 (p = 0.09)	0.03 (p = 0.42)
	FAETG	20.16 ± 2.31	21.34 ± 1.42 [a]			
	CG	20.35 ± 3.40	20.96 ± 2.17			
SM (scores)	SAETG	35.19 ± 2.15	36.23 ± 3.16	0.06 (p = 0.85)	0.065 (p = 0.06)	0.13 (p = 0.036)
	FAETG	34.16 ± 1.75	35.16 ± 4.40			
	CG	35.80 ± 1.10	34.12 ± 2.34			

SAET: Step Aerobics Exercise Training; FAET: Floor Aerobic Exercise Training; CG: Control Group; SC: Self-Confidence; EA: Emotional Adjustment; A: Assertiveness; IR: Interpersonal Relationship; SM: Stress Management; [a]significant difference before and after the intervention.

Discussion

The main finding of this study was that different aerobic training exercises had various positive effects on physical strength and physiological and biochemical parameters in obese men. After 16 weeks of a randomized control trial undertaking aerobic and resistance training intervention, it was shown to improve the quality of life and physical fitness of obese and overweight cancer patients [24]. These results were consistent with previous studies showing that VO2 max improved [25,26] and that HIIT exercise could reduce resting heart rate in children with obesity [27]. Another previous study showed that 12 weeks of isolated and combined randomized control trials undertaking aerobic, resistance, and combined training showed that overweight and obese adults had considerably improved body percentage of fat and cardiorespiratory fitness [28]. Exercise intervention at 16 weeks follow up MLIP has been suggested to improve physical fitness and body composition in adolescents and obese children [29]. In the present study, we found a significant improvement in selected health-related physical fitness parameters after 12 weeks of aerobic exercise training. Importantly, a reduction in body composition study reported that eight weeks of HIIT aerobic exercise intervention improved the quality of life of patients [30].

Our study findings agree with those of previous studies showing a decrease in blood pressure after 12 weeks of combined exercise training in young obese pre-hypertensive men [31]. Our data indicate that breath-holding time and respiratory rate were significantly enhanced after 12 weeks of intervention in the current study. This may follow another mechanism that effectively improves breath-holding time and respiratory rate due to neuromuscular training intervention [32].

The findings of this study are in line with related studies suggesting that aquatic exercise has a beneficial effect on forced vital capacity [33]. Komathi and Indira previously investigated the effects of step aerobics, floor aerobics, and combination exercises on biochemical variables and psychology in female students [34]. After undertaking floor aerobic exercise for a period of 12 weeks, it was shown that female students showed considerable improvement in all selected biochemical and psychological parameters. After participating in step aerobics for a period of twelve weeks, female students showed significant improvements in all selected biochemical and psychological variables. Women in the combined training group performed better on biochemical variables than did those in the other groups. Similar outcomes were obtained in the present study, in which the biochemical profile of obese male adults was found to improve after twelve-week intervention of steps or floor aerobics. Clary et al. examined the effects of ballate, walking on balance, and step aerobics in women aged 50–75 years. Compared to the Ballates program, walking programs and step aerobics result in improved static balance and postural stability [3]. In our study, similar results were obtained in steps aerobics and floor aerobics. Melam et al. examined the effects of aerobics and brisk walking in overweight individuals. For ten weeks, this program was carried out five days a week [18]. Body mass index, hip and waist circumference, and the thickness of the skinfolds in the abdomen, subscapular region, biceps, and triceps were measured in all three categories before and after the experiment. All values fell in women who performed 10 weeks of brisk walking and aerobics. In the present study, body composition was found to be significantly improved among adult obese male after 12 weeks of aerobic exercise. Maiyanga and Gunen investigated the effect of step aerobics on percentage of body fat and visceral fat in obese female nurses in Bauchi's specialty hospital and discovered that step aerobics reduced percentage body fat [19].

Limitations

Being pilot in nature, the present study has several limitations that suggest a lacune on which future studies could be conducted. One limitation of this study is that we only included male participants in the current study. Obesity is also prevalent in females; therefore, future studies should be conducted with female participants. Another limitation of the study is that it focused on specific age groups, and future studies could be conducted by considering all age groups. This will help validate the results of the current study for all age groups. Another limitation of this study was the sample size. Because the sample size of the present study was small, the results of the present study cannot be validated for the general population. Moreover, the present study was a single-centric study, and future studies using a multicentric approach should be conducted to determine the role of aerobic exercise in the management of obesity among adults.

Conclusion

The present study revealed significant improvement in adult obesity in terms of body composition, muscular strength and endurance, cardiovascular and respiratory parameters, biochemical parameters, and psychological domains after practising steps and floor aerobics. Aerobic exercise proved to be helpful in managing the physical and psychological health of obese adults. It is recommended that schools and colleges administer aerobic exercise sessions to adults for better health perspectives.

STATEMENT OF ETHICS

This study was conducted in accordance with the World Medical Association Declaration of Helsinki. The study protocol was reviewed and approved by the SRM Medical College Hospital and Research Centre (SRM CHRC, Kattankulathur, Tamil Nadu, India, Number 8484/IEC/2022). All participants provided written informed consent to participate in this study.

DECLARATION OF CONFLICTING INTERESTS

The authors declared no potential conflicts of interests with respect to the research, authorship, and/or publication of the article *The effect of 12-week step and floor aerobic exercise programs on physical and psychophysiological health parameters in obese men.*

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