

Effect of Moderate Intensity Continuous Training (MICT) on Cardiovascular Parameters and Anthropometric Measurements in Overweight Young Adults

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Abstract

Background: Obesity and overweight is described as accumulation of excessive fat in the body creating leading to numerous health issues. The prevalence of obesity in young adults in developing countries varies from 2.3% to 12%, obesity is common in Asian Indians. The non-active lifestyle and increasing physical inactivity is main culprit for overweight and obesity.

Objective: To find the effect of moderate intensity continuous training (MICT) on cardiovascular parameters blood pressure (BP), rate pressure product (RPP), heart rate (HR) and anthropometric measurements (skin fold measurements) in overweight young adults.

Method: Two groups comprised 37 randomly chosen subjects. Group 1 had a 5-minute warm-up at 40% of HRR, 30-minute running and jogging (15 minutes each), and a 5-minute cool-down; Group 2 will keep up their usual physical activity treatment duration was four weeks (three times a week.) The baseline measurements of BP, HR, RPP skin fold measurement was recorded and at the end of 4 weeks the same measurements was recorded.

Results: Data were analyzed using Paired t-test and one-way ANOVA. Inter-group data analysis shows p-value as 0.001 for both groups but experimental group 1 (MICT) had greater effect as compared to control group. There is significant difference in between group ($p < 0.05$)

Conclusion: The study finds that both the group was successful in lowering body weight, improving anthropometric measurement (% body fat) and cardiovascular parameters (BP, RPP, HR) in overweight young adults but MICT showed more significant improvement when compared to Control group.

Keywords: Adults, MICT, Obesity, Overweight

INTRODUCTION

Obesity and overweight, which are characterized by an excess of body fat, bring serious health risks. A body mass index (BMI) of $30 \text{ kg}\cdot\text{m}^{-2}$ or above is regarded as obese, while a BMI of 25 to $29.9 \text{ kg}\cdot\text{m}^{-2}$ is regarded as overweight [1]. In developing nations, 28.8% of young adults (18–25 years old) are overweight, and 2.3%–12% are obese. Particularly among college and university students, obesity is a serious concern [2].

Obesity in childhood is a new epidemic. Estimates from the International Obesity Task Force (IOTF) and the International Association for the Study of Obesity (IASO) suggest around 200 million school children are overweight or obese [3]. Fascinatingly common among Asian Indians and a main risk factor for metabolic syndrome, cardiovascular disease, and type 2 diabetes mellitus (T2 DM), the 'Asian Indian Phenotype or Paradox,' or extreme abdominal obesity, is [4][5].

Among the many co morbidities connected to obesity are obstructive sleep apnea, musculoskeletal diseases, Alzheimer's disease, asthma, metabolic syndrome, hepatic steatosis, osteoarthritis (OA), cardiovascular disease (CVD), diabetes mellitus (DM), hypertension (HTN), and cancer [6] [7]. Obesity doubles the chance of developing cancer as it causes persistent low-grade inflammation, indicating importance of physical activity for preventing cancer by lowering inflammatory markers [8].

Obesity has been shown to be an independent predictor of CVD by the Framingham Heart and Manitoba studies, and this risk remains even after adjusting for other risk variables. Heart failure (HF), which affects 11% of men and 14% of women, is significantly exacerbated by obesity [9].

At lower BMIs, Asian people have alterations associated with obesity [10]. Increased cardiovascular risk and shorter life spans are associated with higher resting heart rates (RHR) [11, 12]. Heart workload is measured by the rate pressure product ($RPP = \text{Systolic blood pressure (SBP)} \times \text{Heart Rate (HR)}/1000$), where 7.00–9.00 is considered safer and >10.00 indicates a higher risk of heart disease [13].

The Harpenden caliper and Jackson–Pollock equations provide accurate and reasonably priced skin fold measurements for body composition, irrespective of food or hydration [14]. Physical activity in the areas of work, commuting, household, gardening, and leisure is evaluated by the International Physical Activity Questionnaire (IPAQ) [15] [16]. Moderate Intensity Continuous Training (MICT) involves minimum 150 minutes of exercise between 40 to 60 percent maximum oxygen consumption ($VO_2 \text{ max}$), has been shown to enhance body composition, insulin sensitivity, cardiovascular health, and visceral fat [17][18].

Aim:

To see the effects of MICT on cardiovascular parameters and anthropometric measurements in overweight young adults.

Objective:

- To determine the effectiveness of MICT on cardiovascular parameters (BP, RPP, HR) in overweight young adults.
- To find the effectiveness of MICT on anthropometric measurements (skin fold measurements) in overweight young adults.

Null Hypothesis:

Ho1: There is no significant effect of MICT on SBP, Diastolic blood pressure (DBP), HR, RPP in overweight young adults.

Ho2: There is no significant effect of MICT on Anthropometric measurement (Skin fold) in overweight young adult.

Alternate Hypothesis:

H1: There is effect of MICT on SBP, DBP, HR, and RPP in overweight young adult.

H2: There is effect of MICT on Anthropometric measurement (Skin fold) in overweight young adult.

Inclusion Criteria:

People who were overweight, (Using Asian BMI scale, BMI between 23.0 and 24.9 were eligible to participate in this study). Adults (18 to 25 Years) both male and female. Additionally, participants had to fulfill the requirements for moderate physical activity as stated in the IPAQ, which include walking for minimum 0.5 hour every day, or logging at least 600 MET minutes per week, or engaging in moderate-intensity exercise five days a week. Lastly, it was necessary for all participants to indicate that they were willing to take part in the study and to be free of cardiovascular diseases.

Exclusion Criteria: The study excluded participants with Angina pectoris, uncompensated heart failure, a recent myocardial infarction (within the past six months), a stroke within the past six months, severe arrhythmia or heart failure, renal failure, pregnancy, active substance abuse, neurological limitations to exercise, uncontrolled hypertension, or any pre-existing cardiovascular disease.

METHODOLOGY

Study Design: Experimental.

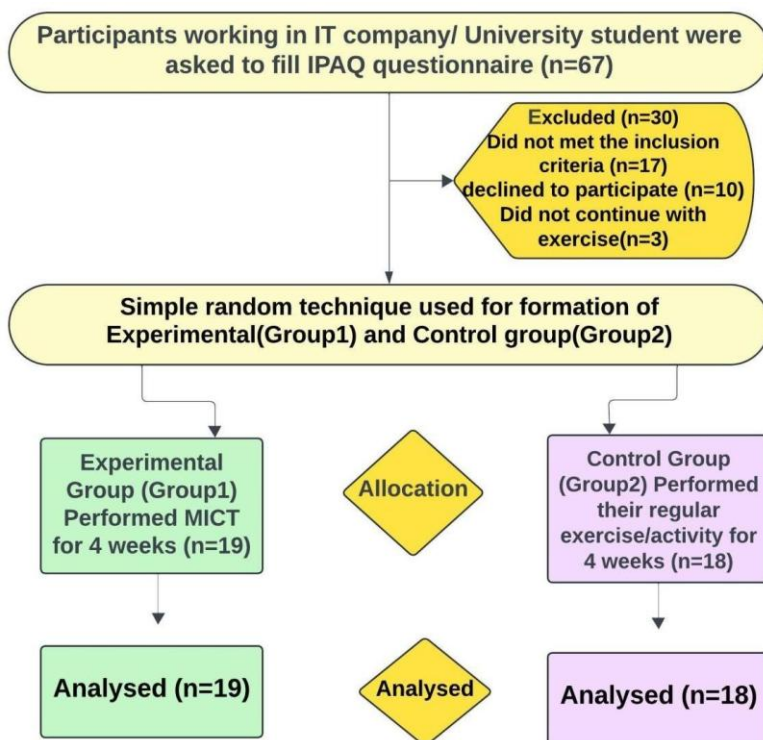
Sampling technique: Randomized sampling technique

Procedure:

Those who qualified gave informed consent to participate in the study and were paired at random to either the experimental group (MICT) or the control group (regular activity). The MICT group performed 5-minute warm-up, 30-minute exercise (running and jogging) at 40-60% HRR, and 5-minute cool-down. Both groups received interventions three times weekly for four weeks. Baseline and post-intervention

measurements of BP, HR, RPP, and skinfold thickness were recorded.

A Consort Flowchart



RESULTS

The paired *t*-tests showed that both Group 1 and Group 2 had substantial within-group decreases in a number of important metrics from the pre-test to the post-test ($p < 0.05$ for all). In particular, there were notable reductions in heart rate (Group 1: mean difference = 6.789, $p < 0.001$; Group 2: mean difference = 3.263, $p < 0.001$), RPP (Group 1: mean difference = 0.955, $p < 0.001$; Group 2: mean difference = 0.490, $p < 0.001$), SBP (Group 1: mean difference = 1.368, $p = 0.011$; Group 2: mean difference = 0.909, $p = 0.047$), and percentage body fat (Group 1: mean difference = 0.024, $p < 0.001$; Group 2: mean difference = 0.007, $p < 0.001$).

While not statistically significant, both groups' DBP decreased (Group 1: mean difference = 0.421, $p = 0.104$; Group 2: mean difference = 0.333, $p = 0.331$), thus need a larger sample size and a longer duration of the treatment to produce the changes in DBP.

These results are further supported by the graphical representations, which show that Group 1 (MICT group) experienced a larger reduction in heart rate and body fat percentage than Group 2 (Control group).

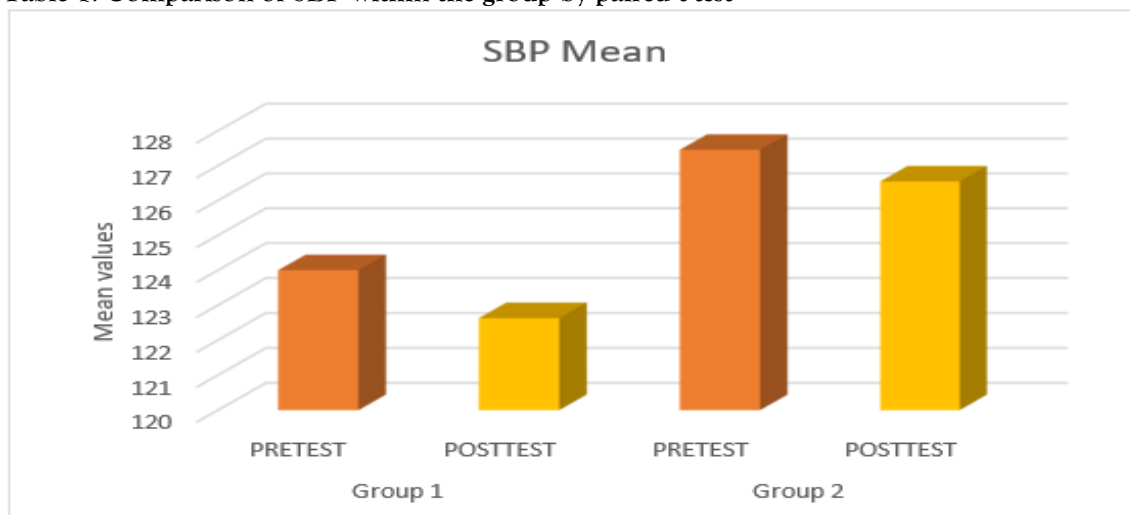
Tables and Figures

1. SBP:

Paired Samples Test									
		Paired Differences				t	Significance		
		Mean	SD	95%Confidence Interval			One- Sided p	Two- Sided p	
				Lower	Upper				
Group 1	PRETEST-POST- TEST	1.36842	2.11373	0.34964	2.3872	2.822	0.006	0.011	

Group 2	PRETEST -POST- TEST	0.90909	2.02153	0.0128	1.80539	2.109	0.024	0.047	
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Table 1: Comparison of SBP within the group by paired t-test



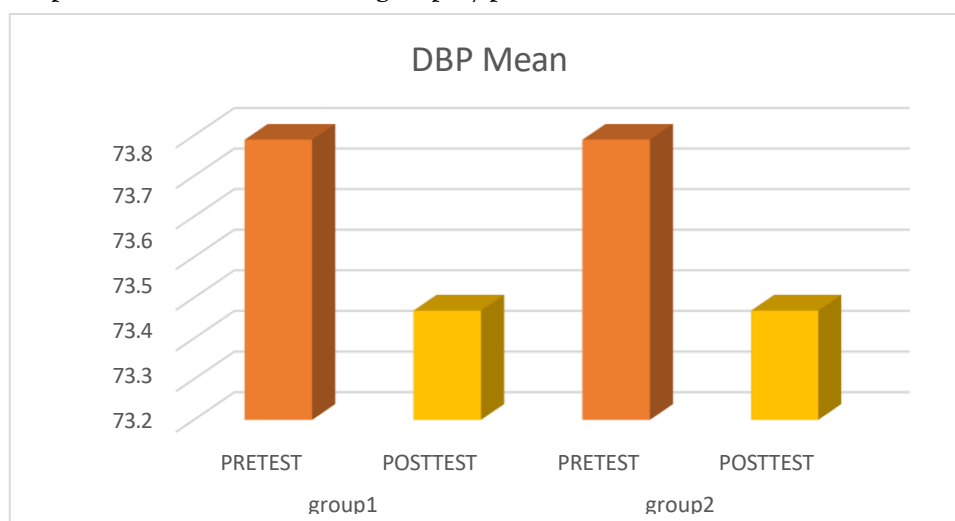
Graph-1: Graphical representation of SBP mean

The graph shows the mean SBP values for two groups before and after an intervention. Both groups exhibit a reduction in SBP post-intervention

2. DBP:

Paired Samples Test								
		Paired Differences				t	Significance	
		Mean	SD	95% Confidence Interval			One-Sided p	Two-Sided p
				Lower	Upper			
Group 1	PRE TEST - POST TEST	-0.42105	1.07061	-0.09496	0.93707	1.714	0.052	0.104
Group 2	PRE TEST - POST TEST	-0.33333	1.41421	-0.36994	1.03661	1	0.166	0.331

Table 2: Comparison of DBP within the group by paired t-test



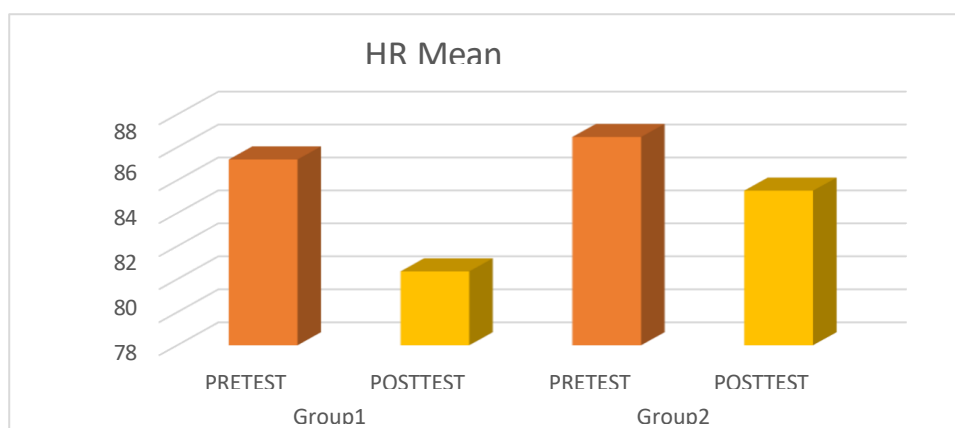
Graph-2: Graphical representation of the DBP Mean

The graph displays the mean DBP values for two groups before (pretest) and after (post-test) an intervention. Both groups show a decrease in DBP post-intervention, with similar patterns of reduction observed in each group

3. HR:

Paired Samples Test								
		Paired Differences				t	Significance	
		Mean	SD	95% Confidence Interval			One-Sided p	Two-Sided p
				Lower	Upper			
Group 1	PRETEST - POST-TEST	6.78947	3.17243	5.26041	8.31854	9.329	<.001	<.001
Group 2	PRETEST - POST-TEST	3.26316	1.96757	2.31482	4.2115	7.229	<.001	<.001

Table 3: Comparison of HR within the group by paired t-test



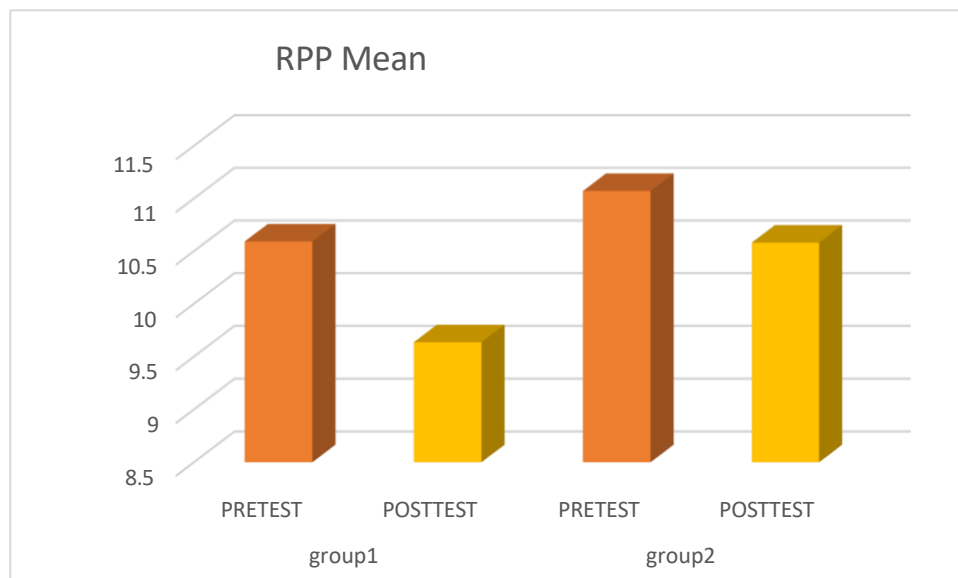
Graph-3: Graphical representation of the HR means

The graph shows the average heart rate between a pretest and post-test for two groups. Group 1 appears to have a larger decrease in HR than Group 2

4. RPP:

Paired Samples Test								
		Paired Differences				t	Significance	
		Mean	SD	95% Confidence Interval			One-Sided p	Two-Sided p
				Lower	Upper			
Group 1	PRE TEST - POST- TEST	0.95537	0.42106	0.75242	1.15831	9.89	<.001	<.001
Group 2	PRE TES T - POST- TEST	0.49	0.40264	0.28977	0.69023	5.163	<.001	<.001

Table 4: Comparison of RPP within the group by paired t-test



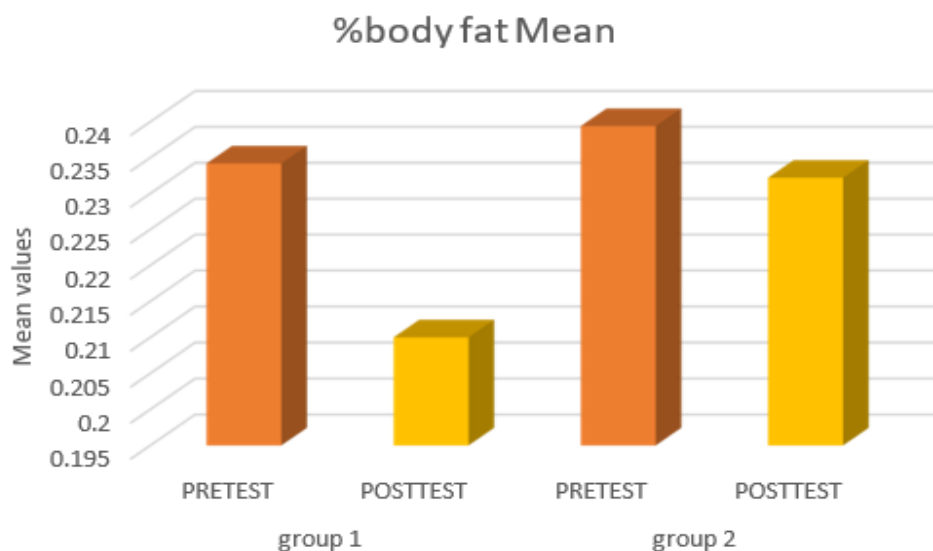
Graph-4: Graphical representation of the RPP means

The graph shows the change in RPP mean between a pretest and post-test for two groups. Group 1 has a larger decrease in RPP mean compared to Group 2

5. %Body Fat:

Paired Samples Test		Paired Differences				t	Significance	
		Mean	SD	95% Confidence Interval			One-Sided p	Two-Sided p
				Lower	Upper			
Group 1	PRE -TEST POST-TEST	-0.02421	0.01121	0.01881	0.02962	9.412	<.001	<.001
Group 2	PRETES T POST-TEST	-0.00722	0.00575	0.00437	0.01008	5.333	<.001	<.001

Table 5: Comparison of body fat within the group by paired t-test



Graph-5: Graphical representation of body fat product means

The graph shows the change in body fat percentage between a pretest and post-test for two groups. Group 1 has a larger decrease in body fat percentage compared to Group 2.

DISCUSSION

This study population include 37 overweight young adults on which the effects of MICT on cardiorespiratory parameters and anthropometric measurements were recorded. Participants were divided randomly into a control group—regular exercise—or an experimental group—three days a week MICT. Data analysis revealed significant improvements in BMI, weight reduction; SBP, HR, and skin fold measurements following the MICT intervention. While DBP showed a slight improvement in both groups, the study suggests a need for a larger sample size to better observe changes in DBP. The study population included 7 men and 30 women, indicating MICT's effectiveness for weight reduction and CVD improvement.

Many research confirm the advantages of MICT, showing how it affects body composition, weight loss, fatty tissue loss, body fat loss, lowering BP, lowering BMI, VO₂ max increase, improvement in physical and mental health, improvement of blood glucose levels, and decrease in inflammation[8][21][22][23][24][25][26][27][28][29][30]. The current study confirms MICT's positive impact on heart rate, contributing to a reduction in cardiovascular risk factors, consistent with the understanding that lower heart rates correlate with better cardiometabolic health. Furthermore, a month of MICT improved anthropometric measurements. Exercise physiology principles indicate that structured physical activity reduces body fat. Physical activity increases energy expenditure, leading to the mobilization and oxidation of stored fat. Aerobic exercises enhance metabolic rate and improve body composition by increasing lean muscle mass. The significant variation in groups' post-test scores ($p = 0.032$) highlights the intervention's effectiveness, suggesting varying degrees of change in % body fat between the groups, possibly due to differences in exercise intensity, duration, or type.

Scientific literature supports the observed effects of moderate-intensity exercise on lowering systolic blood pressure. Regular exercise strengthens the heart muscle, improving pumping efficiency and reducing the force required to circulate blood, thereby lowering resting SBP. Similarly, MICT positively influences DBP. Consistent training enhances endothelial function, improving blood vessel relaxation, reducing peripheral resistance, and lowering diastolic pressure. The RPP, reflecting cardiac workload ($RPP = SBP \times HR/1000$), decreases with consistent MICT. This is because of a stronger heart pumping more blood each beat (increased stroke volume) at a slower rate (decreased heart rate), together with potential blood pressure reductions, indicating improved cardiovascular efficiency.

Ethical Approval:

The University's Institutional Ethics Committee (IEC) provided ethical approval.

Conflict of Interest:

No conflicts of interest are disclosed by the writers.

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