

To Compare the Effects of 4 Weeks Low Intensity Intermittent Training (LIIT) and Low Intensity Continuous Training (LICT) on Heart Rate Reserve, Heart Rate Recovery and Physiological Cost Index on College Going Girls

Moksha Ashishkumar Shah¹, Dr. Harita P Vyas²

¹Post Graduate Student (Cardio-respiratory Department), ²PG Guide, SBB College of Physiotherapy, Gujarat University, Ahmedabad, India.

Corresponding Author: Moksha Ashishkumar Shah

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ABSTRACT

Background and Aim: Exercise strengthens heart muscle, improves blood flow, and lowers blood pressure. This translates to a healthier heart that pumps blood more effectively, recovers faster after exertion, uses oxygen better; reducing risk of heart disease. Exercise intensity is important aspect of enhancing health-related fitness. Aim of the study is to make appropriate prescription of the fitness, obesity, diseased person according to their needs and also see the impact of both type of training.

Methods and Materials: Interventional study was conducted on girls of a physiotherapy college, Ahmedabad. Ethical approval was taken. 14 girls were randomly divided into 2 groups (LIIT and LICT), Protocol of 42 min was completed on treadmill for 4 weeks (5 days/week). Training was done at 50–70% maximal heart rate, 11-13 RPE with Talk test. In both group 5 min of warm-up and cool-down period was given. In LIIT, 4 sets with 4 minute of interval (32min), in LICT continuous walking/jogging (32 min) was done. Unpaired t test was applied between outcomes. Statistical analysis was done using SPSS.

Result: 7 girls with mean age of (20.5714±1.718) years were included in intermittent training, 7 girls with mean age of (22±2.160) years were included in continuous training, there was significant difference between HRr but no significant difference between HRR and PCI of both the groups.

Conclusion: Present study concluded that intermittent training is better than continuous training on heart rate reserve, heart rate recovery and physiological cost index on college going girls.

Keywords: Low intensity intermittent training (LIIT), Low intensity continuous training (LICT), Heart rate reserve, Heart rate recovery, Physiological cost index, College going girls.

INTRODUCTION

Exercise is a subcategory of physical activity that is planned, structured, repetitive, and purposeful with primary purpose of improving or maintaining physical fitness, physical performance or health^[1]. The benefits of physical activity are obvious. Its optimal level stimulates development, secures motor needs, strengthens heart function, improves muscle and joint flexibility, strengthening the

muscles and bones^[2]. It has been proven that active people, compared to those inactive, enjoy a better well-being and are less likely to experience mental or physical discomfort². Regular physical exercise has been considered an effective strategy for improving health and quality of life¹ and On the other hand, increasing sedentary rates and the associated increasing prevalence of hypokinetic diseases, especially obesity, highlights that there still is a need for identifying effective methods of prescribing exercise^[3]. While exercise alone results in small weight losses, the combination of diet and exercise elicits the greatest magnitude of weight reduction for lifestyle therapy.

Approximately 31% of the global population aged ≥ 15 years engages in insufficient physical activity, due to their sedentary lifestyle. A poor participation in physical activity, some environmental factors include traffic congestion, air pollution, shortage of parks, lack of sports or leisure facilities, television viewing, video viewing, cell phone usage are positively correlated with an increasingly sedentary lifestyle^[4].

Low-intensity training offers a powerful, boosting your heart and lungs while being gentle on your joints. Ideal for beginners, those recovering from injuries, or anyone looking for a sustainable way to manage weight, improve sleep, reduce stress, and enhance overall well-being^[5]. Interval training can vary in the number and intensity of intervals, the time and nature (active or passive) of recovery periods and therefore the work: recovery schedule^[5]. Continuous training is 'traditional' exercise protocols performed continuously at a steady state for a set duration (usually 20–60 minute)^[6].

A blunted heart rate response during the exercise test is associated with an increased risk of cardiovascular disease (CVD). exercise heart rate parameters are largely influenced by cardiorespiratory fitness, which provides a biomarker of

cardiopulmonary and musculoskeletal integrity. The autonomic nervous system activity may serve as an important modulator of exercise heart rate responses. Autonomic imbalance, which occurs when there is a decrease in vagal activity or an increase in sympathetic activity^[7].

Heart rate reserve (HRr) is measured to figure out best intensity level for workouts. It is the difference between your resting heart rate and your maximum heart rate^[7]. Heart rate recovery (HRR) is a measurement of heart's ability to return to its normal, resting pace after finishing a workout. It is defined as the rate at which heart rate decreases within the following minutes after the cessation of physical exercise, Heart rate recovery (HRR) is a noninvasive assessment of autonomic dysfunction and has been implicated with risk of cardiovascular events and all-cause mortality^[8]. Physiological Cost Index (PCI) is a simple method used to estimate energy expenditure during walking. It is based on a ratio between heart rate and self-selected walking speed^[9].

Low intensity exercise minimize stress on joints and muscles and ideal for beginners. We are comparing both the training LIIT and LICT on different parameters. On that basis we can made appropriate prescription for the fitness, obesity and diseased person according to their needs and also, we can see the impact of both type of training. So, the Aim of the study is to make appropriate prescription for the fitness, obesity and any diseased person according to their needs, lifestyle, age and profession and also see the impact of both type of training and impacts of both the training on different parameters and cardio-vascular system.

MATERIALS & METHODS

An interventional study was conducted in SVP hospital among college going girls of college of physiotherapy, Ahmedabad. Study was done in December 2023 to February 2024. Ethical approval was taken.

Basic and advanced Cardio-pulmonary Resuscitation (CPR) training was taken by the researcher because of ethical committee's suggestion to manage any adverse events. Written informed consent was taken.

✚ Inclusion criteria:

- college going girls.
- 18 to 25 years age.
- Normal BMI.
- Eligible according to PAR-Q scale.

✚ Exclusion criteria:

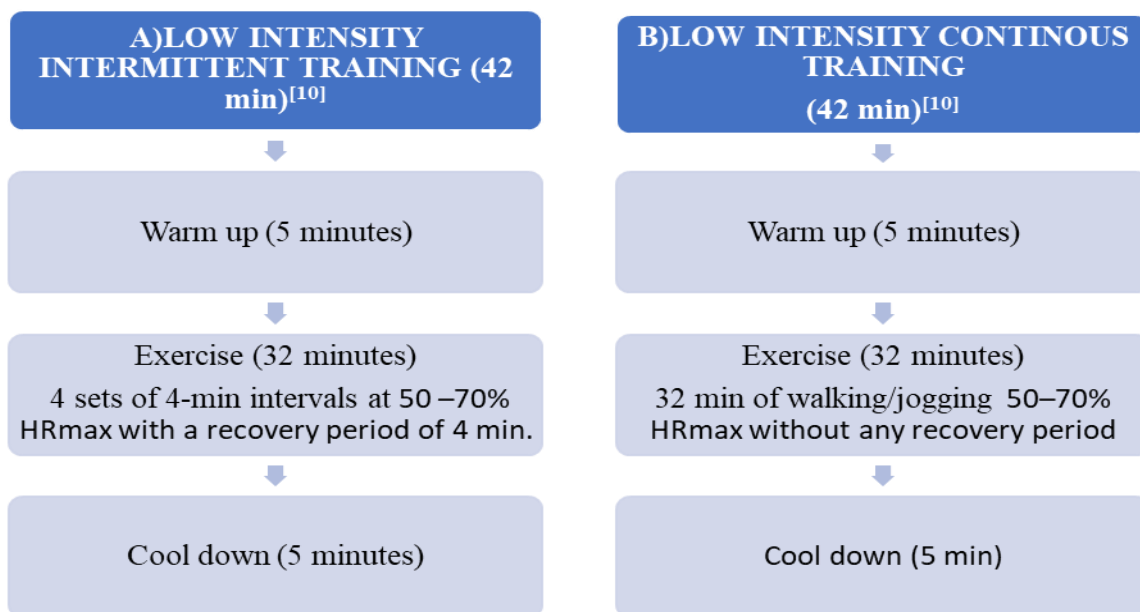
- Cardio-respiratory disorder.
- Neurological condition.
- Musculoskeletal disorder.

People doing regular exercise.

Participants were randomly allocated in two groups using a computer-generated table of random numbers. Group A: Low intensity intermittent training (LIIT), Group B: Low intensity continuous training (LICT). Baseline assessment was done. PAR-Q scale was taken.

Pre intervention outcomes were measured. Heart rate reserve (HRr), Heart rate recovery (HRR), Physiological cost index (PCI). Both the training protocol was done on treadmill for 42 minutes of each session done for 5 days/week upto 4 weeks. Training was done at 50–70% maximal heart rate, 11-13 RPE with talk test^[10].

PROCEDURE ^[11,12]



At the end of 4 weeks Group A and B participants were re-assessed. There were no dropouts.

Outcome measures:

Heart rate reserve: Calculated subtracting subjects' resting heart rate from their maximum heart rate. [By ACSM]

Heart rate recovery: Measured as the difference between the maximum HR and the HR after three minutes of recovery. (HRmax=220-person's age).^[13]

Physiological cost index: PCI=Walking HR-Resting HR/Walking speed.^[9]

STATISTICAL ANALYSIS

Unpaired t test was applied between post heart rate reserve, heart rate recovery and physiological cost index of both the group. Data was analyzed using SPSS version 20.

RESULT

14 females from community of Ahmedabad were taken by convenient sampling. 7

females with mean age of (20.57143 ± 1.718249) were included in interval training and 7 females with mean age of (22 ± 2.160247) were participated in continuous

training. There was no significant difference between baseline heart rate reserve, heart rate recovery and physiological cost index of both the group.

Table 1. baseline outcomes of participants of both groups.

Table.1		LIIT	LICT
1.	Age	(20.5714±1.718249) years	(22±2.160) years
2.	Heart rate reserve	(108.1429 ±6.66904) per minute	(116.5714±3.047247) per minute
3.	Heart rate recovery	(101.2857 ±4.680252) per minute	(101.2857±5.282496) per minute
4.	Physiological cost index	(0.533086±0.114714) kilocalories per hour	(0.556471±0.046675) kilocalories per hour

Table 2: Post intervention outcomes of participants of both groups.

Table.2		LIIT	LICT
1.	Heart rate reserve	(112 ±4.242641) per minute	(122.4284±1.812654) per minute
2.	Heart rate recovery	(90 ±6.350853) per minute	(89.57143±6.2411) per minute
3.	Physiological cost index	(0.533457±0.144021) kilocalories per hour	(0.5777±0.115519) kilocalories per hour

There was significant difference between heart rate reserve of both the group post exercise but there was no significant difference between heart rate recovery and

physiological cost index of both the group post exercise. Table 3 shows comparison data between both groups.

Table 3. Post data of intermittent training versus continuous training.

Measures	t value	P value
Heart rate reserve	-5.98	0.00
Heart rate recovery	0.456	0.901
Physiological cost index	0.623	0.538

DISCUSSION

Present study showed significant difference in heart rate reserve post intervention and no significant difference between heart rate recovery and physiological cost index of both the group post exercise

Exercise intensity is an important aspect of enhancing health-related fitness. It is well established that intermittent training is more effective than continuous training in improving parameters of health and physical fitness. Two main factors may be used to explain that which one is better: Physical fitness and exercise characteristics. It is plausible that these controversial findings occurred due to the exercise characteristics applied in each study reinforcing the need to compare the exercise characteristics used in different studies with respect to the primary outcome of the present study^[14].

Tiziana Pietrangelo, et al (2015) studied that Low Intensity Exercise Training Improves Skeletal Muscle Regeneration Potential at 12 days of low-to-moderate exercise training at low altitude, and they concluded that it improves the regenerative capacity of skeletal muscle in adult women^[15].

Viviane M. Conraads, et al (2015) has conducted study on Aerobic interval training (AIT) and continuous training (ACT) equally improve aerobic exercise capacity in patients with coronary artery disease: The SAINTEX-CAD study on 200 coronary artery disease patients and he conclude that similar improvements in exercise capacity and peripheral endothelial function following AIT and ACT in a large population of CAD patients^[16].

There are several studies done at high intensity interval training versus high or

moderate intensity continuous training but there are less studies done at low intensity interval training versus continuous training, low intensity exercise is recommended to prevent sudden cardiac death on young population because of their sedentary life-style and diet.

Sedentary lifestyles are associated with metabolic dysfunctions, such as elevated plasma triglycerides and high-density lipoprotein (HDL) cholesterol and reduced insulin sensitivity. Lipoprotein lipase (LPL) is a protein that interacts at the cellular level, and a low LPL concentration is known to decrease the plasma HDL cholesterol level, while affecting the prevalence of severe HTN, diabetes-induced dyslipidemia, metabolic disorders caused by aging, metabolic syndrome, and coronary artery diseases^[4].

Victor Silveira Coswig, et al (2020) has conducted study on Effects of high vs moderate-intensity intermittent training on functionality, resting heart rate and blood pressure of elderly women and concluded that High intensity interval training promoted greater benefits for body composition and functional performance than Moderate intensity continuous training and Moderate intensity interval training and also showed less pronounced effects of training. This suggests that the intensity of physical exercise is an important factor to consider when prescribing exercise to the elderly^[17].

CONCLUSION

The present study concludes that there is a significant difference in heart rate reserve in of both the group post exercise.

Limitations of the study:

- 1) Sample size was limited,
- 2) Only female gender was taken,
- 3) cardio-respiratory outcome was not taken like $V_{O_{2max}}$ and $V_{O_{2peak}}$.
- 4) Long term effects of exercise were not seen.

Future recommendation:

- 1) To compare the effects of LIIT versus LICT among larger sample size.
- 2) To compare the effects of training on different intensities like moderate to high among athletes.
- 3) To compare the effects of LIIT and LICT on other population like Hypertension, diabetes mellitus.
- 4) To compare the effects of LIIT and LICT on both the gender.

Clinical implication:

To prescribe appropriate exercise protocol in healthy individual, different age group wise and patient with disease population according to their need and symptoms.

Declaration by Authors

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