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Analytical Study Of Low Intensity Interval Training (LIIT) With Resistance Training (VS) Low Intensity Interval Training With Yoga Among Over Weight Female Engineering Students

K. Mythily[1*], Dr. P. Vanithamani[2]
[1*]Avinashilingam Institute for Home Science and Higher education for Women Email: 20phpep002@avinuty.ac.in
[2]Associate Professor, Department of Physical Education Avinashilingam Institute for Home Science and Higher education for Women Email: vanithamani_phys@avinuty.ac.in

Abstract:
This study investigates the comparative effects of LIIT with Resistance Training and LIIT with Yoga on body composition among overweight female engineering students. A total of 100 participants (n = 50 per group), aged 18–25 years, underwent 12 weeks of structured interventions. Statistical analyses using one-way ANOVA revealed significant improvements in both groups. For BMI, there was a significant difference between groups ($F = 23.844$, $p < 0.001$). For Body Fat Percentage, a significant difference was observed ($F = 26.458$, $p < 0.001$). For Muscle Mass, ANOVA showed a significant difference ($F = 22.570$, $p < 0.001$). LIIT combined with Resistance Training showed greater reductions in BMI and Body Fat, as well as higher increases in Muscle Mass, while LIIT with Yoga demonstrated moderate but steady benefits.A one-way ANOVA revealed a significant difference in BMI posone-way ANOVA scores between groups ($F = 23.844$, $p < 0.001$).
The study concludes that a significant positive impact of both methods shows effective. Specifically LIIT with Resistance Training is Superior in reducing the BMI and Body fat Percentage while increasing the Muscle mass and comparatively LIIT with Yoga provides sustainable fitness benefits and flexibility improvements. Both methods gave an effective through the training but the resistance training delivers faster results.
Keywords: *Overweight female students, Low Intensity Interval Training, Resistance Training, Yoga, Body composition*

I. INTRODUCTION

Obesity and overweight conditions are increasing among Indian youth. Particularly among female students due to sedentary lifestyle, poor dietary habits and academic stress. Studies indicate that nearly 40% of young adults India are overweight, posing risk of diabetes, Cardio vascular diseases and mental health issues (Momma et al., 2022) (Goossens, 2017) (Momma et al., 2022) (Goossens, 2017) (Gupta et.al. 2022). High intensity workouts may not be suitable for overweight individuals. Low Intensity Interval Training (LIIT) is emerging as a time efficient alternatives to conventional workouts with similar metabolic benefits and reduce the injury risk.

High-intensity workouts may be unsuitable for overweight individuals. Low Intensity Interval Training (LIIT) is emerging as a safer, time-efficient alternative to High Intensity Interval Training (HIIT), offering similar metabolic benefits with lower injury risks. LIIT paired with resistance training enhances calorie burning and muscle hypertrophy, while LIIT with yoga emphasizes flexibility, mindfulness, and gradual fat loss. Despite individual benefits, comparative evidence for these two modalities in overweight young women remains limited. This study addresses this gap by evaluating the relative effectiveness of LIIT combined with resistance training versus LIIT with yoga.

LIIT with resistance training enhances calorie burning, Muscle hyper trophy and strength LIIT with yoga focuses on flexibility, mindfulness and gradual fat loss. Both methods are gaining popularity yet their comparative effectiveness for overweight female students remains unclear.

Resistance training is well documented for its role in increasing Muscle Mass (Fisher et al., 2017) (Kraemer & Castracane, 2015) (Wewege et al., 2022), improving metabolism and reducing body fat (Schoenfeld et.al.2018). Incorporating resistance training into LIIT can enhance and promote long term fat loss in overweight women students (westcitt, 2019).

Yoga on the other hand focuses on flexibility, mental relaxation (Ramesh & Iyer, 2020) (Patel & Nair, 2020) (Desai et al., 2023) and balance while also contributing to weight loss through controlled movement and mindful breathing (Crames et. Al., 2016). The combination of LIIT with yoga can provide a holistic approach to weight management by addressing both physical and psychological aspects of obesity. Yoga has been found to reduce stress – related eating and improve adherence to healthy life styles (Ross et.at, 2013).

Despite the individual benefits of LIIT resistance training and yoga limited research exists comparing their combined effects on weight loss and fitness parameters in corpulent women students. This study aims to assess the effectiveness of LIIT with Resistance Training versus LIIT with Yoga in improving body composition, fitness levels and psychological well being among obese female students by identifying the most effective combination this research can contribute to designing sustainable fitness programs tailored to young women struggling with obesity.

II. REVIEW OF LITARATURE :-

Low intensity interval training (LIIT) is gaining popularity as an effective sustainable fitness approach, particularly among individuals who may find High Intensity Workouts challenging LIIT follows a structured pattern of short bursts of moderate exercise followed by active recovery periods, making it a more accessible alternative to High Intensity interval training (HIIT) unlike HIIT which often requires maximal effort and can be physically demanding LIIT focuses on controlled movements, lower impact and longer durations making it ideal for beginners, older , individuals with obesity and those recovering from injuries (Sharma et.al., 2021)

LIIT has been shown to enhance cardio vascular health (Cornelissen & Smart, 2013) (Figueroa et al., 2019) by gradually increasing heart rate and oxygen consumption. It improves cardiac efficiency helping individuals strengthen their heart muscles without excessive strain (Wen et. al., 2020).

While yoga is not traditionally considered as a high intensity workout (Irving et al., 2008) (Matsuo et al., 2014) but now its emerging evidence supports its effectiveness is sustainable weight management unlike rapid weight loss methods yoga promotes gradual but long lasting to work on maintaining the BMI reduction by improving metabolism enhancing digestion and fostering mindful eating habits (Rao et.at., 2021).

A randomized controlled trail (RCT) by (Bharshankar et.at., 2022) demonstrated that over weight individuals practicing yoga for six months experienced significant reductions in abdominal fat and waist circumference compared to those engaging in conventional aerobic exercise.

Ross et.al (2016) Found That While Yoga and Moderate Intensity Walking Produced Similar Short Term Weight Loss Effects, Yoga Practitioners maintained their weight loss for a longer duration due to behavioral and psychological modifications.

III. OBJECTIVE OF THE STUDY :-

The study is primary objective is to compare the effects of LIIT with resistance Training and LIIT with Yoga on BMI, Body Fat percentage and Muscle Mass among the overweight women students. The Secondary Objective is to explore the factor like mental well being and stress relief.

IV. METHODOLOGY

A. Selection of the Subject:-

Thirty students with aged of 18 – 24 inclusion criteria of BMI ≥ 25 belonging to the PSG College of Technology, Coimbatore region, Tamilnadu State, India. Were recruited based on the purposive sampling techniques. All the selected subjects were diagnosed with sedentary lifestyle, no metabolic disorders based on their prier life history was given during the study. The selected subject (N=100) categorized into two equal groups: LIIT with Resistance (n_1 = 50) and LIIT with Yoga (n_2 = 50) groups.

Table – I Shows that the inclusion primary criteria for selected subjects. They were informed and consent form obtained from the subjects and the institutional head for the subjects can participate and en compassing the intervention methods.

Table – ***I Inclusion of demographic criteria of the Subjects***

Particulars	Response | ANOVA Result
Age (N=30) (G_1=50) (G_2 = 50)	Mean Age = 24 ±5
BMI	≤ 25 Consider | F = 23.844, p < 0.001
Previous Experience	No Metabolic Disorders
	With sedentary lifestyle

V. RESEARCH DESIGN AND PROCEDURE

This study was used one-way ANOVA to compare the pre – test and post – test differences within each group and one-way ANOVA to compare the post – test results between two groups with a significance level of $p \leq 0.05$.

The study designed for total of 12 weeks duration (Total of 36 sessions) Group – I (LIIT with Resistance training) adopted the training interventions thrice in a week lasting 40 – 45 minutes, including the warm – up and warming down part. The study important to focus on the training of LIIT with resistance and LIIT with Yoga to work on the selected variables of BMI, and weight loss. The interventions includes the incline walking, outdoor walking and other exercise as a warm part and it will eventually increase the pace and intensity during the training. Before start the intervention both the groups (G1, G2) were measured on their selected variables and record the data as a pre – test after 12 weeks of intervention both the groups tested and recorded the data as a post test. The extracted measures of pre – test and post – test interventions result were compared with t – test to evaluate the effect of this training results were present in this study.

A. BODY MASS INDEX (BMI)

BMI was evaluated by using the BMI metric system formula.BMI – Body Mass Index is a commonly used measure to assess the body weight relative to height. It helps to categorize the individuals into different weight status groups to determine if they are under weight, normal weight, overweight or obese (WHO, 2020).

The BMI formula is,

BMI = Weight (kg) / Height (M)

BMI categories according to the Who classification underweight = ≤ 18.5, Normal weight = 18.5 – 24.9, Over weight = 25 – 29.9, Obesity (Class I) = 30 – 34.9, Obesity (Class II) = 35 – 39.9, Obesity (Class – III) = ≥40.

A. BODY COMPOSITION MEASURES :-

In this study was used to evaluate BMI the metric system formula, Body fat percentage by using the skin fold caliper and the Muscle Mass evaluated by using BIA (Bio Electrical Impedance Analysis) as a total of three measures taken to assessed the physical fitness level were conducted both prior and after the intervention among the Group – I LIIT with Resistance and Group – II LIIT with yoga. A recovery interval of ten minutes was allotted between each of three assessments resulting in a cumulative duration of 60 Minutes for entire testing procedure.

B. BODY FAT PERCENTAGE :-

Body fat percentage assessed by using the skin fold caliper on the common sites (i.e.) Triceps, Abdomen, Thigh and Suprailiac. Caliper to measure the thickness by skin folds at different body sites (Jackson & Pollack et.al 1978). Body fat percentage formula for Skin Fold Caliper method for women (Jack & Pollack, 1980)

BF% = 1.097 – (0.00046971 X sum of skin folds) + (0.00000056 X Sum of Skinfolds^2) – (0.00012828 X Age)

C. MUSCLE MASS PERCENTAGE :-

The Muscle Mass percentage measured via BIA (Bio electrical Impedance Analysis). BIA uses electrical currents to estimate the body mass percentage (Kyle et.al 2004).

VI. STATISTICAL ANALYSIS

A body composition (BMI, Body fat percentage, Muscle Mass Percentage) was conducted by SPSS – R software, suggest that requisite sample size of fewer than 50 participants was calculated to attain with a significance level of $\alpha = 0.05$. Descriptive statistics are used to analysis the mean, standard deviation (SD) and range for all pre-test and post – test variables. In spite that the limited sample size in each subgroup evaluated by inferential statistics to make the comparison of pre test data to check the baseline equivalence and the normal distribution used in this study so the one-way ANOVA was computed. The determination of statistical significance was established at α=0.05 and all the analyses were conducted utilizing a two tailed approach to testing the deviations in both directions (Higher to Lower).

Data were analyzed using SPSS-R software. Descriptive statistics (mean ± SD) were calculated. Independent one-way ANOVAs compared posone-way ANOVA outcomes between groups, with significance set at $p \leq 0.05$.

VII. RESULTS :-

TABLE – II Descriptive statistics are reported as the mean alongside the standard deviation (±SD).

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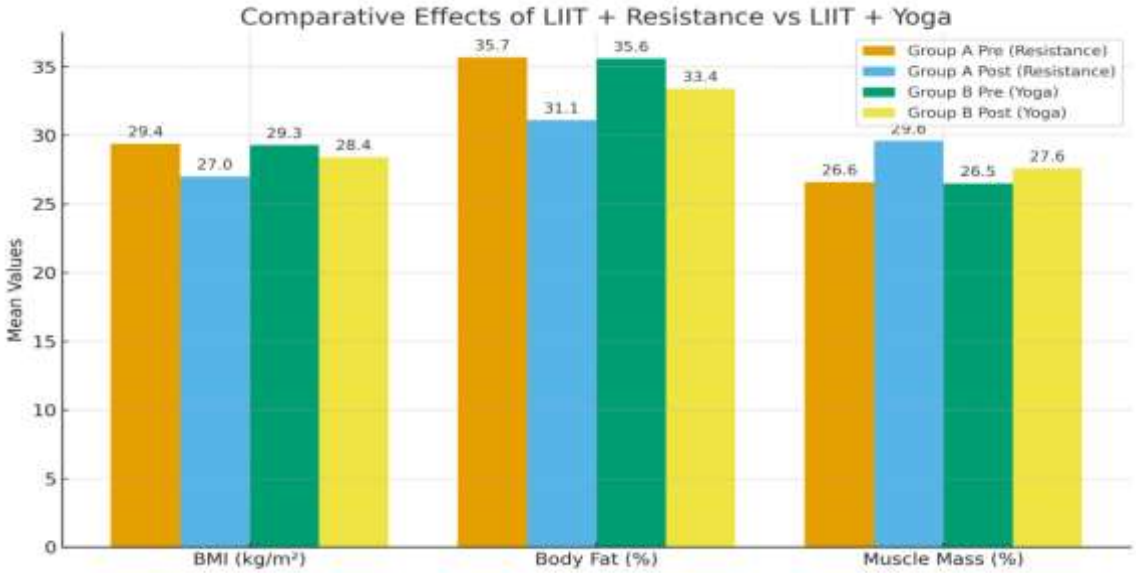
Parameter	Group A (LIIT + Resistance) Pre-Test	Post-Test	Group B (LIIT + Yoga) Pre-Test	Post-Test	ANOVA Result	Effect Size
BMI (kg/m²)	29.4 ± 2.0	27.0 ± 1.8	29.3 ± 2.1	28.4 ± 1.7	$F = 23.844$, $p < 0.001$	$\eta^2 = 0.196$ (large)
Body Fat (%)	35.7 ± 3.0	31.1 ± 2.6	35.6 ± 3.2	33.4 ± 2.8	$F = 26.458$, $p < 0.001$	$\eta^2 = 0.213$ (large)
Muscle Mass (%)	26.6 ± 1.9	29.6 ± 2.0	26.5 ± 2.0	27.6 ± 1.8	$F = 22.570$, $p < 0.001$	$\eta^2 = 0.187$ (large)

Descriptive statistics of selected body composition test. A one-way ANOVA revealed a significant difference in BMI posone-way ANOVA scores between groups ($F = 23.844$, $p < 0.001$).

FIGURE: I BAR DIAGRAM



A bar chart (Figure I) illustrates pre- and post one-way ANOVA values of BMI, body fat percentage, and muscle mass for both groups. The figure highlights the sharper decline in BMI and fat percentage and the higher increase in muscle mass for Group A (Resistance Training) compared to Group B (Yoga).

VIII. DISCUSSION

The present study compared the effects of Low intensity interval Training (LIIT) with resistance and Low intensity Interval Training (LIIT) with yoga on BMI, Body fat Percentage and muscle mass percentage among corpulent women students. The statistical analyses supported by the bar chart provide insights in to the relative effectiveness of that intervention.The effect size (η^2) values further support these findings, showing large effects: BMI ($\eta^2 = 0.196$), Body Fat ($\eta^2 = 0.213$), and Muscle Mass ($\eta^2 = 0.187$). These results confirm that the observed differences are not only statistically significant but also practically meaningful, strengthening the evidence for the effectiveness of LIIT with Resistance Training compared to LIIT with Yoga.

The result indicates that both the intervention groups experienced a reduction in BMI, but Group A compared to Group B the effect size for BMI reduction were moderate. Suggesting that resistance training plays a crucial role in reduction in Group A can be attributed to the metabolic demands of resistance training, which enhances lean muscle mass and increasing resting energy expenditure (REE) even after exercise.

These findings align with previous studies (Muse et al., 2009) (Gist et al., 2013) that indicate resistance training in combination with aerobic exercise is more effective in reducing BMI and improving Body Composition than Yoga alone (Willies et.at. 2012). Yoga although beneficial for flexibility (Huang et al., 2025) (Singh et al., 2021)

(Kumar & Verma, 2022), Stress Reduction and core strength might not have elicited the same level of metabolic impact for significant BMI reduction.

Impact on Body fat percentage both groups exhibited a decline in body fat percentage with Group A showing more substantial reduction compared to Group. The conclusion that resistance training is more effective in reducing fat mass compared to yoga. These outcomes can be explained by the post – exercise oxygen consumption (EPOC) effect of resistance training, which leads to prolonged calorie burning after workouts. Resistance training calorie burning after workouts. Resistance training also enhances insulin sensitivity and fat oxidation, contributing to greater fat loss (Westcott, 2012). In contrast yoga despite its effects on stress reduction and hormone balance may not generate the same level of energy expenditure and fat metabolism on resistance based LIIT workouts.

Effects on muscle mass percentage one of the most significant findings of this study and this study proven that increase in Muscle mass percentage where Group A demonstrated greater improvements compared to Group B. The effect size was moderate to high including a meaningful difference between the groups. Resistance Training in well documented for its role in hypertrophy (Scott et al., 2019) (Batrakoulis et al., 2020) (Mazurek et al., 2014) and strength development through progressive over load, leading to increased muscle protein synthesis (MPS) (Schoenfeld et.al. 2017). The muscle mass gains observed in Group A suggest that even low intensity resistance training can yield substantial improvements in lean body mass.

Resistance training should be prioritized in weight management programs to enhance fat loss while preserving or increasing muscle mass. Yoga can still be incorporated as a supplementary modality to improve flexibility, Stress reduction and mental well being but may not be as effective as resistance training for body composition changes. A combination of both modalities (LIIT + Resistance + Yoga) may provide holistic benefits: optimizing metabolic, Muscles and mental health outcomes.

IX. CONCLUSION

The analysis concludes that clearly demonstrate that LIIT combined with Resistance training produced superior results in improving body composition compared to LIIT combined with yoga. BMI, Body fat percentage and muscle mass demonstrate substantial responsiveness to group differences with large effect size suggesting that group based training is particularly effective for enhancing these attributes. This highlights the potential of structured training programs to improve the Body Compositions. Low intensity interval Training is superior in reducing BMI and Body fat while increasing muscle mass. Low intensity with yoga provides sustainable fitness benefits and flexibility improvements. Both methods are effective resistance training delivers faster results. These findings highlight the importance of resistance training in optimizing body composition and suggest that it should be a priority in weight management programs for women.

ETHICAL CLEARANCE: This Study Was Officially Permitted by The Institutional Human Ethical Committee and received the clearance report of Avinashilingam Institute for Home Science and Higher Education for Women (Deemed to be University).

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AUTHORS CONTRIBUTION: K.Mythily – Methodology, Data collection, Analysis and Interpretative the results, writing the original draft and reviews
Dr. P. Vanithamani, Head and Associate Professor – Supervision, validation and editing.
(All the authors read and approved the final manuscript.)

CONFLICT OF INTEREST: K.Mythily, Dr. P. Vanithamani declares that they have no conflicts of interest relevant to the content of this study.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request. Personal data are securely stored in a restricted-access online system at our institute, ensuring compliance with privacy and data protection regulations.

Ethical Approval: This study was officially approved by the Institutional Human Ethical Committee of Avinashilingam Institute for Home Science and Higher Education for Women (Deemed to be University).

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