"EFFECT OF TRADITIONAL RESISTANCE TRAINING VS CIRCUIT RESISTANCE TRAINING ON BODY COMPOSITION"

By

SUNIDHI MAROTHI

Dissertation Submitted to the

THE ODISHA UNIVERSITY OF HEALTH SCIENCES,

Bhubaneswar, 751009

In partial fulfilment of the requirements for the degree of

MASTER OF PHYSIOTHERAPY (M.P.T)

In

ORTHOPAEDIC

Under the guidance of

DR. PRIYADARSHINI MISHRA (PT)

Associate Professor

ABHINAV BINDRA SPORTS MEDICINE &

RESEARCH INSTITUTE

Bhubaneswar, Odisha

2023-2025

DECLARATION BY THE CANDIDATE

I hereby declare that this dissertation entitled "**EFFECT OF TRADITIONAL RESISTANCE TRAINING VS CIRCUIT RESISTANCE TRAINING ON BODY COMPOSITION**" is a Bonafide and genuine research work carried out by me under the guidance of **Dr. Priyadarshini Mishra (PT)**, Associate Professor of ABSMARI, BBSR.

Date: Signature:

Place -Bhubaneswar, Odisha **Sunidhi Marothi**

Student, ABSMARI

MPT (ORTHOPAEDICS)

CERTIFICATE BY THE GUIDE

This is to certify that the dissertation entitled "**EFFECT OF TRADITIONAL RESISTANCE TRAINING VS CIRCUIT RESISTANCE TRAINING ON BODY COMPOSITION**" is a Bonafide research work done by Ms. Sunidhi Marothi in partial fulfilment of the requirement for the degree of Master of physiotherapy in Orthopaedic Physiotherapy.

Date:

Place: Bhubaneswar, Odisha

Signature

Dr. Priyadarshini Mishra (PT)
Associate Professor,
ABSMARI

ENDORSEMENT BY THE HEAD OF THE DEPARTMENT

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Date

Place

Seal & Signature of the HOD

Dr. Asifuzzaman Shahriyar Ahmed (PT)

Department of Musculoskeletal & Sports

ENDORSEMENT BY THE PRINCIPAL

This is to certify that the dissertation entitled **"EFFECT OF TRADITIONAL RESISTANCE TRAINING VS CIRCUIT RESISTANCE TRAINING ON BODY COMPOSITION"** is a Bonafide research work done by Ms. Sunidhi Marothi under the guidance of Dr. Priyadarshini Mishra (PT), Associate Professor, Abhinav Bindra Sports Medicine and Research Institute, Bhubaneswar, Odisha.

Date:

Place: Bhubaneswar,

Signature & Seal

Dr. Chinmaya Kumar Patra (PT)
Principal
ABSMARI

ODISHA UNIVERSITY OF HEALTH SCIENCES

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This is to certify that the dissertation entitled "EFFECT OF TRADITIONAL RESISTANCE TRAINING VS CIRCUIT RESISTANCE TRAINING ON BODY COMPOSITION" carried out by Ms. Sunidhi Marothi bearing University Registration Number 23MP435004, has been evaluated and accepted by me as an Examiner / Evaluator, appointed by the Odisha University of Health Sciences, Bhubaneswar, in partial fulfilment of the requirements for the award of the degree of Master of Physiotherapy (MPT) in Orthopedics.

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ACKNOWLEDGEMENT

At the very outset, I express my deepest gratitude to **Dr. Apjit S. Bindra**, chairman**, Mr.Abhinav A. Bindra**, Founder, and **Dr. Digpal Ranawat**, Executive Director of ABSMARI, Bhubaneswar, Odisha for giving me this opportunity. I take this opportunity to convey my heartful gratitude to my guide **Dr. Priyadarshini Mishra (PT)**, Associate Professor, ABSMARI, for her valuable constant support, and constructive feedback throughout the course of this study, along with suggestions that rendered in giving shape and coherence to this endeavor. Her insight and encouragement helped me refine my research skills and navigate every challenge with confidence.

I express my sincere thanks to **Dr. Chinmaya Kumar Patra**, Principal for their support and help to make this dissertation successful. I am grateful to Jogger's Fitness Club, Nagpur for allowing me to carry out the clinical portion of this study, for their cooperation and assistance during data collection.

I also acknowledge with a deep sense of reverence, my gratitude towards my parents, my family, and my friends who have always supported me morally and mentally. I would like to thank every participant who participated in this study for their kind cooperation. And above all, I express my heartfelt gratitude to the Almighty for granting me the strength to successfully complete this research work on time.

Date: Signature:

Place: Bhubaneswar, Odisha Sunidhi Marothi

List of abbreviations used

S.NO	ABBREVIATIONS USED	WORDS
1.	TRT	Traditional Resistance Training
2.	CRT	Circuit Resistance Training
3.	BMI	Body Mass Index
4.	% Body Fat Mass	Percentage of Body Fat Mass

ABSTRACT

Background- Sedentary lifestyle is posing the threat to the individuals in the present day to maintain healthy lifestyle and body compositions. In turn of events, the present day lifestyle is getting hampered leading to improper body compositions. This study will help us to elevate the lifestyle by incorporating the resistance exercises in our daily life to promote the individuals for healthy life. So, the resistance training protocol is used for incorporating it in daily routine for improvement of lifestyle.

Objective-

This study is designed to find out effects of traditional resistance training and circuit resistance training on body composition respectively.

Methodology:

In this study, 26 participants aged between 18 - 30 years were included, all of those who met inclusion criteria were randomly allocated to the 2 groups which consist of Group A Traditional resistance training and Group B Circuit resistance training. Participants were evaluated. Then they were given intervention for 60 minutes protocol for 4 times a week for 6 weeks. While at 1^{st}, 3^{rd} and 6^{th} week the body composition parameters were assessed to observe its effects on body composition parameters. Microsoft excel 2021 and IBM SPSS 26.0 were used for data analysis, that calculated statistics analysis.

Results:

The findings showed a statistically significant and clinically meaningful reduction in both scores .i.e. BMI & % Body fat mass. Mean BMI scores in Group A reduced from 24.98 ± 2.93 to 24.56 ± 2.90 and % Body fat mass reduced from 25.76 ± 4.68 to 24.15 ± 4., while BMI scores in Group B reduced from 24.2 ± 2.37 to 23.57 ± 2.32 and %

Body fat mass reduced from 24.46 ± 3.58 to 22.92 ± 3.53 from 1st week to 6th week. During the study period no adverse effects or complications occurred.

Conclusion:

Traditional resistance training and Circuit resistance training was found effective in reduction of BMI & % Body fat mass in healthy individuals. These are effective interventions proved for improving body composition parameters. These findings suggests that the inclusion of resistance training is an effective training to be practiced for healthy lifestyle. Future studies with different training protocols and long-term follow-up are recommended to validate the result.

Keywords:

Body Mass Index , Body composition, , Circuit Resistance Training, Percentage body Fat mass, , Sedentary Lifestyle, Traditional Resistance Training

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INTRODUCTION

INTRODUCTION

Physical activity is vital essence for the healthy aging, and it can be requisite at any phase of life. Physical activity refers to all the movements including we perform during leisure time, to get from one place to another, or as part of a person's work or domestic activities. The globally recommended criteria to be called physically active is of at least 150 minutes of moderate-intensity physical activity per week. Often people tend to think is it too late to start being physically active and to enjoy the benefits of active lifestyle. But physical activity is an opportunity to not only improve fitness by participating in activities we like, feel energetic to perform in our daily pursuits, but also spend time with friends and family, get outdoors, and maintain a healthy weight. Altogether, being physically active as an older adult is an blessing to relish the benefits by improving health and increasing health-related quality of life which tends adult to live longer. Nowdays lack of physical activity is giving rise to the sedentary lifestyle behaviour.

Sedentary lifestyle behaviour can be defined as any waking behaviour such as sitting or leaning with an energy expenditure of 1.5 metabolic equivalent task (MET) or less. It has become one of the commonest problem spreading worldwide because of lack of exercise, increased occupational sedentary behaviors such as office work, the increased screentime on devices. Therefore, the associated health problems are on the rise. It has resulted in increased all-cause mortality, cardiovascular disease mortality, cancer risk, and risks of metabolic disorders such as diabetes mellitus, hypertension, and dyslipidemia,

musculoskeletal disorders such as arthralgia and osteoporosis, depression and cognitive impairment. According to a Lancet study in June 2024, 49.4% of adults in India are physically inactive. Sedentary lifestyle shows the physiological effects which shows reducing lipoprotein lipase activity, muscle glucose, protein transporter activities, impaired lipid metabolism, and diminished carbohydrate metabolism. Increased sedentary lifestyle has resulted change in body's weight homeostat, weight gain, adiposity, and elevated chronic inflammation. Hence, reducing sedentary behaviors and increased physical activity are both important to promote public health.[1,2]

Traditional Resistance training is the use of resistance for muscular contraction to build strength, anaerobic endurance and size of skeletal muscles. According to the principles, muscles of the body will work to overcome a resistance force when they are required to do so. When you do resistance training repeatedly and consistently, your muscles become stronger. Systematic and methodological resistance training is vital in developing various physical performance characteristics. However, it is dynamic process, which is impossible to improve without altering over time to maintain or advance specific training goals. Strength training to improve joint function, bone density, muscle, tendon and ligament strength, as well as aerobic exercise to improve your heart and lung fitness, flexibility and balance exercises.[3] Meanwhile, different training methods, loads, intensities, durations, and intervals are important factors when designing resistance training plans depending on the manipulation of these variables can lead to different adaptations and varying magnitudes of increase in strength, power, endurance, and muscle hypertrophy. TRT is conducted

continuously with no rest between repetitions, with inter-set rest ranging from 1 to 5 min.

Resistance Circuit training is a type of powerful training regimen in which performing a series of exercises with little rest between them, resting after finishing the circuit and repeating it again. The protocol is designed according to the need of the individual and to achieve the desired result the components which may vary can be number of exercises, volume, load, rest-interval length, session duration, and length of training phase. This is one of the trending training types being practiced to maintain the overall health of the body. The benefits replenished from this training is not only by boosting the muscular strength, endurance, changes in metabolic adaptations but also it is improving lactate threshold time, changes in hormone concentrations, circulating the cholesterol levels and promoting altogether the weight loss and body composition changes which aids in overall health status of people.[4,5]

Administering resistance circuit training with short rest intervals yields identical effects on lactate threshold as observed in traditional strength training. The increase in lactate threshold can be possible with executing the resistance circuit training by which in turn results in an improvement of lactate clearance by an increase of mitochondrial density.

It has also shown significant effects on body composition in regards to following parameters total body mass (BM), lean BM (LBM), and body fat (BF) percentage. Body composition changes will most likely depend on the type of the individual, circuit type, protocol induced with the gains expected to be achieved.

Physical Fitness has become one of the important fragment of our life. To maintain the physical fitness, being physically active is much needed in everyday life, to have more energy and add years to your life which upgrades the quality of life. This can only be achieved by implying exercises in routine of life.[5]

Xiaomi Body Composition Scale S400 is an device that is utilized for testing the body composition. It gives precise information about body weight, heart rate, BMI, body score, body water content, body hydration, body fat percentage, fat mass, protein mass, protein rate, muscle mass, muscle rate, bone mineral mass, bone mineral rate, visceral fat rate, basal metabolic rate, lean body mass, body type, estimated waist-hip ratio, body age, skeletal muscle mass, weight control, muscle control, fat control, standard weight.[6]

Need of the Study

Sedentary lifestyle is posing the threat to the individuals in the present day giving rise to improper body compositions. In turn of events, the present day lifestyle is getting hampered leading to diseases. This study will help us to elevate the lifestyle by incorporating the resistance exercises in our daily life. And promoting the individuals to lead the healthy life. Not only it will promote the modifications in lifestyle but also add numerous benefits like prevention from secondary diseases, obesity and chronic diseases. This would ultimately benefit the overall health of the individuals. Traditional resistance training is one of the familiar training showing numerous benefits on muscle strength, tone, bone density, body composition, physical performance. While circuit resistance training is the evolving training protocol used solely or in conjunction with other techniques. As we have observed that both the training protocol are effective to be used for healthy lifestyle in everyday life.

But due to dearth of literature on comparison of these two training protocols on body composition is not known. So we designed this research to compare their effects on body composition in individuals.

AIM & OBJECTIVE

AIM AND OBJECTIVES

AIM OF THE STUDY-

To compare the effects of traditional resistance training and circuit resistance training in individuals on body composition

Objectives of the study-

- To find out effects of traditional resistance training on body composition.
- To find out effects of circuit resistance training on body composition.
- To compare the effects of traditional resistance training and circuit resistance training on body composition.

HYPOTHESIS

Hypothesis

Hypothesis (H1)

It is hypothesized receiving traditional resistance training on body composition would exhibit significant improvements as compared to those in circuit resistance training.

Hypothesis (H0)

It is hypothesized that individuals receiving traditional resistance training would exhibit no significant improvement on body composition as compared to those in circuit resistance training on body composition.

Hypothesis (Ha)

It is hypothesized that individuals receiving circuit resistance training would exhibit significant improvements on body composition as compared to those in traditional resistance training.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

1. **Santos et al. (2022)** This systematic review and meta-analysis was conducted on "What is the traditional method of resistance training: a systematic review." The 39 studies were eligible and included in this review. The common characteristics of the traditional training protocol were frequency of 3 sessions/week, 3 sets of 9 repetitions, with weight =75% 1RM. The movement time was 2±1 seconds for the concentric and for the eccentric phases. Resting time between sets was 2±1 minutes. The study concluded that the traditional method of resistance training" can be defined as: "Three (±1) sets of 9±6 repetitions of concentric and eccentric exercises using an external load of 75±20% of one maximum repetition, completed 3±1 times/week.

2. **Thapa et al. (2024)** A systematic review and meta-analysis was conducted on "Effects of complex training compared to resistance training alone on physical fitness of healthy individuals: A systematic review with meta-analysis." by including Thirty-two studies involving 726 healthy participants. In this both groups RT and CT similarly improved one-repetition maximum (1RM) squat and bench press, 10 m and 30–60 m linear sprint time, squat jump height, jump power, reactive strength index, and standing long jump distance. Compared to RT, CT favoured 5-m (ES = 0.96) and 20-m linear sprint (ES = 0.52), change-of-direction speed (CODS; ES = 0.39), and countermovement jump height (CMJ; ES = 0.36). Compared to traditional resistance training, complex training may improve 5-m and 20-m linear sprints, CODS, and CMJ height.

3. **Beqa Ahmeti G et al. (2020)** This study presents the 'Endurance Training vs. Circuit Resistance Training: Effects on Lipid Profile and Anthropometric/Body Composition Status in Healthy Young Adult Women." In this 57 women participants were included and were divided into the ET group (n = 20), RT group (n = 19), and non-exercising control group (n = 18). All participants were tested pre and post-test for cardiovascular risk factors (CRF), including total cholesterol, high density lipoprotein (HDL), low density lipoprotein (LDL), triglycerides, glucose, and anthropometric/body composition (body mass, body mass index, skinfold measures, body fat %). For 8 weeks, the ET group trained three times/week on a treadmill while the RT group participated in equal number of circuit weight training sessions. The results of this study evidence improvements of CRF in young adult women as a result of 8-week ET and RT.
4. **Ridho Gata Wijaya et al. (2023)** This study explores "The effect of the Body weight circuit: does it affect fat percentage, muscle and cardiovascular fitness in adult women in singcronous? In this ample of 20 adult women aged 30-50 years was employed in this correlational and experimental study. The correlation and results revealed a significant relationship and comparison revealed significant differences in pretest and post test percentage of fat, back muscle fitness, limbs, and cardiovascular with a sig 0.05. It was determined that as the percentage of fat in the body decreased, fitness increased and vice versa. Circuit body weight training boosts cardiovascular fitness, lowers body fat percentage, and improves muscle fitness.
5. **Ramos-Campo et al. (2021)** This systematic review and meta-analysis was studied on "The effects of resistance circuit-based training on body composition, strength and cardiorespiratory fitness: A Systematic Review and

Meta-Analysis" used to analyze the effects of pre–post-intervention CT and differences from control groups (CG). Of the 830 studies found, 45 were included in the meta-analysis. The study concluded that the CT interventions led to increases in muscle mass and decreases in fat mass. Therefore, CT has been shown to be an effective method for improving body composition, cardiorespiratory fitness, and strength of the lower and upper limbs.

6. **Alcaraz et al. (2011)** This study represents "Similarity in adaptations to high-resistance circuit vs. traditional strength training in resistance-trained men." In this 33 healthy men were randomly assigned to high-resistance circuit (HRC), traditional strength training (TS), or a control group. To compare the effects of 8 weeks of on physical performance parameters and body composition. Training consisted of weight lifting 3 times a week for 8 weeks. Before and after the training peak power output, and body composition determined. Shuttle-run performance was significantly better after both HRC and TS training, however peak cycling power increased only in TS training ($p \leq 0.05$). Significant decreases were found in % body fat in the HRC group only; HRC and TS training both resulted in an increased lean but not bone mass. The HRC training was as effective as TS for improving weight lifting 1RM and peak power, shuttle-run performance and lean mass.
7. **Alcaraz et al. (2008)** This study focuses on "Physical Performance and Cardiovascular Responses to an Acute Bout of Heavy Resistance Circuit Training versus Traditional Strength Training." This investigation compared physical performance parameters and cardiovascular load during heavy-resistance circuit (HRC) training to the responses during a traditional, passive rest strength training set (TS). Ten healthy with strength training experience volunteered for the study.

Testing was performed once weekly for 3 weeks. On day 1, subjects were familiarized with the test and training exercises. On the subsequent 2 test days, subjects performed 1 of 2 strength training programs: HRC (5 sets × (bench press + leg extensions + ankle extensions); 35-second interset rest; 6 repetition maximum [6RM] loads) or TS (5 sets × bench press; 3-minute interset rest, 6RM loads). The study resulted in HRC may be an effective training strategy for the promotion of both strength and cardiovascular adaptations.

8. **Yasep Setiakarnawijaya et al. (2021)** This study titled "Body composition through biomedical impedance analysis: development of body score predictive equation among rural society." The participants (15 males and 19 females) were included. Their body height was measured through a wall-hung measure while their body weight was measured using a BIA-based scale, namely Xiaomi Mi Body Composition scale S400. The results showed that the body score system offered by the scale offers a relatively high accuracy of body composition.
9. **Yasaman Alidadi et al. (2019)** This study explores "The validity of a bioelectrical impedance analyzer, Xiaomi MI Body Composition scale S400, for measurement of body composition." A total of 30 university students and employees (18 women and 12 men) aged between 19 and 50 years were selected. The results suggest that Xiaomi MI Body Composition scale S400 is a valid device to measure body composition which makes it appropriate for clinical use.
10. **Xing Zhang et al. (2025)** presented a meta-analysis on "Superset Versus Traditional Resistance Training Prescriptions: A Systematic Review and Meta-analysis Exploring Acute and Chronic Effects on Mechanical, Metabolic, and Perceptual Variables." The primary aim of this systematic review and meta-analysis was to compare the acute and chronic effects of

superset and traditional set prescriptions on mechanical, metabolic, and perceptual variables. We also aimed to conduct subgroup analyses to determine the effect of different types of supersets (agonist–antagonist, similar biomechanical, and alternate peripheral supersets). In this meta-analysis Nineteen studies involving 313 participants were included which compared with traditional set prescription, supersets allow for (1) a similar total number of repetitions and volume load with a shorter session duration and increased training efficiency (2) higher blood lactate concentration during and after RT (3) higher energy cost during RT (4) similar creatine kinase concentration after RT and (6) similar chronic adaptations in maximal strength, strength endurance, and muscle hypertrophy. The subgroup analysis revealed that utilizing agonist–antagonist supersets leads to a significant increase in the number of repetitions that are able to be completed compared with traditional sets. Similar biomechanical supersets led to less volume load compared with traditional sets. The study concluded that supersets provide a time-efficient alternative to traditional RT, reducing session duration without compromising training volume, muscle activation, perceived recovery, or chronic adaptations in maximal strength, strength endurance, and muscle hypertrophy.

11. **Andersen et al. (2022)** published a meta-analysis on "Comparing the effects of variable and traditional resistance training on maximal strength and muscle power in healthy adults: A systematic review and meta-analysis" in the Journal of Science and Medicine in Sport. The aim of the study was to aggregate different effects between variable resistance training and traditional resistance training on maximal muscle strength and muscle power and

identify potential sex- and training program-related moderator variables. A total of 491 participants (341 men and 150 women, age 18–37 years) were included in the analyses. In terms of maximal muscle strength, there were no statistically significant differences between variable resistance training and traditional resistance training for the lower or the upper. Additionally, there were no significant training-related differences in muscle power for the lower or upper body. It was concluded that variable resistance training and traditional resistance training are equally effective in improving maximal muscle strength and muscle power in healthy adults.

12. **Westcott et al. (2012)** published a article on "Resistance Training is Medicine - Effects of Strength Training on Health" which states that the inactive adults experience a 3% to 8% loss of muscle mass per decade, accompanied by resting metabolic rate reduction and fat accumulation. Ten weeks of resistance training may increase lean weight by 1.4 kg, increase resting metabolic rate by 7%, and reduce fat weight by 1.8 kg. Resistance training may promote bone development, with studies showing 1% to 3% increase in bone mineral density. Resistance training may be effective for reducing low back pain and easing discomfort associated with arthritis and fibromyalgia and has been shown to reverse specific aging factors in skeletal muscle.
13. **Schoenfeld et al. (2017)** conducted meta-analysis on "Strength and Hypertrophy Adaptations Between Low- vs. High-Load Resistance Training: A Systematic Review and Meta-analysis" with the studies that met the following criteria: (a) an experimental trial involving both low-load training [≤60% 1 repetition maximum (1RM)] and high-load training (>60% 1RM); (b) with all sets in the training protocols being performed to momentary

muscular failure; (c) at least one method of estimating changes in muscle mass or dynamic, isometric, or isokinetic strength was used; (d) the training protocol lasted for a minimum of 6 weeks; (e) the study involved participants with no known medical conditions or injuries impairing training capacity. A total of 21 studies were ultimately included for analysis. The findings indicate that maximal strength benefits are obtained from the use of heavy loads while muscle hypertrophy can be equally achieved across a spectrum of loading ranges.

14. **Muñoz-Martínez et al. (2017)** presented the meta-analysis on "Effectiveness of Resistance Circuit-Based Training for Maximum Oxygen Uptake and Upper-Body One-Repetition Maximum Improvements: A Systematic Review and Meta-Analysis" in which 118 healthy adults who performed resistance circuit-based training, maximum oxygen uptake was evaluated before and after the training programme. In this 308 articles found for one-repetition maximum, eight articles were analysed. The bench press one-repetition maximum load, of 237 healthy adults who performed resistance circuit-based training, was evaluated before and after the training programme. The meta-analysis showed that resistance circuit-based training, independent of the protocol used in the studies, is effective in increasing maximum oxygen uptake and one-repetition maximum bench press in healthy adults.
15. **Hedayati et al. (2012)** represented a study on "Effects of Circuit Resistance Training Intensity on the Plasma Ghrelin to Obestatin Ratios in Healthy Young Women" in which Twenty-seven female students with the mean age of 22 1.54 years and mean body mass index (BMI) of 20.76 1.86 kg/m^2 were selected and randomly divided into experimental and control groups. Subjects

performed circuit resistance training with 40% and 80% of 1 repetition maximum (1RM) for 4 weeks. Total plasma ghrelin, obestatin, and glucose levels and the ghrelin to obestatin ratio were measured for all subjects before and after training. It concluded that the plasma ghrelin to obestatin ratio increased significantly in the 80% 1RM group and a significant reduction of the plasma obestatin level.

16. **Maroto-Izquierdo et al. (2024)** conducted a study on "Pumping up the Fight against Multiple Sclerosis: The Effects of High-Intensity Resistance Training on Functional Capacity, Muscle Mass, and Axonal Damage" in which Eleven relapsing–remitting MS patients volunteered in this within-subject counterbalanced intervention study. Serum neurofilament light-chain (NfL) concentration, vastus lateralis thickness (VL), timed up-and-go test (TUG), sit-to-stand test (60STS), and maximal voluntary isometric contraction (MVIC) were measured before and after intervention. Participants performed 18 sessions of high-intensity RT (70–80% 1-RM) over 6 weeks. The study concluded that 6-week RT program significantly increased muscle mass, functional capacity, and neuromuscular function while also decreasing serum NfL in MS patients.
17. **Cui J et al. (2025)** published the meta-analysis on "Effectiveness of long-term cluster training and traditional resistance training in enhancing maximum strength in young adults: a systematic review and meta-analysis." assessed the long-term impact of cluster training on the augmentation of maximum strength in young adults through the implementation of meta-analysis and further investigation of the factors associated with training duration. After screening, 21 articles and 49 reports were included. The

analysis concluded that Cluster training (CT) mitigates exercise-induced fatigue more effectively than traditional resistance training (TRT) and enables more efficient maximum strength growth within the initial 8 weeks, however, the converse holds after 9 weeks

18. **Mcleod et al. (2023)** conducted a systematic reveiew "The influence of resistance exercise training prescription variables on skeletal muscle mass, strength, and physical function in healthy adults: An umbrella review" published in Journal of Sports and Health science, involving 4 systematic reviews that met inclusion criteria. The review concluded that RT increased muscle mass, strength, and physical function compared to no exercise. RT intensity (load) and weekly frequency impacted RT-induced increases in muscular strength but not muscle hypertrophy.
19. **Vargas-Molina S et al. (2025)** represented the study on "Cluster sets and traditional sets elicit similar muscular hypertrophy: a volume and effort-matched study in resistance-trained individuals." The study included 10 resistance-trained volunteers (7 men and 3 women) participated in this study. Participants performed two training protocols over an 8-week period, with two weekly sessions consisting of 5 sets of 12 repetitions of the leg press and leg extension exercises. The study employed a within-participant, unilateral design where one limb performed a TS protocol and the contralateral limb performed 3 clusters of 4 repetitions with a 20-s intra-set rest period of the same exercises (CS). Muscle thickness was assessed via ultrasound and thigh lean tissue mass was assessed by dual-energy X-ray absorptiometry pre- and post-study. The authors concluded that when sets, repetitions, and load

adjustments were equalized based on RIR, a CS protocol elicits similar increases in muscle thickness and lean mass compared to a TS protocol.

20. **Davies et al. (2021)** explored the meta- analysis on "Chronic Effects of Altering Resistance Training Set Configurations Using Cluster Sets: A Systematic Review and Meta-Analysis." was conducted to compare the effects of RT programs implementing cluster and traditional set configurations on muscular and neuromuscular adaptations. Twenty-nine studies were included in the meta-analysis. Results showed both cluster and traditional set configurations demonstrate equal effectiveness to positively induce muscular and neuromuscular adaptation.
21. **Wang et al. (2024)** in International Journal of Asian Social Science presented a study on "Effects of different intensity resistance training on fat level, energy intake, and appetite among overweight and obese female college students." was conducted 515 overweight and obese female college students aged 18–25 were sampled in which the impact of High-Intensity Interval Training (HIIT) and Moderate-Intensity Resistance Training (MIRT) on body composition, fat level/body composition, and muscle mass them. The study concluded that MIRT and HIIT outperformed Control in weight loss and diet.
22. **Ashtary-Larky et al. (2022)** in Critical Reviews in Food Science and Nutrition published a systematic review and meta-analysis on "Effects of resistance training combined with a ketogenic diet on body composition: A systematic review and meta-analysis." which evaluated the effects of ketogenic diets (KDs) on body mass (BM), fat mass (FM), fat-free mass (FFM), body mass index (BMI), and body fat percentage (BFP) compared to non-KDs in individuals performing resistance training (RT). Out of 1372

studies, 13 randomized controlled trials (RCTs) that enrolled 244 volunteers were included. The results demonstrated that KDs significantly decreased BM, FM, BMI, and BFP compared to non-KDs in individuals performing RT.

23. **Campbell et al. (2020)** in Journal of Functional Morphology and Kinesiology represented a "Intermittent Energy Restriction Attenuates the Loss of Fat Free Mass in Resistance Trained Individuals. A Randomized Controlled Trial" in this study body composition changes in RT-individuals during continuous energy restriction or intermittent restriction was evaluated. A total of 27 males and females were randomized to a ~25% caloric restricted diet Refeed (RF; $n = 13$) or Continuous group (CN; $n = 14$) in conjunction with 4-days/week resistance training for 7-weeks. RF implemented two consecutive days of elevated carbohydrate (CHO) intake, followed by 5-days of caloric restriction each week. CN adhered to a continuous 7-week caloric restriction. Body mass (BM), fat mass (FM), fat-free mass (FFM), dry fat-free mass (dFFM), and resting metabolic rate (RMR) were assessed pre/post-diet. The study concluded that both groups significantly reduced BM and with no differences between groups.

24. **Martinez-Rodriguezet al. (2021)** in International Journal of Environmental Research and Public Health conducted a cross-over design study on "Effect of High-Intensity Interval Training and Intermittent Fasting on Body Composition and Physical Performance in Active Women" in this study the effects of HIIT, with or without intermittent fasting, on muscular and anaerobic performance in 14 active women to assess performance, body composition, hand-grip strength, and counter-movement jump (CMJ) height

was measured, and a 30 s Wingate test was completed assessed. This study concluded that HIIT + IF reduced fat mass and increased CMJ height.

25. **Tsirigkakis et al. (2021)** conducted a parallel randomized design on "Effects of Two Workload-Matched High-Intensity Interval Training Protocols on Regional Body Composition and Fat Oxidation in Obese Men" in this study the two high-intensity interval training (HIIT) protocols on regional body composition and fat oxidation in men with obesity were compared. Sixteen inactive males were randomly assigned to either HIIT10 (48 × 10 s bouts at 100% of peak power [W_{peak}] with 15 s of recovery) or HIIT60 group (8 × 60 s bouts at 100% W_{peak} with 90 s of recovery), completed eight weeks of training, while maintaining the same diet. The study concluded both HIIT protocols were equally effective in improving regional body composition and fat oxidation during exercise in obese men.
26. **Jackson et al. (2018)** in Applied Physiology, Nutrition, and Metabolism presented a article on "Exercise training and weight loss, not always a happy marriage: single blind exercise trials in females with diverse BMI**"** in this study thirty-four females finished the 4-week intervention and 36 females the 8-week intervention the circuit exercise training programs (3 times a week (45–90 min), intensity 50%–90% peak oxygen uptake for 4 and 8 weeks) were conducted. The study concluded that exercise training in both studies did not lead to a significant reduction of weight/body mass index (BMI) in the participants' groups; however, lean participants gained muscle mass.
27. **Versic et al. (2021)** represented a study on "Differential Effects of Resistance- and Endurance-Based Exercise Programs on Muscular Fitness, Body Composition, and Cardiovascular Variables in Young Adult Women:

Contextualizing the Efficacy of Self-Selected Exercise Modalities" to determine the effects of RT and ET three times a week over an eight-week period on anthropometric/body composition indices, blood pressure (BP), and muscular fitness. The sample of participants comprised 57 young healthy women divided into ET, RT, and non-exercising groups. The variables consisted of anthropometric/body composition indices, muscular fitness variables, and cardiovascular parameters. The study concluded that the RT improved the participants' strength and force capacities to a greater extent than ET.

28. **Idrizovic et al. (2021)** published a study on "Indices of Cardiovascular Health, Body Composition and Aerobic Endurance in Young Women; Differential Effects of Two Endurance-Based Training Modalities" to analyse the effectiveness of two different types of ET on changes in indicators of CVH in apparently healthy adult women. The sample included 58 women divided into one control non-exercising group (n = 19), and two exercising experimental groups The first EE participated in choreographed aerobic-endurance training (CAT; n = 19), while the second participated in treadmill-based endurance exercise (TEE; n = 20) during the experimental protocol (8 weeks, 24 training sessions). The study concluded that TEE improved endurance capacity to a greater extent than CAT.
29. **Delgado-Floody et al. (2019)** in Journal of Exercise Science & Fitness introduced a systematic review on "Feasibility of incorporating high-intensity interval training into physical education programs to improve body composition and cardiorespiratory capacity of overweight and obese children: A systematic review." This review was to analyze the feasibility of

incorporating HIIT programs into PE classes to improve the body compositions and cardiorespiratory fitness of overweight students. The final six studies selected, three were conducted in children under 12 years old and three involved adolescents between 12 and 18 years old. The HIIT protocols consisted of 2–3 sessions per week, with intervals of 15 s and passive or active rests of 15 s, totalling up to 6 min of work with 4 min of rest for 6–24 weeks. The study concluded that the significant changes were reported in body composition, body mass index, body fat (%), waist circumference, and sum of skinfolds and increases in muscle mass were observed.

30. **Franco et al. (2019)** in Journal of Strength and Conditioning Research was published on "Lower-Load is More Effective Than Higher-Load Resistance Training in Increasing Muscle Mass in Young Women." The study was designed to investigate the impact of load (higher vs. lower) performed until or close to volitional fatigue on muscle strength (MS) and fat and bone-free lean mass (FBFM) in young women. It included 32 women performed resistance training (RT) in 1 of 2 conditions: lower-load RT and higher-load RT were evaluated before and after 9 weeks (the first week was used for familiarization) of RT. Both groups performed 3 unilateral , 3 sets per exercise, 60–90 seconds of rest between sets, 2 days per week. In the LL group, the loads used in the exercises were the loads necessary to perform 30–35 repetitions in the first set. For the HL group, the loads used were the loads necessary to perform 8–10 repetitions in the first set. The study concluded that lower-load RT is more effective than higher-load RT in increasing FBFM.
31. **Wewege et al. (2021)** represented a meta-analysis on "The Effect of Resistance Training in Healthy Adults on Body Fat Percentage, Fat Mass and

Visceral Fat: A Systematic Review and Meta-Analysis." This review evaluated resistance training for body composition outcomes in healthy adults. They included randomised trials that compared full-body resistance training for at least 4 weeks to no-exercise control in healthy adults. From 11,981 records, 58 studies were included in the review, with 54 providing data for a meta-analysis. The analysis concluded that compared to the control, resistance training reduced body fat percentage by − 1.46%, body fat mass by − 0.55 kg and visceral fat.

32. **Lafontant et al. (2025)** in Journal of the International Society of Sports Nutrition presented a meta-analysis on "Comparison of concurrent, resistance, or aerobic training on body fat loss: a systematic review and meta-analysis**.**" This systematic review and meta-analysis compared the differential effects of resistance training (RT), aerobic training (AT), and concurrent training (CT) on body mass and body fat loss in metabolically healthy individuals. Primary outcomes of interest included changes in fat mass and body fat percentage; secondary outcomes were body mass and fat-free mass (FFM). Sub-analyses on intervention duration (< or ≥ 10 weeks), CT timing (aerobic and resistance exercises done on the same day versus different days within a week), and workload matching (equating workloads between AT, RT, and CT) were conducted. The study resulted that lasting at least 10 weeks, AT outperformed RT in reducing body mass and fat mass but led to less FFM retention. CT reduced significantly more fat mass compared to RT. These results support the concurrent use of aerobic and resistance exercises for fat

mass reduction, as well as an emphasis on workload and duration when programming exercise for fat loss.

33. **Cicek et al. (2023)** in Universa Medicina printed a randomized controlled trial on "Effect of aerobic and resistance exercises on body composition and quality of life in overweight and obese women: a randomized control trial." In this study the 90 overweight/obese women aged between 20-45 years participated randomized into control (n=30), aerobic exercise (AE) (n=30), and resistance exercise (RE) (n=30) groups. Either AE or RE groups performed exercise for 60 minutes per day for 10 weeks, whereas the control group did not perform any exercise. The study concluded that both AE and RE were effective in improving body composition and thereby increasing the QoL in overweight and obese women.

34. **Khalafi et al. (2025)** in Healthcare published a meta-analysis on "The Effects of Concurrent Training Versus Aerobic or Resistance Training Alone on Body Composition in Middle-Aged and Older Adults: A Systematic Review and Meta-Analysis**.**" In this review total of 53 studies involving 2873 participants were included in which it compared CT versus either AT or RT, and included body composition measures such as fat mass, body fat percentage, waist circumference, visceral fat mass, lean body mass (LBM), muscle mass/volume, or muscle or muscle fiber cross-sectional area (CSA), in middle-aged (50 to <65 years) and older adults (≥65 years). The study concluded that CT is as effective as AT for decreasing body fat measures and as effective as RT for increasing muscle mass in middle-aged and older adults.

METHODOLOGY

METHODOLOGY

Study Design-Experimental Study

Sample Size – 26 (Formula: $N=2k\ SD^2/d^2$)

Sampling Technique – Simple Random Sampling.

Setting and Duration-The study was conducted at the Jogger's fitness club, Nagpur, Maharashtra over a period of 3 months including patient recruitment, intervention, and post-intervention assessment.

Ethical Considerations

Approval was obtained from the Institutional Ethical Committee (IEC Approval No.: [ABSMARI/IEC/2025/169]). All participants were informed about the study procedure and provided written informed consent prior to participation.

Selection Criteria

Inclusion:

- Age between 18 – 30 years of age
- Both genders
- Willingness to participate in the study

Exclusion:

- Adults with any respiratory disorders
- Adults with any musculoskeletal disorders
- Adults with any psychological disorders
- Adults with any cardiac disorders

Outcome Measures

1. Body Mass Index (BMI)

Purpose: to assess changes in body mass index

2. % Body Fat Mass

Purpose: to assess changes in percentage of body fat mass

MATERIALS

Instruments and Tools Used

- Xiaomi Body Composition Scale S400
- Dumbbells
- Kettlebells
- Weight Discs
- Data collection sheets

PROCEDURE

The study was approved by the institutional research review committee and the institutional ethical committee. A sample of 26 subjects, who met the inclusion and exclusion criteria, were recruited.

A written informed consent was obtained from the subjects. Demographic data was taken and detailed examination was done.

The subjects were then randomly allocated into following two groups by simple random sampling method.

- Group 1 (Traditional Resistance Training) was given intervention
- Group 2 (Circuit Resistance Training) was given intervention

All subjects were given a detailed explanation of the procedure in respective. Baseline assessment of measurements was carried out for all participants prior to the intervention. Each group then underwent its respective protocol for 4 days a week / 6 weeks= 24 sessions.

At the completion of 1st,3rd & 6th week, BMI and % Body fat mass were reassessed to determine both intra-group and inter-group differences.

Group A (Traditional Resistance Training)	**Group B (Circuit Resistance Training)**
Warm up – 5 min. (Arm circles, side rotations, side twists)	Warm up – 5 min. (Arm circles, side rotations, side twists)
Frequency – 4 times/week for 6 weeks	Frequency – 4 times/week for 6 weeks
Intervention – 1) Push-up 2) Goblet squat 3) Bicep curls to shoulder press 4) Lunges 5) Dumbbell Row 6) Russian twist	Intervention – 1) Chest Press 2) Dumbbell Squat 3) Bent over dumbbell Row 4) Burpees 5) Mountain Climbers 6) Crunches
Intensity– 1) Week 1 – 8 reps./3 set 2) Week 2 – 10 reps./3 set 3) Week 3 – 12 reps./3 set 4) Week 4-6 – Adding 2.5 kg. to reps. each week /3 set	Intensity– 1) Week 1 – 8 reps./3 set 2) Week 2 – 10 reps./3 set 3) Week 3 – 12 reps./3 set 4) Week 4-6 – Adding 2.5 kg. to reps. each week /3 set

Rest time – 1 min. between each set Materials – Dumbbells, Kettlebell, weight discs	Rest time – 0-15 sec. between each exercise Materials - Dumbbells, Kettlebell, weight discs
Total duration – 60 min. (warm up – 5 min. exercise – 50 min. cool down – 5 min.)	Total duration – 60 min. (warm up – 5 min. exercise – 50 min. cool down – 5 min.)
Outcome Measure - Xiaomi Body Composition Scale S400	Outcome Measure - Xiaomi Body Composition Scale S400

Photographs

Fig 1- Xiaomi Body Composition Scale S400

Fig 2- Intervention induced in Group A participant

Push-up

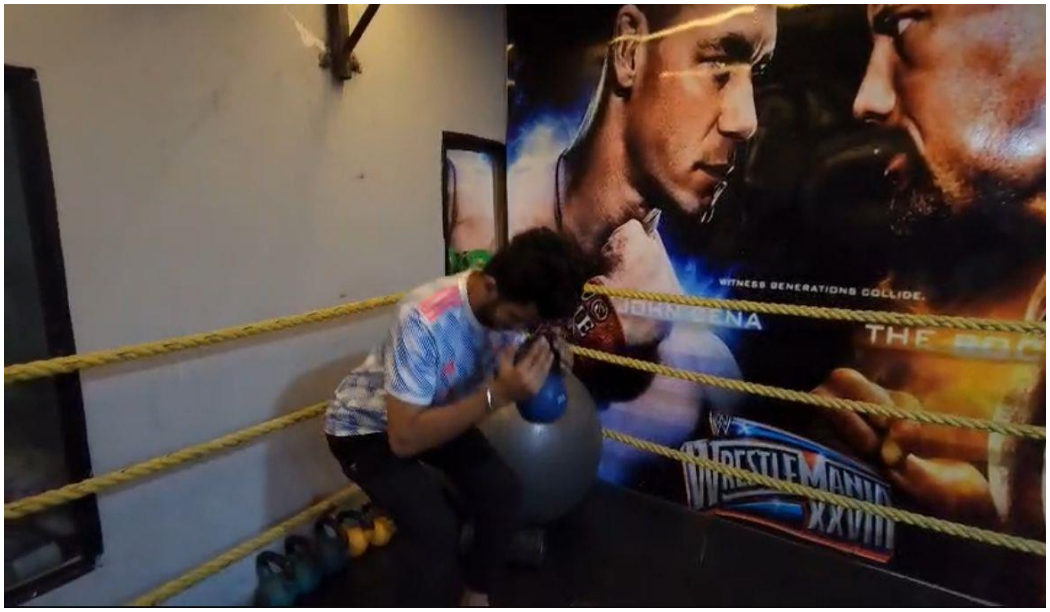
Goblet Squat

Bicep curls to shoulder press

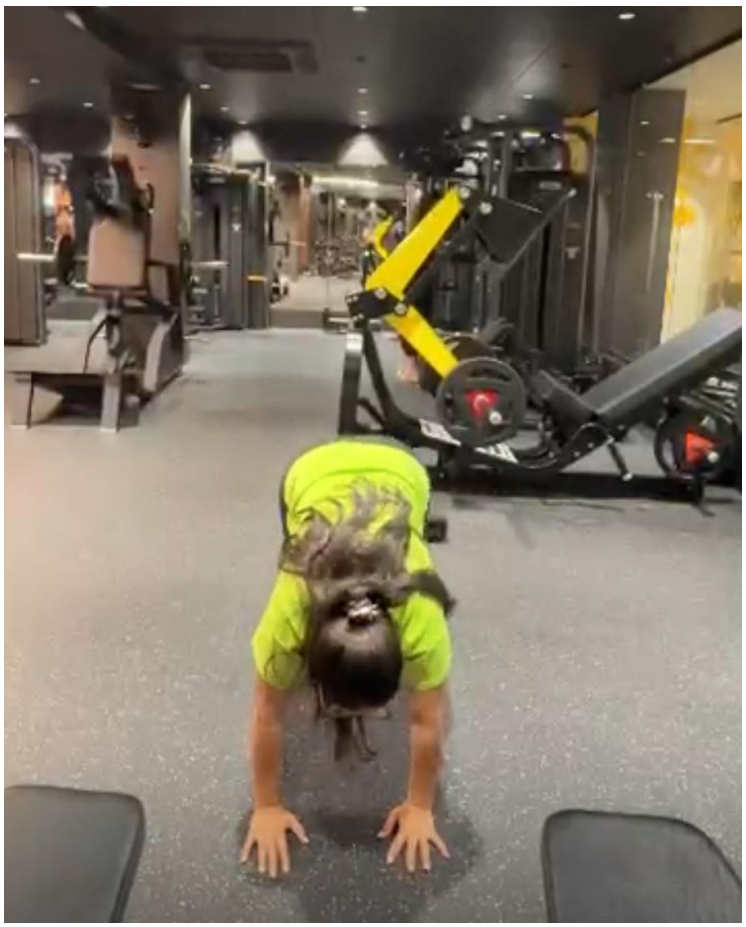
Russian Twist

Fig 3- Intervention induced in Group B participant

Chest Press



Dumbbell Squat



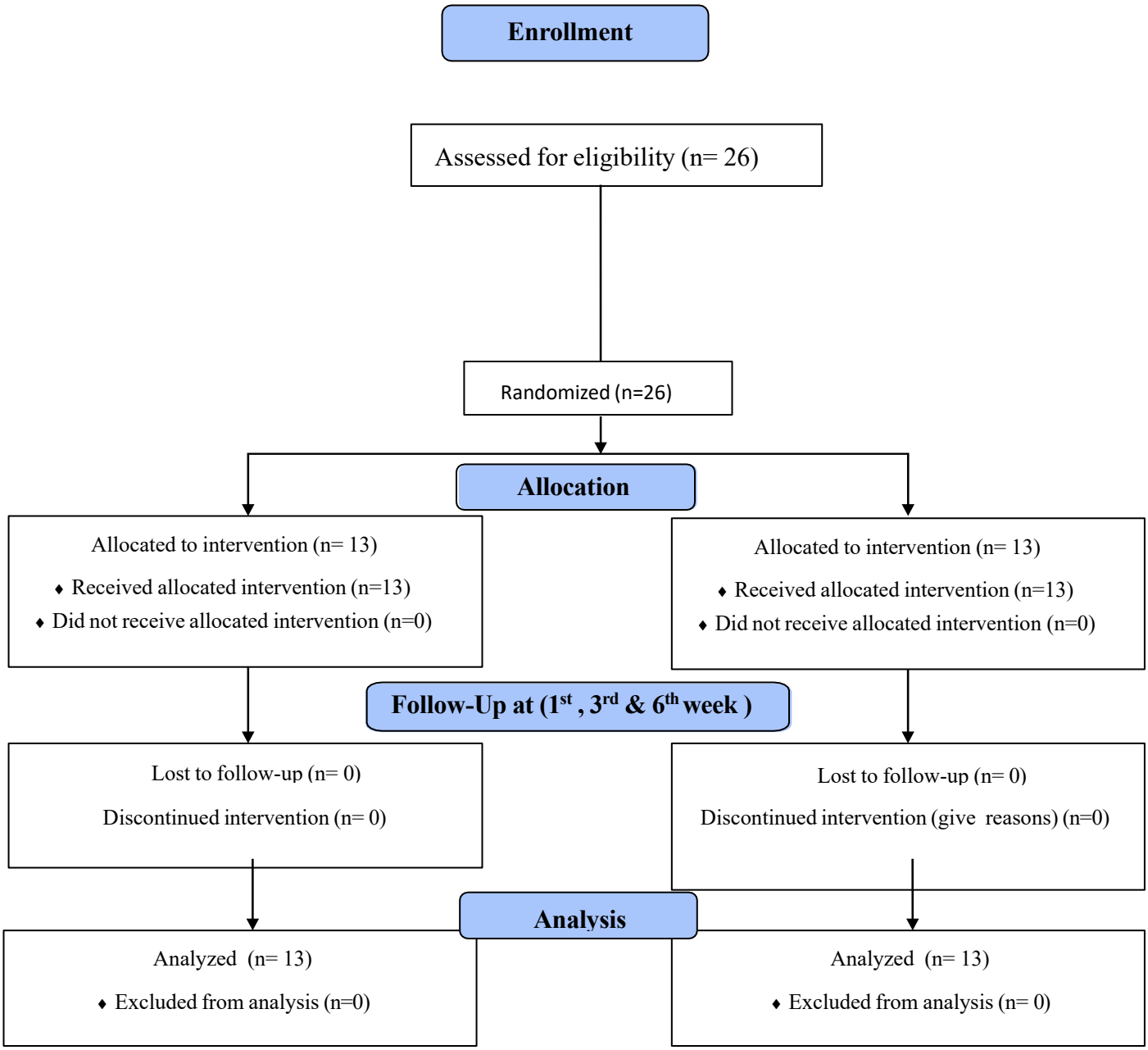
Mountain Climbers

Crunches

Burpees

Flowchart of Methodology

Fig 4. CONSORT Flow Diagram



STATISTICAL ANALYSIS

Data Analysis

Data was entered in Microsoft Excel 2021 and analyzed using IBM SPSS Version 26.

Descriptive statistics (mean, standard deviation) were used for demographic and outcome measures.

Anova: Two-Factor Without Replication was applied to compare within group at 1^{st}, 3^{rd} and 6^{th} week on BMI, % Body Fat mass respectively.

Unpaired t-test was applied for intergroup comparison on BMI, % Body Fat mass at 1^{st} ,3^{rd} and 6^{th} week respectively.

A p-value < 0.05 was considered statistically significant.

Graphical representations (bar graphs, line graphs) were prepared using Excel.

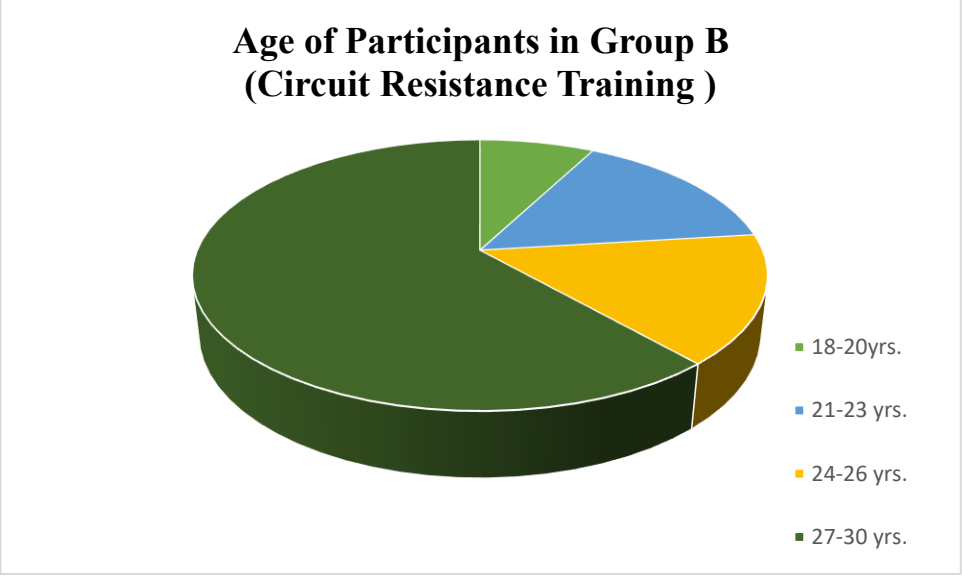
RESULT

Result

Table 1 - There were 13 patients in Group A given Traditional Resistance Training intervention with mean age 26.07 and 13 patients in Group B who were given Circuit Resistance Training with mean age 26.69 age ranged between 18 to 30 yrs.

	Group A	Group B
No. of participants	13	13
Mean	26.07	26.69
SD	2.46	3.38

Graph 1: Pie charts showing age group wise distribution of participants



Graph 2: Normality distribution curve of age group

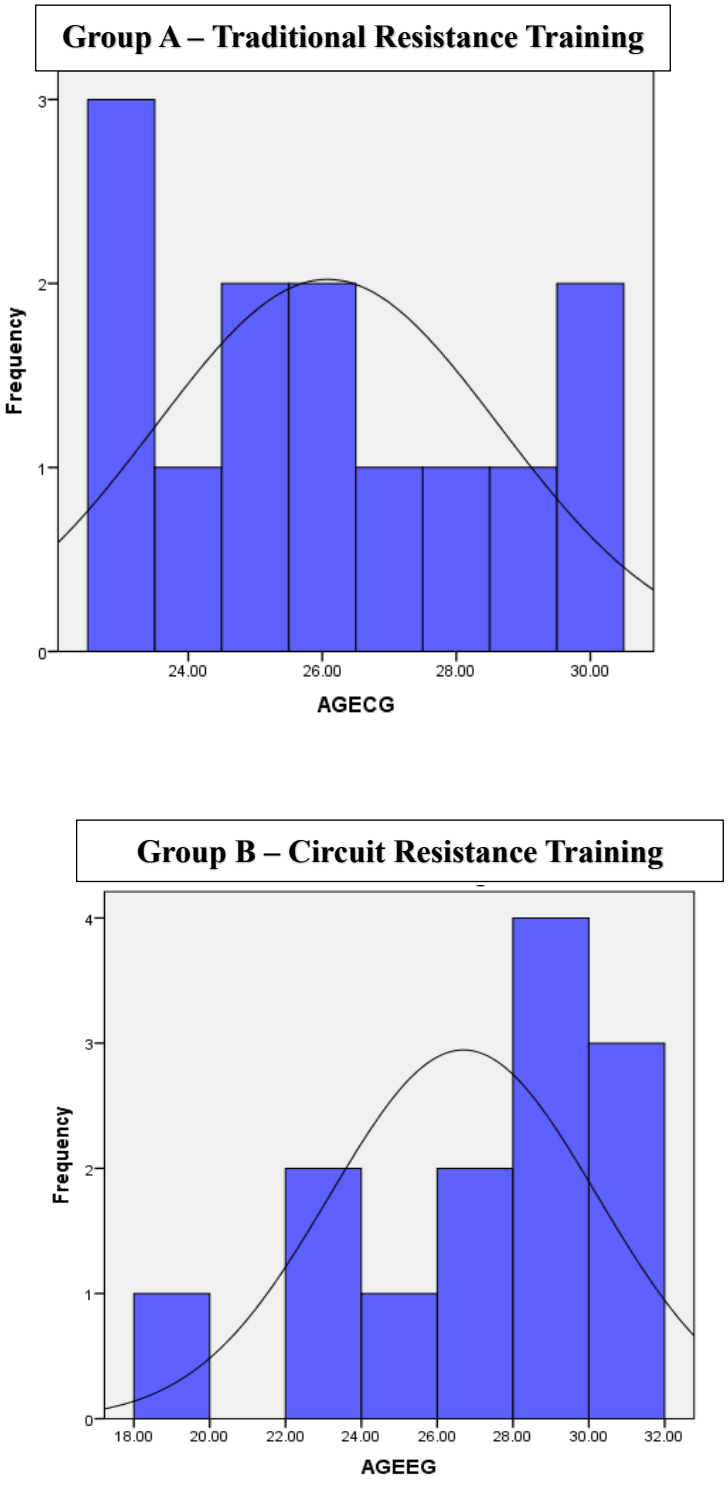
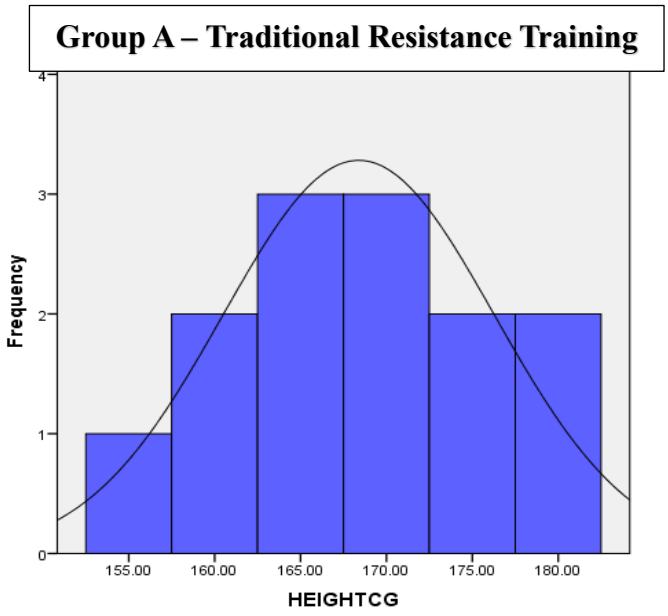


Table 2 - There were 13 patients in Group A with mean height of 168.38 and 13 patients in Group B with mean height of 170.15.

	Group A	Group B
No. of participants	13	13
Mean	168.38	170.15
SD	7.90	7.33

Graph 3: Normality distribution curve of height



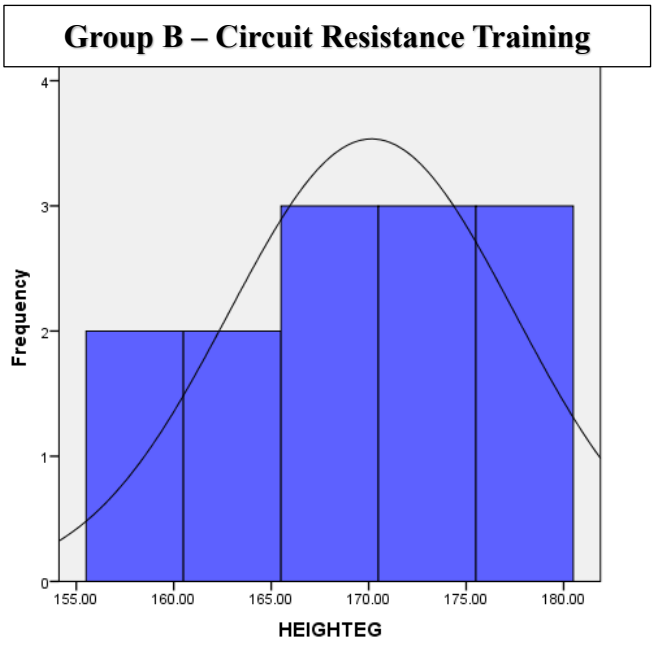


Table 3 - There were 13 patients in Group A with mean weight of 70.85 and 13 patients in Group B with mean weight of 69.08.

	Group A	Group B
No. of participants	13	13
Mean	70.85	69.08
SD	9.91	9.83

Graph 4: Normality distribution curve of weight

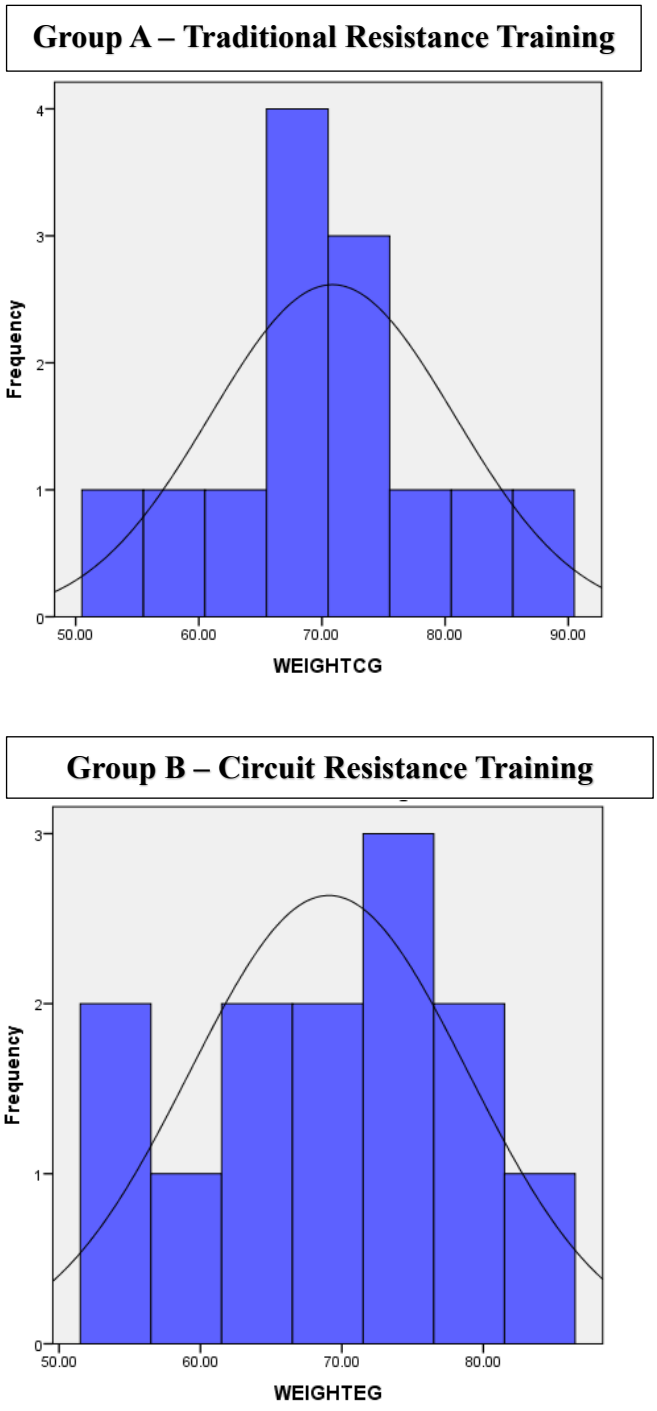
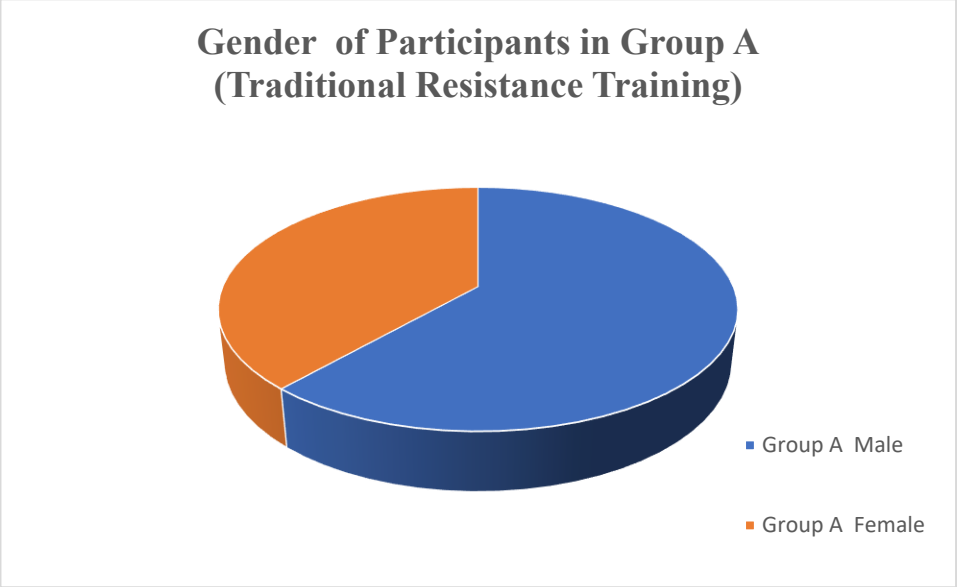


Table 4 - The gender distribution in this study, there were 13 patients in Group A given Traditional resistance training intervention with mean of (8 male and 5 female) and 13 patients in Group B who was given Circuit resistance training intervention with mean of (8 male and 5 female).

Group A		Group B	
Male	Female	Male	Female
8	5	8	5

Graph 5: Pie charts showing gender distribution group wise of participants



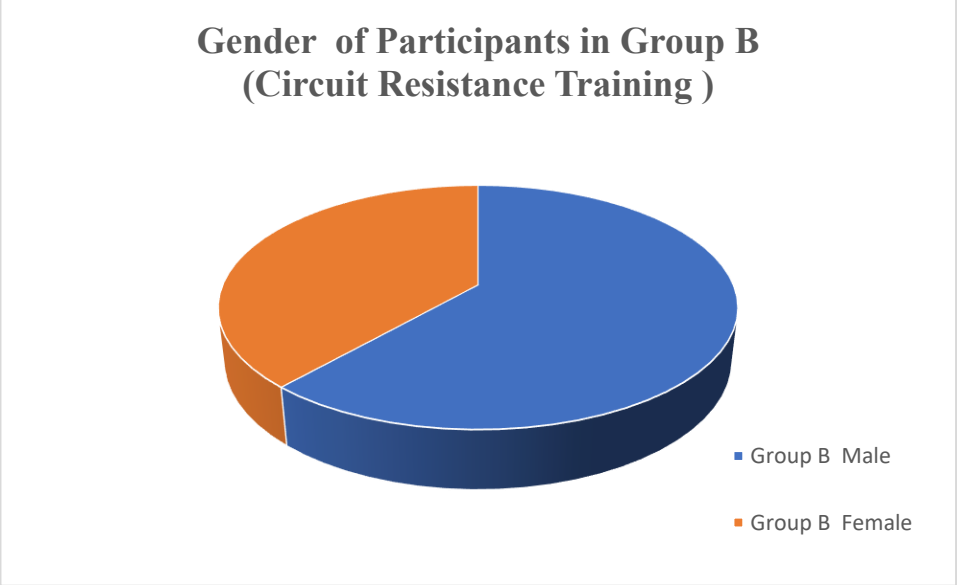


Table 5 - Group A Traditional Resistance Training (TRT) intervention given at 1st, 3rd & 6th week. P value of 1.15E-22 resulted in intragroup comparison for BMI (Body Mass Index) at 1st, 3rd & 6th week. (P value < 0.05 that is highly significant).

BMI			
Intervention	1st week	3rd week	6th week
Average	24.98	24.72	24.56
SD	2.93	3.01	2.9
P value	1.15E-22		

Graph 6: Graphical representation of comparison of means difference within Group A (Traditional Resistance Training) of intervention of BMI (Body Mass Index) at 1st week, 3rd week & 6th week in participants.

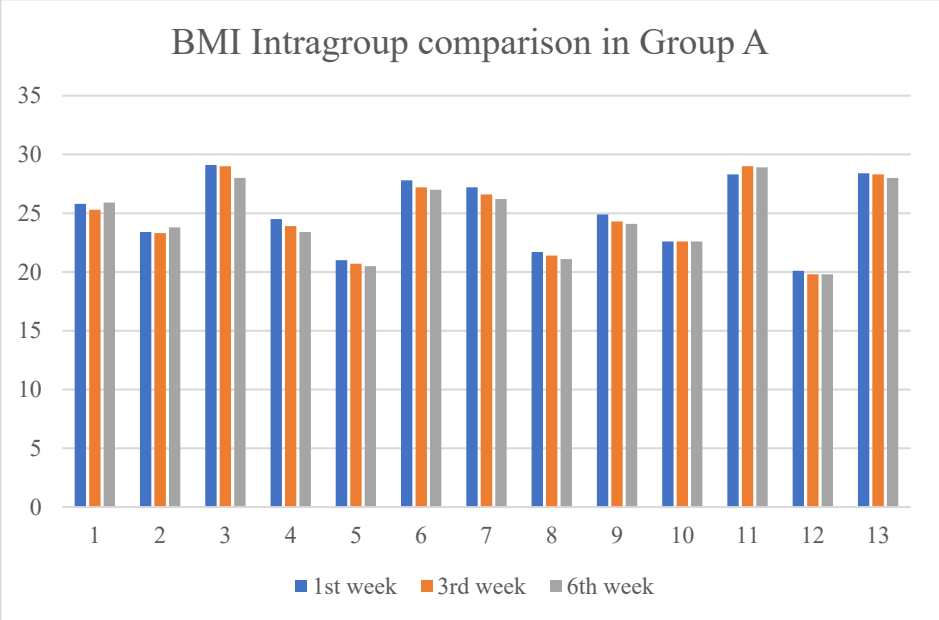


Table 6 - Group B Circuit Resistance Training (CRT) intervention given at 1st, 3rd & 6th week. P value of 8.42E-26 resulted in intragroup comparison for BMI (Body Mass Index) at 1st, 3rd & 6th week. (P value < 0.05 that is highly significant).

BMI			
Intervention	1st week	3rd week	6th week
Average	24.2	23.83	23.57
SD	2.37	2.37	2.32
P value	8.42E-26		

Graph 7: Graphical representation of comparison of means difference within Group B (Circuit Resistance Training) of intervention of BMI (Body Mass Index) at 1st week, 3rd week & 6th week in participants.

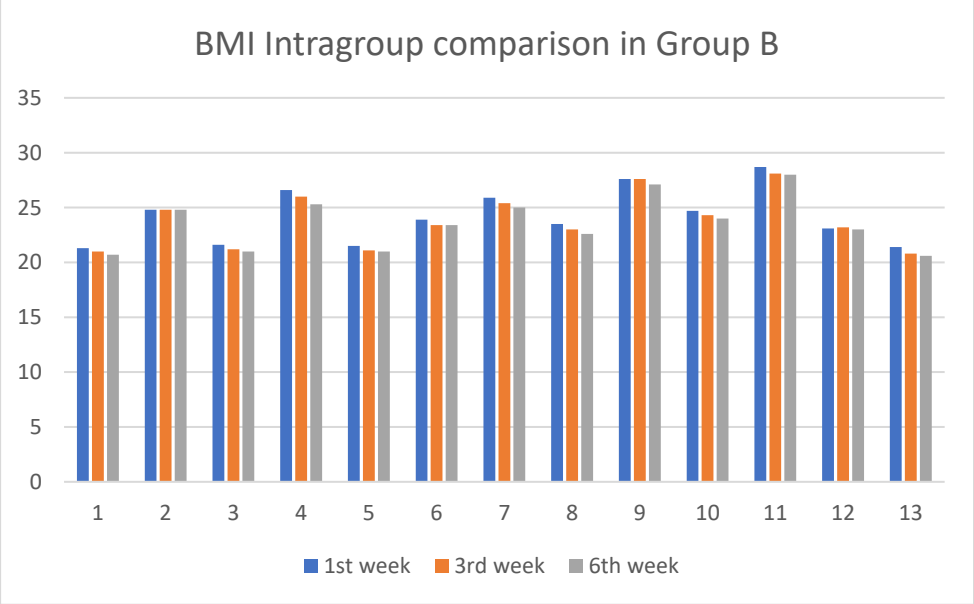


Table 7 - Group A Traditional Resistance Training (TRT) and Group B Circuit Resistance Training (CRT) intervention given to assess Body Mass Index (BMI) in intergroup comparison of group A and group B respectively. It resulted in P value of 0.006 at 1st week. (P value < 0.05 that is moderately significant).

Intervention	**1st week**	
	Group A	Group B
Mean ± SD	25.56 ± 6.14	22.88 ± 4.12
P value	0.006*	

Graph 8: Graphical representation of comparison of mean difference of Group A and Group B of BMI (Body Mass Index) in participants at 1st week.

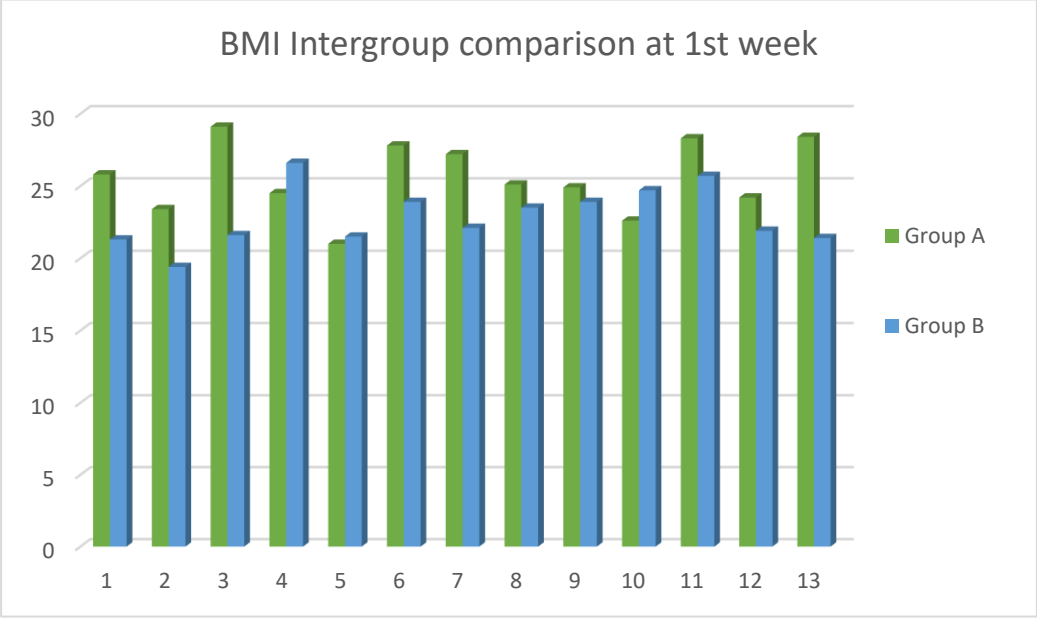


Table 8 - Group A Traditional Resistance Training (TRT) and Group B Circuit Resistance Training (CRT) intervention given to assess Body Mass Index (BMI) in intergroup comparison of group A and group B. It resulted in P value of 0.04 at 3rd week. (P value < 0.05 that is significant).

Intervention	**3rd week**	
	Group A	Group B
Mean ± SD	24.72 ± 9.85	22.39 ± 6.04
P value	0.003*	

Graph 9: Graphical representation of comparison of mean difference of Group A and Group B of BMI (Body Mass Index) in participants at 3rd week.

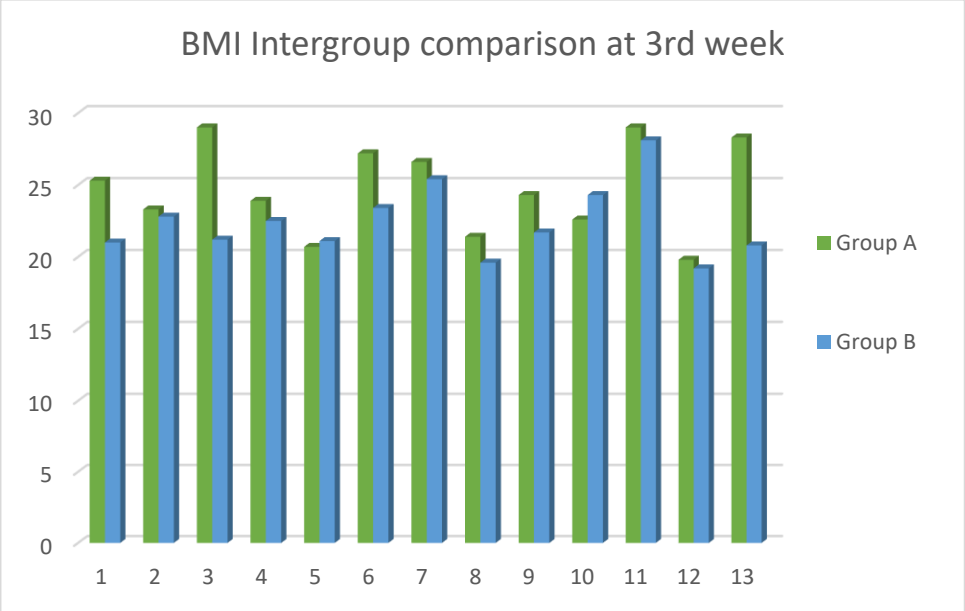


Table 9 - Group A Traditional Resistance Training (TRT) and Group B Circuit Resistance Training (CRT) intervention given to assess Body Mass Index (BMI) in intergroup comparison of group A and group B. It resulted in P value of 0.003 at 6th week. (P value < 0.05 that is highly significant).

Intervention	**6th week**	
	Group A	Group B
Mean ± SD	24.56 ± 9.16	21.7 ± 1.31
P value	0.003*	

Graph 10 : Graphical representation of comparison of mean difference of Group A and Group B of BMI (Body Mass Index) in participants at 6th week.

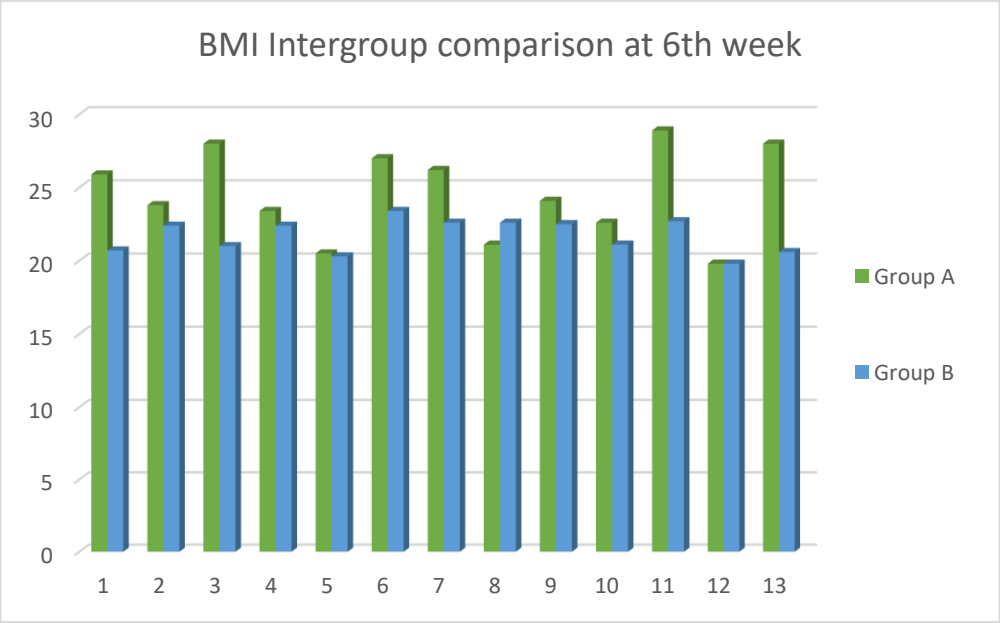


Table 10 - Group A Traditional Resistance Training (TRT) intervention given at 1st, 3rd & 6th week. P value of 2.34E-17 resulted in intragroup comparison of % Body Fat Mass at 1st, 3rd & 6th week. (P value < 0.05 that is highly significant).

% Body Fat Mass			
Intervention	1st week	3rd week	6th week
Average	25.76	24.53	24.15
SD	4.68	4.79	4.35
P value	2.34E-17		

Graph 11 : Graphical representation of comparison of means differences within Group A (Traditional Resistance Training) after intervention of % Body Fat Mass at 1st week, 3rd week & 6th week in participants.

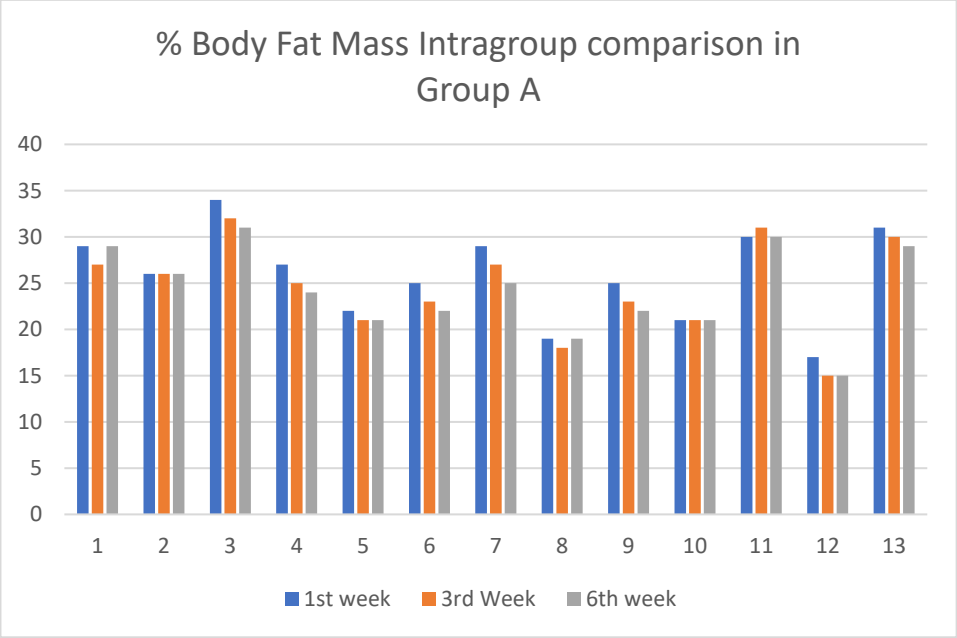


Table 11 - Group B Circuit Resistance Training (CRT) intervention given at 1st, 3rd & 6th week. P value of 1.03E-15 resulted in intragroup comparison of % Body Fat Mass at 1st, 3rd & 6th week. (P value < 0.05 that is highly significant).

% Body Fat Mass			
Intervention	1st week	3rd week	6th week
Average	25.769231	24.538462	24.153846
SD	4.6827581	4.7934692	4.3536063
P value	1.03E-15		

Graph 12: Graphical representation of comparison of means differences within Group B (Circuit Resistance Training) of intervention of % Body Fat Mass at 1st week, 3rd week & 6th week in participants.

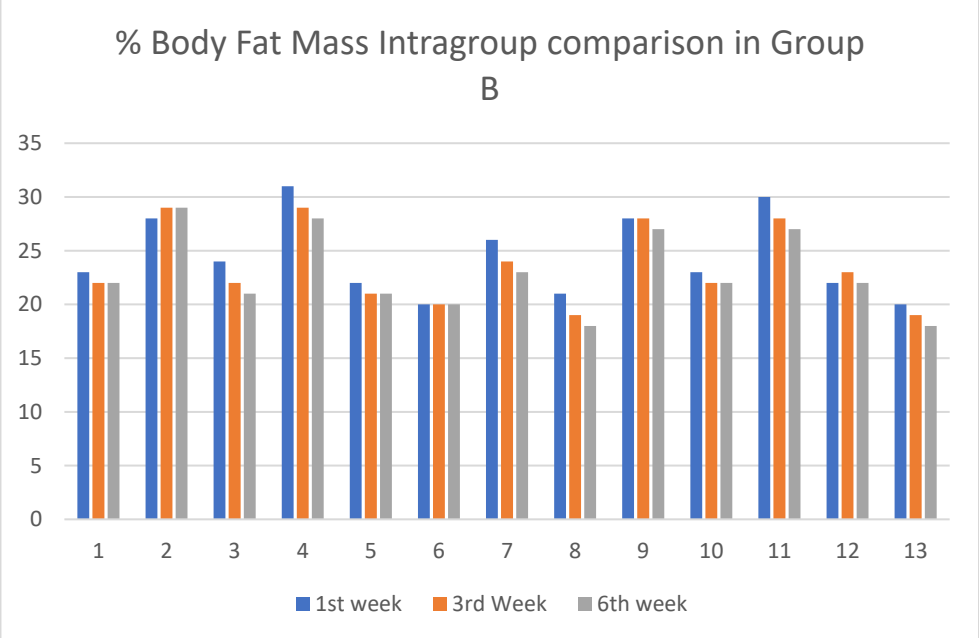


Table 12 - Group A Traditional Resistance Training (TRT) and Group B Circuit Resistance Training (CRT) intervention given to assess % Body Fat Mass in intergroup comparison of group A and group B respectively. It resulted in P value of 0.04 at 1st week. (P value < 0.05 that is slightly significant).

Intervention	**1st week**	
	Group A	Group B
Mean ± SD	25.76 ± 24.69	22.53 ± 6.10
P value	0.046	

Graph 13: Graphical representation of comparison of mean differences of Group A and Group B of % Body Fat Mass in participants at 1st week.

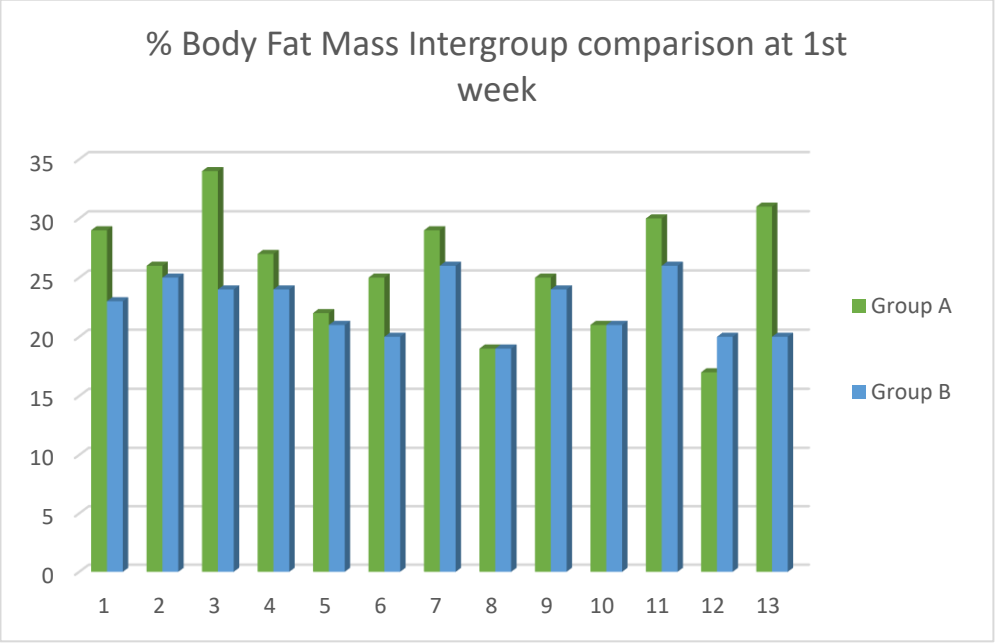


Table 13 - Group A Traditional Resistance Training (TRT) and Group B Circuit Resistance Training (CRT) intervention given to assess % Body Fat Mass in intergroup comparison of group A and group B. It resulted in P value of 0.03 at 3rd week. (P value < 0.05 that is significant).

Intervention	**3rd week**	
	Group A	Group B
Mean ± SD	24.53 ± 25.43	21.15 ± 4.80
P value	0.036	

Graph 14 : Graphical representation of comparison of mean difference of Group A and Group B of % Body Fat Mass in participants at 3rd week.

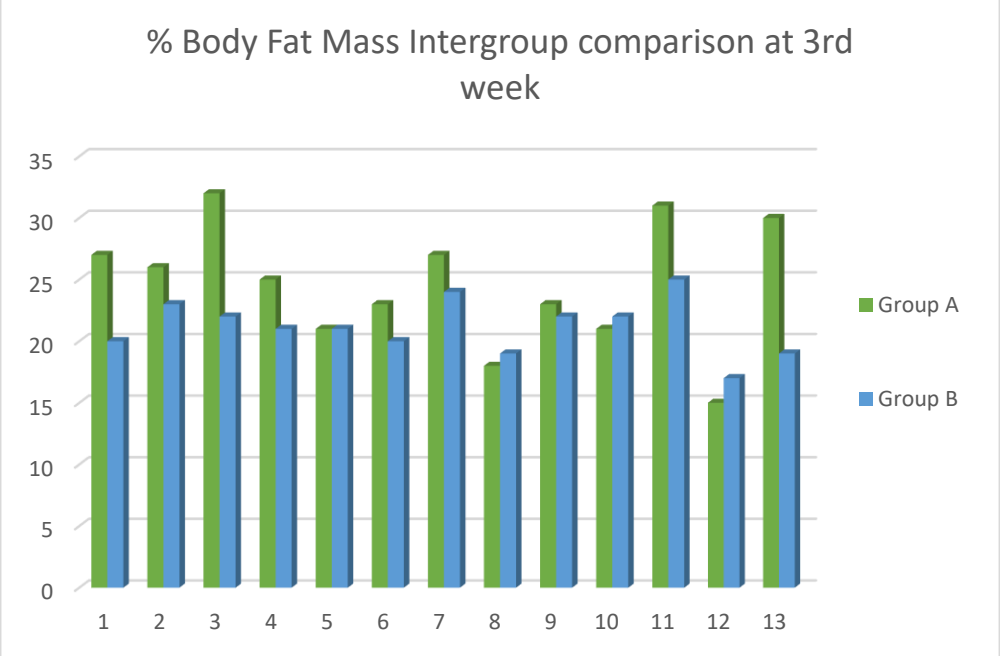


Table 14 - Group A Traditional Resistance Training (TRT) and Group B Circuit Resistance Training (CRT) intervention given to assess % Body Fat Mass in intergroup comparison of group A and group B. It resulted in P value of 0.019 at 6th week. (P value < 0.05 that is significant).

Intervention	**6th week**	
	Group A	Group B
Mean ± SD	24.15 ± 22.64	20.53 ± 4.60
P value	0.019*	

Graph 15 : Graphical representation of comparison of mean difference of Group A and Group B of BMI (Body Mass Index) in participants at 6th week.

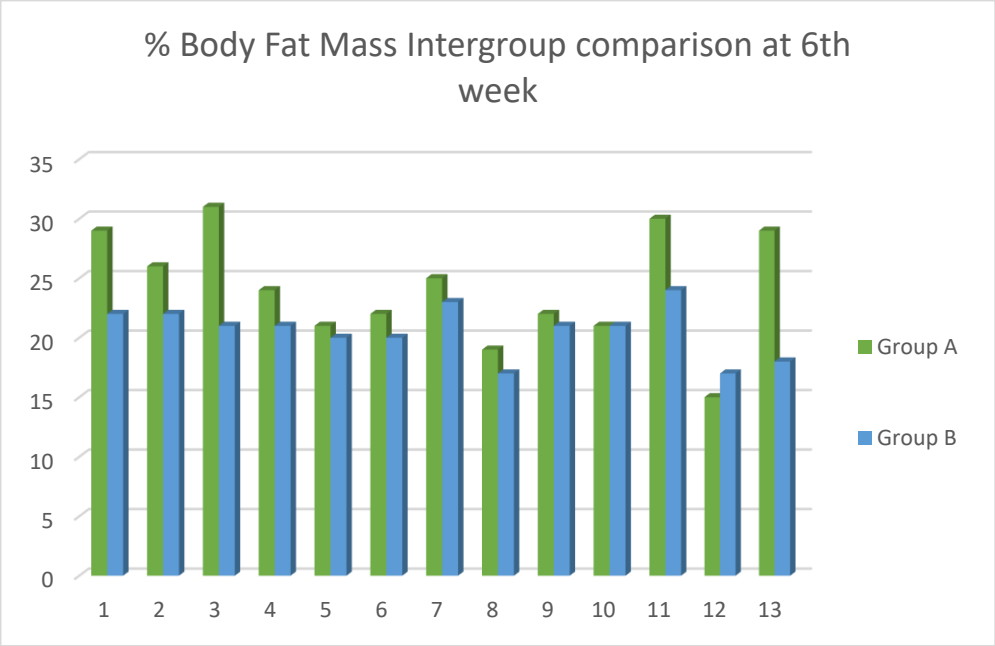


Table 15 - Comparison of Traditional resistance exercise vs Circuit resistance exercise on BMI & % Body Fat mass

Parameters	1st week	3rd week	6th week
BMI	P<0.05 (0.006)	P<0.05 (0.045)	P<0.05 (0.0039)
Body Fat	P<0.05 (0.046)	P<0.05 (0.036)	P<0.05 (0.019)

The findings showed a significant decrease in BMI and % Body fat mass in both the groups, when compared from 1st week to 6th week, with p value of 0.003 and 0.019 which is highly significant. Though, when compared the group B Circuit Resistance Training has shown more significant changes in BMI while % Body fat mass has shown more significant changes in group A Traditional Resistance Training respectively.

DISCUSSION

DISCUSSION

The current experimental study evaluated the comparative effect of a Traditional resistance training (TRT) and Circuit resistance training (CRT) on body composition respectively in adults aged between 18 and 30 years which is shown in graph 1, while table 1 represents distribution of participants in group according to the age group with its mean and standard deviation. The normality distribution of baseline data is done in that graph 2 presents the normality graph according to the age in both the groups. In the table 2, there is presentation of normality distribution according to the height with their mean and standard deviation of group A & group B. While graph 3 is presenting the normality distribution of height of both the groups. The table 3 is presenting the normality distribution according to the weight with their mean and standard deviation of group A & group B, whereas graph 4 presents the normality distribution graph of weight of both the groups. All 26 participants (10 females and 16 males) were randomly allocated to the either of the groups A & B after being evaluated for inclusion and exclusion criteria as represented in graph 5, whereas in table 4 there is representation of gender distribution in both the groups. The results revealed that group A with intervention of Traditional Resistance training were assessed for BMI at 1st week, 3rd week & 6th week for intragroup comparison showed in graph 6 presents that there is decrease in BMI with high statistically significant p values presented in table 5. Whereas in graph 7, group B with intervention of Circuit Resistance training is shown on which BMI was assessed at 1st week, 3rd week & 6th week for intragroup comparison with high statistically significant p values as shown in table 6. The graph 8 represents the intergroup comparison of participants

of group A & group B at end of 1st week on BMI, group B has shown reduction in BMI as compared to group A when compared with highly significant p value presented in table 7. The graph 9 represents the intergroup comparison of participants of group A & group B at end of 3rd week on BMI, group B has shown significant reduction in BMI as compared to group A when compared with highly significant p value presented in table 8. The graph 10 represents the intergroup comparison of participants of group A & group B at end of 6th week on BMI, group B has shown significant reduction in BMI as compared to group A when compared with highly significant p value presented in table 9.

Wewege et al. (2021) represented similar results to our study which states that the traditional resistance training has significant effects on body fat percentage, body fat mass and visceral fat. In traditional resistance training there is energy expenditure not only during exercise but also after exercise. This mechanism contributes for post-exercise oxygen consumption giving rise to extra burning of calories which results in changes in body composition.[31]

Alcaraz et al.(2011) represented similar results which states that circuit resistance training has significant effects on body composition, weight lifting 1RM and peak power, shuttle-run performance and lean mass. In this when after exercise there is stimulation of muscle protein synthesis which reduces resting metabolic rate and helps to recruit type 2 muscle fibres which in turn results in impact on body composition.[6]

When group A with intervention of Traditional Resistance training were assessed for % Body fat mass at 1st week, 3rd week & 6th week for intragroup comparison showed in graph 11 presents that there is decrease in % Body fat mass with high statistically significant p values presented in table 10. Although in group B with

intervention of Circuit Resistance training were assessed for % Body fat mass at 1st week, 3rd week & 6th week for intragroup comparison showed in graph 12 presents that there is decrease in % Body fat mass with highly statistically significant p values presented in table 11. The graph 13 represents the intergroup comparison of participants of group A & group B at end of 1st week on % Body fat mass, group B has shown reduction in % Body fat mass as compared to group A when compared it presented significant p value presented in table 12. The graph 14 represents the intergroup comparison of participants of group A & group B at end of 3rd week on % Body fat mass, group B has shown significant more reduction in % Body fat mass as compared to group A when compared it showed moderately significant p value presented in table 13. The graph 15 represents the intergroup comparison of participants of group A & group B at end of 6th week on % Body fat mass, group B has shown significant reduction in % Body fat mass as compared to group A when compared with highly significant p value presented in table 14.

group A & group B are statistically significant for changes in body composition. Therefore, confirming that both type of resistance training are effective to reduce BMI and % Body fat mass. Table 15 represents the comparison of Traditional resistance exercise vs Circuit resistance exercise in participants on body composition parameters of BMI & % Body Fat mass with its highly significant p values at 1st, 3rd and 6th week.

Beqa Ahmeti et al. (2020) demonstrated similar results to our study which states that circuit resistance training has significant effects on body mass, body mass index, and body fat percentage (from 37% to 31%). When the resistance training is performed in circuit the carbohydrates are one of the main energy sources during PA which increases

insulin sensitivity, and reduces the plasma glucose concentration. PG utilization increases with the intensity of PE which leads to increase in glucose utilization by muscles. Throughout the PE, the utilization is affected by which the intensity of the activation of each muscle unit and thereby increasing the number of active muscle units.[3]

Versic et al. (2021) presented the similar results to our study which states that circuit resistance training has significant effects on anthropometry/body composition. The circuit resistance training group showed a decrease in body fat percentage while an increase in lean body mass. The decrease in body fat percentage was due to the increased metabolism of stored fat cells and an increased caloric expenditure. Although, the increase in lean body mass probably resulted in neural adaptations which was accompanied by a gradual increase in myofibrillar proteins, thus leading to muscular hypertrophy.[27]

CONCLUSION

CONCLUSION

The findings showed a significant decrease in BMI and % Body fat mass in both the groups, when compared from 1st week to 6th week, with p value of 0.003 and 0.019 which is highly significant. The consistent outcomes across both genders helps to understand the effectiveness of exercises across the samples age group.

Future studies with larger sample sizes, different training groups, and wider age group are encouraged to validate and extend these findings and to explore the cumulative effects.

LIMITATIONS & FUTURE SCOPE

LIMITATIONS

The intervention was done on limited population which can be done on diversified population.

Only effects were recorded for 6 weeks; the long-term effectiveness of more than 6 weeks remains unknown on body composition.

FUTURE SCOPE

Future research should be done on comparing other resistance training types to strengthen the inference on resistance trainings.

Long-term follow-up studies are needed to enhance the knowledge on effects over weeks or months on body composition parameters.

Studies with other populations such as obese, athletes, middle age individuals and older individuals can help establish relative effectiveness and comparisons between them on body composition parameters.

Future studies should use comparisons of different Bioelectrical impedance Analysis modalities to upgrade the knowledge.

Larger sample sizes with stratified analysis by gender, age group, and body composition parameters may provide better subgroup-specific evidence.

Combining Resistance training with dietary habits, different training protocols could enhance outcomes on body composition parameters.

SUMMARY

Summary

This experimental study evaluated the effectiveness of the **Traditional resistance training VS Circuit resistance training**, a type of resistance training protocols, on **body composition** in healthy individuals. A total of **26 participants** aged 18-30 years were assessed using **BMI** and **% Body fat mass** after intervention at 1^{st},3^{rd} and 6^{th} week. The results demonstrated statistically and clinically significant reductions in BMI & % Body Fat mass, as confirmed by **Unpaired t-tests ($p < 0.05$)**. The findings support that the both the resistance training protocols are effective on body composition parameters and improving the lifestyle of individuals.

Data Availability Statement

Not Applicable

Conflict of Interest

Not Applicable

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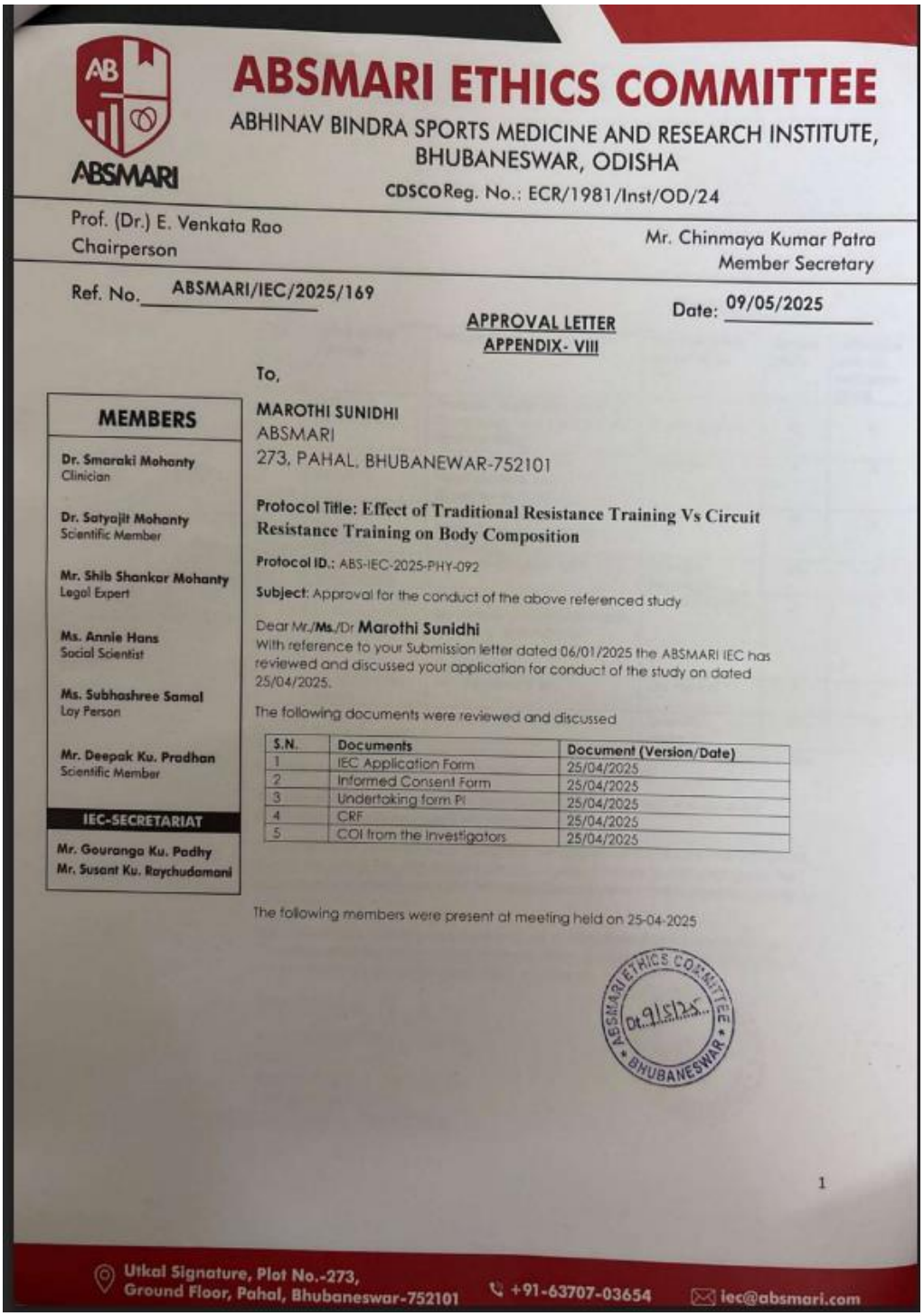
ANNEXURE-I



ABSMARI ETHICS COMMITTEE

ABHINAV BINDRA SPORTS MEDICINE AND RESEARCH INSTITUTE, BHUBANESWAR, ODISHA

CDSCO Reg. No.: ECR/1981/Inst/OD/24

Prof. (Dr.) E. Venkata Rao
Chairperson

Mr. Chinmaya Kumar Patra
Member Secretary

Ref. No. ABSMARI/IEC/2025/169

Date: 09/05/2025

APPROVAL LETTER
APPENDIX- VIII

To,

MAROTHI SUNIDHI
ABSMARI
273, PAHAL, BHUBANEWAR-752101

MEMBERS

Dr. Smaraki Mohanty
Clinician

Dr. Satyajit Mohanty
Scientific Member

Mr. Shib Shankar Mohanty
Legal Expert

Ms. Annie Hans
Social Scientist

Ms. Subhashree Samal
Lay Person

Mr. Deepak Ku. Pradhan
Scientific Member

IEC-SECRETARIAT

Mr. Gouranga Ku. Padhy
Mr. Susant Ku. Raychudamani

Protocol Title: Effect of Traditional Resistance Training Vs Circuit Resistance Training on Body Composition

Protocol ID.: ABS-IEC-2025-PHY-092

Subject: Approval for the conduct of the above referenced study

Dear Mr./**Ms.**/Dr **Marothi Sunidhi**
With reference to your Submission letter dated 06/01/2025 the ABSMARI IEC has reviewed and discussed your application for conduct of the study on dated 25/04/2025.

The following documents were reviewed and discussed

S.N.	Documents	Document (Version/Date)
1	IEC Application Form	25/04/2025
2	Informed Consent Form	25/04/2025
3	Undertaking form PI	25/04/2025
4	CRF	25/04/2025
5	COI from the Investigators	25/04/2025

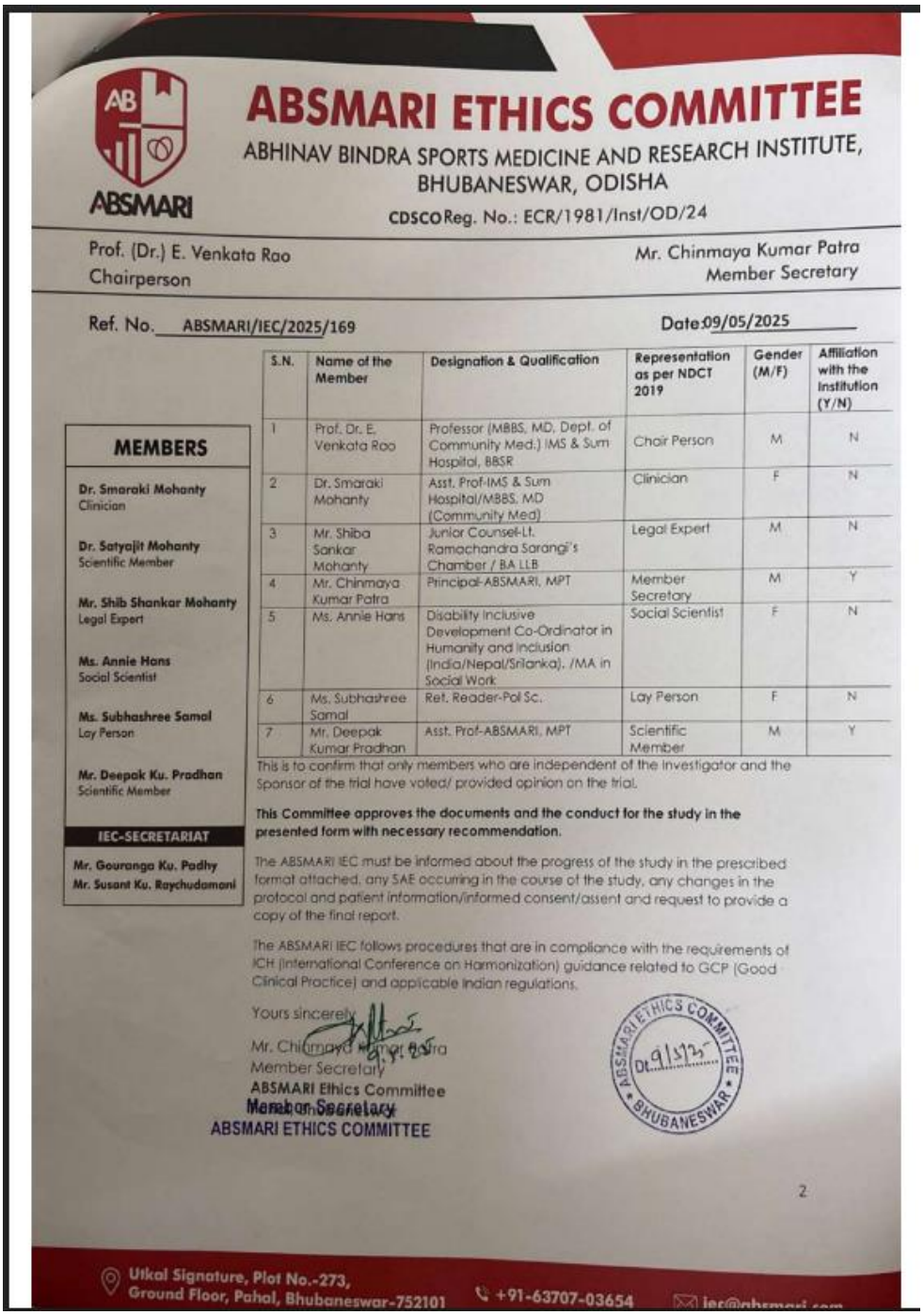
The following members were present at meeting held on 25-04-2025

ABSMARI ETHICS COMMITTEE 04/5/25 BHUBANESWAR

1

Utkal Signature, Plot No.-273, Ground Floor, Pahal, Bhubaneswar-752101 +91-63707-03654 iec@absmari.com

ANNEXURE- II



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Chairperson

Mr. Chinmaya Kumar Patra
Member Secretary

Ref. No. ABSMARI/IEC/2025/169

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Legal Expert

Ms. Annie Hans
Social Scientist

Ms. Subhashree Samal
Lay Person

Mr. Deepak Ku. Pradhan
Scientific Member

IEC-SECRETARIAT

Mr. Gouranga Ku. Padhy
Mr. Susant Ku. Raychudamani

S.N.	Name of the Member	Designation & Qualification	Representation as per NDCT 2019	Gender (M/F)	Affiliation with the Institution (Y/N)
1	Prof. Dr. E. Venkata Rao	Professor (MBBS, MD, Dept. of Community Med.) IMS & Sum Hospital, BBSR	Chair Person	M	N
2	Dr. Smaraki Mohanty	Asst. Prof-IMS & Sum Hospital/MBBS, MD (Community Med)	Clinician	F	N
3	Mr. Shiba Sankar Mohanty	Junior Counsel-Lt. Ramachandra Sarangi's Chamber / BA LLB	Legal Expert	M	N
4	Mr. Chinmaya Kumar Patra	Principal-ABSMARI, MPT	Member Secretary	M	Y
5	Ms. Annie Hans	Disability Inclusive Development Co-Ordinator in Humanity and Inclusion (India/Nepal/Srilanka). /MA in Social Work	Social Scientist	F	N
6	Ms. Subhashree Samal	Ret. Reader-Pol Sc.	Lay Person	F	N
7	Mr. Deepak Kumar Pradhan	Asst. Prof-ABSMARI, MPT	Scientific Member	M	Y

This is to confirm that only members who are independent of the investigator and the Sponsor of the trial have voted/ provided opinion on the trial.

This Committee approves the documents and the conduct for the study in the presented form with necessary recommendation.

The ABSMARI IEC must be informed about the progress of the study in the prescribed format attached, any SAE occurring in the course of the study, any changes in the protocol and patient information/informed consent/assent and request to provide a copy of the final report.

The ABSMARI IEC follows procedures that are in compliance with the requirements of ICH (International Conference on Harmonization) guidance related to GCP (Good Clinical Practice) and applicable Indian regulations.

Yours sincerely

Mr. Chinmaya Kumar Patra
Member Secretary
ABSMARI Ethics Committee

Member Secretary
ABSMARI ETHICS COMMITTEE

ABSMARI ETHICS COMMITTEE Dt. 9/5/25 BHUBANESWAR

2

Utkal Signature, Plot No.-273, Ground Floor, Pahal, Bhubaneswar-752101 +91-63707-03654 iec@absmari.com

ANNEXURE-III

JOGGERS FITNESS CLUB
Ayodhya Nagar Road Nagpur 440084

Date: 13/05/2025

NO OBJECTION CERTIFICATE

To
DR. SUNIDHI MAROTHI (PT)
PHYSIOTHERAPIST

We are pleased to inform you that your request has been reviewed and approved. This is to certify that I, Ravindan Datanwar at Joggers Fitness Club, have no objection to Dr. Sunidhi Marothi (PT), a 2nd year postgraduate student pursuing Master of Physiotherapy in Orthopaedic Speciality, is hereby granted permission to carry out data collection and associated research activities.

The title of her dissertation study is: "Effect of Traditional Resistance Training VS Circuit Resistance Training on Body composition."

The study will be conducted under ethical guidelines, subject to the following conditions:

1. All participants must provide informed consent prior to participation.
2. Data confidentiality and privacy must be strictly maintained.
3. The research should not disrupt the regular functioning or operations of the club/institution.
4. A copy of the final report or findings is to be shared upon completion of the study.

We appreciate your interest in conducting ethical and meaningful research and wish you success in your work. Should you require further support or clarification, please feel free to contact us.

Ravindan Datanwar

JOGGERS FITNESS CLUB NAGPUR
RAVINDAN DATANWAR
BECOME THE BEST VERSION OF YOU

Yours Sincerely

RAVINDAN DATANWAR

ANNEXURE - IV

INFORMED CONSENT

Informed Consent form to participate in a clinical trial

STUDY TITLE: EFFECT OF TRADITIONAL RESISTANCE TRAINING VS CIRCUIT RESISTANCE TRAINING ON BODY COMPOSITION

Study IEC registration Number: ABSMARI/IEC/2025/169

Subject's Name: _____

Date of Birth / Age: _____

Address of the Subject_____

Qualification _____

Occupation: _____

- I confirm that I have read and understood the information sheet dated for the above study and have had the opportunity to ask questions.
- I understand that my participation in the study is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected.
- I understand that the Sponsor of the clinical trial, others working on it.
  Sponsor 's behalf, the Ethics Committee and the regulatory authorities will not need my permission to look at my health records both in respect of the current study and any further research that may be conducted in relation to it, even if I withdraw from the trial. I agree to this access. However, I understand that my identity will not be revealed in any information released to third parties or published.
- I agree not to restrict the use of any data or results that arise from this study, provided such a use is only for scientific purposes.
- I agree to take part in the above study.

Signature (or Thumb impression) of the Subject

Date: _____/ ____/ _____

Signatory's Name:

Signature of the Investigator:

Date: _____/ ____/ _____

Study Investigator's Name:

ANNEXURE-V

CONSENT FORM

EFFECT OF TRADITIONAL RESISTANCE TRAINING VS CIRCUIT RESISTANCE TRAINING ON BODY COMPOSITION

हे प्रमाणित करण्यासाठी आहे की मी ..... माझ्या भाषेत अभ्यासाच्या फॉर्मची सामग्री मला समजावून सांगण्यात आली आहे.

मी पुष्टी करतो की मी स्वेच्छेने संमती फॉर्मच्या या प्रतवर स्वाक्षरी केली आहे. मला अभ्यासाचे स्वरूप समजले आणि मी या संशोधन अभ्यासामध्ये विषय म्हणून सहभागी होण्यासाठी स्वेच्छेने काम केले.

नाव: -.....

वय/लिंग: .....

पत्ता: .....

संपर्क क्रमांक: .....

तारीख: / / 25

साइन:

ठिकाण:

मी, अधोरेखित सुनिधी मरोठी यांनी अभ्यासाचे तपशील स्पष्ट केले आहेत आणि वरील स्वयंसेवकांनी माझ्या क्षमतेनुसार सर्व प्रश्न साफ केल्या आहेत. मी पुष्टी करतो की सर्व डेटा आणि चाचणी निकाल काटेकोरपणे गोपनीय ठेवले जातील आणि कोणत्याही गैरवापरापासून रोखले जातील.

तारीख: / / 25

साइन: -

ठिकाण:

ANNEXURE-VI

ASSESMENT FORM

DEMOGRAPHIC DATA:

- **Name**: _____
- **Age**: _____
- **Gender**: _____
- **Address**: _____
- **Occupation**: _____
- **Date of Assessment**: _____
- **Qualification:** _____
- **Past Medical & Surgical History**

(A) Medical History
- **Any medical history ? (Yes/No, specify)**

(B) Surgical History
- **Any surgeries in the past ? (Yes/No, specify)**

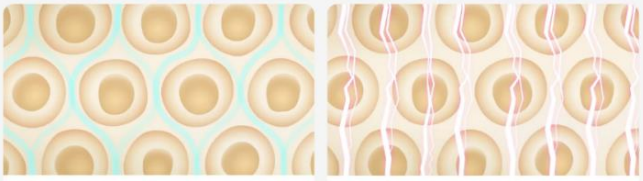
PARAMETERS	GROUP A			GROUP B		
	1ST WEEK	3RD WEEK	6TH WEEK	1ST WEEK	3RD WEEK	6TH WEEK
Body Mass Index						
% Body Fat Percentage						

ANNEXURE-VII

Brochure of Xiaomi Body Composition Scale S400

Dual-frequency bioelectrical impedance measurement
A new level of precision

Using high and low dual-frequency alternating currents to penetrate cell membranes, intracellular and extracellular fluids' electrical impedance values can be accurately measured to capture physical data such as body fat, water content, and muscle mass.



50kHz low frequency
Measure extracellular fluid
Measure water in blood and tissue fluids

250kHz high frequency
Measure intracellular fluid
Measure cellular components of muscle, fat, bones, and organs

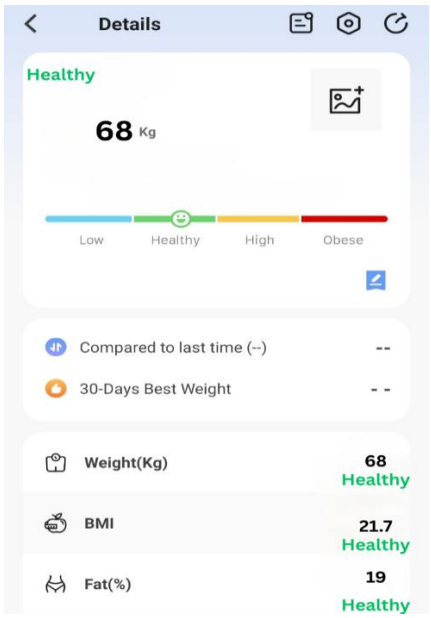
Analyse 25 body composition indicators
Take full control of your health

A single measurement can generate an analysis report of 25 body composition indicators* evaluating body composition including body fat, muscle mass, water content, protein, and bone mineral density. It also evaluates visceral fat rate and identifies hidden obesity risks. Get a deep analysis of your health status so you can quickly and easily identify any changes.

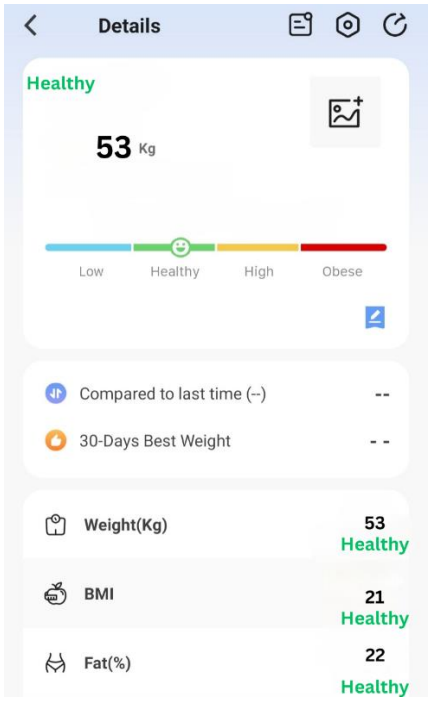
Weight	Heart rate	BMI	Body score	Body water mass
Body water	Fat mass	Body fat percentage	Protein mass	Protein percentage
Muscle mass	Muscle percentage	Bone mineral content	Bone mineral percentage	Visceral fat rate

ANNEXURE -VIII

Reports Generated



Picture 4– Report generated of Group A participant



Picture 5 – Report generated of Group B participant

ANNEXURE - IX

Masterchart of the study

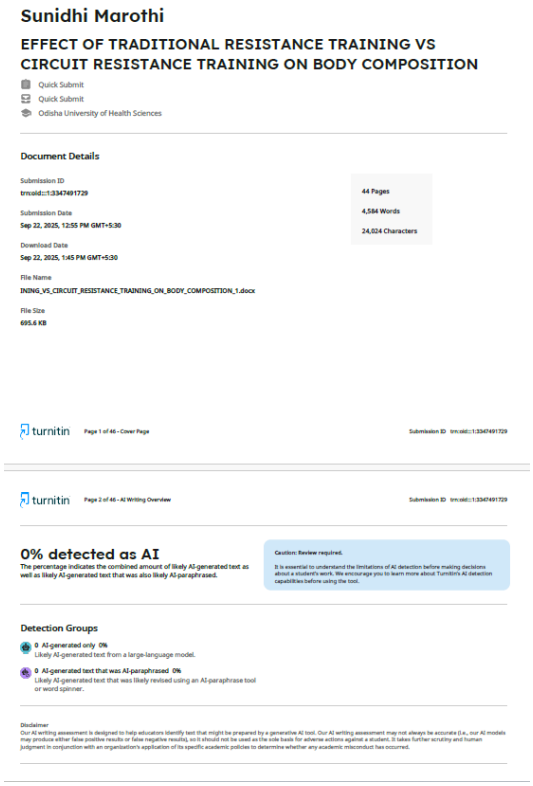
Group A – Traditional Resistance Training

S.NO.	AGE	GENDER	OCCUPATION	UALIFICATIO	HEIGHT (CMS.)	WEIGHT (KGS.)	BMI			% BODY FAT PERCENTAGE		
							1st week	3rd week	6th week	1st week	3rd week	6th week
1	26	F	Job	M.B.A	167	72	25.8	25.3	25.9	29%	27%	29%
2	23	F	Job	B.Tech	160	60	23.4	23.3	23.8	26%	26%	26%
3	30	F	Banker	M.Com	155	70	29.1	29	28	34%	32%	31%
4	23	F	Housewife	B.Com	164	66	24.5	23.9	23.4	27%	25%	24%
5	25	F	Job	B.Tech	159	53	21	20.7	20.5	22%	21%	21%
6	24	M	echanical Engine	B.Tech (Mech.	180	90	27.8	27.2	27	25%	23%	22%
7	30	M	Enterpreneur	B.Com	165	74	27.2	26.6	26.2	29%	27%	25%
8	27	M	Enterpreneur	B.Com	177	68	21.7	21.4	21.1	19%	18%	19%
9	23	M	oftware Develope	B.Tech (IT)	169	71	24.9	24.3	24.1	25%	23%	22%
10	29	M	CA	rtered Accoun	172	67	22.6	22.6	22.6	21%	21%	21%
11	28	M	Enterpreneur	B.Com	168	80	28.3	29	28.9	30%	31%	30%
12	25	M	Enterpreneur	B.Com	180	65	20.1	19.8	19.8	17%	15%	15%
13	26	M	Enterpreneur	B.Com	173	85	28.4	28.3	28	31%	30%	29%

Group B – Circuit Resistance Training

S.NO.	AGE	GENDER	CCUPATIO	JALIFICATI	HEIGHT (CMS.)	WEIGHT (KGS.)	BMI			% BODY FAT PERCENTAGE		
							1st week	3rd week	6th week	1st week	3rd week	6th week
1	28	F	tware Engi	B.Tech	165	58	21.3	21	20.7	23%	22%	22%
2	27	F	Job	B.Com	162	65	24.8	24.8	24.8	28%	29%	29%
3	30	F	Job	BBA	158	54	21.6	21.2	21	24%	22%	21%
4	30	F	Housewife	B.Com	160	68	26.6	26	25.3	31%	29%	28%
5	29	F	Housewife	MA (English	170	62	21.5	21.1	21	22%	21%	21%
6	23	M	nterpreneu	B.Com	178	76	23.9	23.4	23.4	20%	20%	20%
7	22	M	nterpreneu	B.Com	170	75	25.9	25.4	25	26%	24%	23%
8	26	M	Architect	B.Arch	175	72	23.5	23	22.6	21%	19%	18%
9	29	M	Banker	B.A (Finan	168	78	27.6	27.6	27.1	28%	28%	27%
10	25	M	ivil Enginee	B.E.(Civil)	180	80	24.7	24.3	24	23%	22%	22%
11	30	M	Lawyer	L.L.B	172	85	28.7	28.1	28	30%	28%	27%
12	29	M	keting Man	.A (Market	174	70	23.1	23.2	23	22%	23%	22%
13	19	M	Student	B.Tech	180	55	21.4	20.8	20.6	20%	19%	18%

ANNEXURE-X



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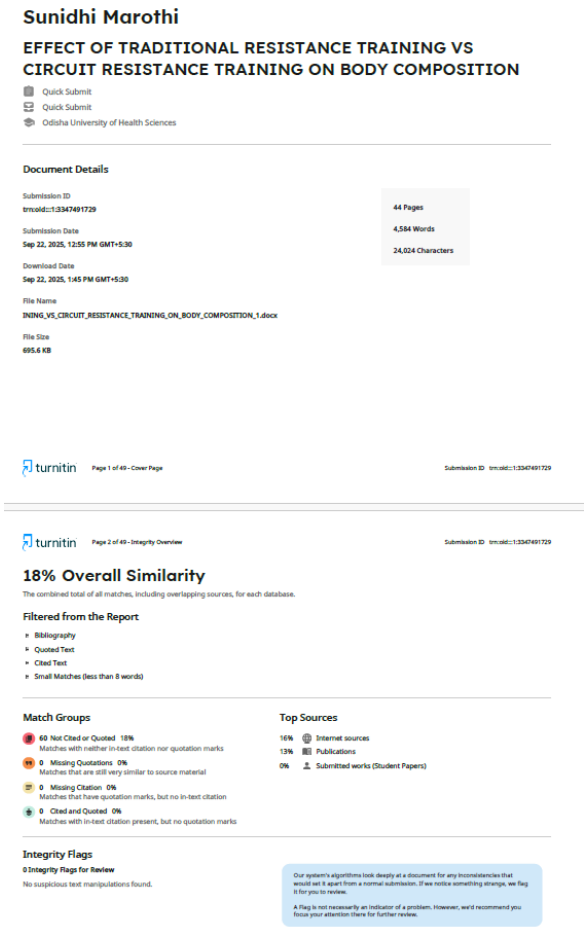

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