EFFECT OF INTERMITTENT FASTING, LOW CARB-HIGH FAT DIET AND RESISTANCE TRAINING ON SELECTED COMPONENTS OF OBESE POPULATION

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DECLARATION

I hereby declared that the presented work in the thesis entitled "Effect of Intermittent Fasting, Low Carb-High Fat Diet and Resistance Training on Selected Components of Obese Population" in fulfilment of degree of **Doctor of Philosophy (Ph. D.)** is outcome of research work carried out by me under the supervision of Dr. Neelam K Sharma, working as Professor, HOD & Deputy Dean in the School of Physical Education of Lovely Professional University, Punjab, India. In keeping with general practice of reporting scientific observations, due acknowledgements have been made whenever work described here has been based on findings of other investigator. This work has not been submitted in part or full to any other University or Institute for the award of any degree.

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CERTIFICATE

This is to certify that the work reported in the Ph. D. thesis entitled “Effect of Intermittent Fasting, Low Carb-High Fat Diet and Resistance Training on Selected Components of Obese Population” submitted in fulfillment of the requirement for the award of degree of **Doctor of Philosophy (Ph.D.)** in the School of Physical Education of Lovely Professional University, Punjab, India, is a research work carried out by Rahul Dev Choudhury, Registration Number 41800152, is bonafide record of his/her original work carried out under my supervision and that no part of thesis has been submitted for any other degree, diploma or equivalent course.

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Dated: -

Abstract

The study examines the effects of three interventions - intermittent fasting, a low-carb high-fat (LCHF) diet, and resistance training - on obese individuals. Intermittent fasting involves cycling between periods of eating and fasting, aiming to induce metabolic shifts for weight loss and health benefits. The LCHF diet drastically reduces carbs while increasing healthy fats, promoting fat-burning ketosis. Resistance training builds muscle mass and strength through weightlifting or bodyweight exercises. These approaches combat obesity's alarming global rise by targeting different physiological mechanisms. Intermittent fasting may optimize body composition, blood markers, and metabolic flexibility. LCHF diets support weight regulation, cardiovascular risk reduction, and glycemic control by altering fuel utilization. Resistance training increases lean mass and metabolic rate while reducing adiposity.

Healthy lifestyle through methods like intermittent fasting, resistance training, and the ketogenic diet. Intermittent fasting involves alternating periods of reduced calorie intake with unrestricted eating to induce metabolic shifts for health and weight management. Common protocols include alternate-day fasting, time-restricted eating, and the 5:2 approach. Studies show that intermittent fasting can improve cardiovascular function and help control glucose levels, benefiting obese individuals. Resistance training, also known as strength training, enhances muscle endurance and strength through activities like weightlifting.

It is recommended two to three times per week for obese individuals to aid in weight loss and improve muscle function. The World Health Organization suggests engaging in physical training for at least 150 to 300 minutes weekly for low or medium-intensity workouts, with additional time for resistance training. The ketogenic diet, marked by its low carbohydrate and high-fat consumption, endeavors to transition the body's energy supply from glucose to fat via the process of ketogenesis. This dietary approach can help with weight regulation and overall wellness. The usual macronutrient breakdown consists of approximately 50-60% fat, 30-35% protein, and 5-10% carbohydrates. While the ketogenic diet has gained popularity for its potential benefits, it is essential to consider the limitations and consult healthcare experts for personalized guidance. Overall, integrating intermittent fasting, resistance training, and the

ketogenic diet can contribute to a holistic approach to promoting a healthy lifestyle and managing obesity.

The study aims to establish standardized, evidence-based guidelines by comprehensively examining these weight loss strategies' effects across multiple health markers. Integrating dietary modification, scheduled eating windows, and strength training may synergistically address the obesity epidemic's root causes and detrimental outcomes.

The study delves into three interventions: intermittent fasting, an LCHF diet, and resistance training and their impact on obese individuals. Intermittent fasting involves alternating between eating and fasting periods to trigger metabolic changes for weight loss and health improvements. The LCHF dietary approach involves the reduction of carbohydrate consumption while simultaneously increasing the intake of healthy fats. This dietary strategy is designed to induce a state known as ketosis, wherein the body primarily utilizes fat for energy production. Concurrently, resistance training, such as weightlifting, is employed to enhance muscle mass and strength. These interventions target various physiological mechanisms to combat obesity's global surge. Intermittent fasting methods include alternate-day fasting, time-restricted eating, and the 5:2 approach. Research indicates its potential to enhance cardiovascular health and glucose regulation, benefiting obese individuals. Resistance training, recommended two to three times per week, improves muscle function and aids weight loss. The World Health Organization suggests incorporating physical activity for at least 150 to 300 minutes weekly, with additional time for resistance training. The ketogenic diet, featuring low carbs and high fats, shifts the body's energy source from glucose to fat through ketogenesis. Its macronutrient composition typically comprises 50-60% fat, 30-35% protein, and 5-10% carbohydrates. While popular for weight regulation, it's crucial to consider its limitations and seek personalized advice. By integrating intermittent fasting, resistance training, and the ketogenic diet, a holistic approach to health and obesity management emerges. The study seeks to establish evidence-based guidelines by examining these strategies' effects across various health markers. Integrating dietary modifications, scheduled eating windows, and strength training may synergistically address obesity's root causes and detrimental outcomes.

Intermittent fasting (IF) has garnered considerable attention in recent years due to its potential positive impacts on metabolism, weight regulation, and general well-being. Numerous studies have delved into IF's effects on health, revealing insights into its mechanisms and advantages, particularly for individuals dealing with obesity and metabolic issues. (Stockman et al., 2018)'s study, for instance, delved into clinical trials and animal models to probe IF's potential benefits and underlying mechanisms. Their findings demonstrated diverse variations of IF, with study protocols influencing interpretations of trends in weight reduction. Overall, IF exhibited enhancements in metabolic functions and weight management. Animal studies showed IF's capacity to postpone aging, diminish oxidative stress, enhance cognition, mitigate inflammation, and bolster gut microbiome and autophagy. However, the balance of benefits versus risks depended on factors like the model, initiation age, duration, and IF regimen. While clinical experiments indicated IF's positive impacts on insulin sensitivity, glucose regulation, and weight loss, further extensive research with larger sample sizes and extended durations is warranted for a comprehensive understanding of its effects.

(Golbidi et al., 2017) compared the merits of calorie restriction and fasting, particularly concerning contemporary lifestyle-induced ailments such as obesity, diabetes, and cardiovascular issues. They observed that while calorie restriction enhanced autophagy, activated cellular stress-related components, modified apoptosis, and altered hormonal equilibrium, intermittent fasting emerged as more efficacious and safer than calorie restriction, promoting weight loss without malnutrition risks. IF also demonstrated favorable effects on psychological well-being. Consistent adherence to IF or calorie restriction was underscored as crucial for maintaining desired outcomes. (Maughan et al., 2010) delved into fasting's impacts on performance and metabolism, particularly in religious fasting practices like Ramadhan. They found that fasting-induced metabolic shifts favored fat utilization over carbohydrates as an energy source. While fasting's metabolic effects might be minimal, its pronounced impacts on cognitive and physical functions could significantly influence exercise performance and overall wellness. Strategies to mitigate fasting's effects on performance included adjusting competition schedules to accommodate physiological changes during fasting periods.

Shifting to dietary interventions, (Giugliano et al., 2018) explored the benefits of low carbohydrate diets (LCD) on individual health. They underscored the adverse effects of excessive sugar intake on obesity, diabetes, and metabolic syndrome. By prioritizing carbohydrate reduction through LCD or ketogenic diets, individuals could effectively manage weight and enhance metabolic parameters. Controlled trials evidenced greater weight loss with ketogenic diets compared to low-fat diets, emphasizing the importance of carbohydrate quality over quantity. For individuals with metabolic concerns, recommendations included restricting or eliminating carbs, refined grains and added sugars and focusing on fiber intake. Furthermore, (Ludwig & Ebbeling, 2018) delved into the carbohydrate-insulin model (CIM) of obesity, stressing that obesity transcends mere calorie balance. The CIM posited that excessive carbohydrate consumption, particularly refined carbs, could elevate insulin levels, fostering fat storage and weight gain. Informed dietary choices informed by an understanding of insulin's role in metabolism could facilitate effective weight management.

(Ruscello et al., 2018) compared the effects of various exercise modalities, such as bicycling and spinning, on body composition, blood parameters, and physical fitness, with spinning demonstrating superior benefits. They also explored strategies to mitigate fasting's effects on athletes' training performance during religious practices like Ramadhan, advocating adjustments in training principles to uphold performance levels during fasting periods. Examining psychological factors' impact on weight management behaviors, de Sousa (de Sousa Rodrigues et al., 2017) investigated chronic psychological stress's effects on cognitive, metabolic, and inflammatory traits in a mouse model of diet-induced obesity. Their findings underscored the intricate interplay between behavioral impairment, stress, diet, and metabolic syndrome, emphasizing the necessity of addressing psychological factors in weight management strategies.

(Mulgrew et al., 2019) scrutinized the link between body image, stress, dieting status, and weight control behaviors in young adults, emphasizing the promotion of healthy weight management practices while mitigating the adverse effects of unhealthy methods on psychological well-being. Lastly, (Solianik & Sujeta, 2018) explored the effects of a 2-day total fasting on various parameters in overweight women, revealing alterations in autonomic function and stress responses and highlighting physiological adaptations during short-term fasting. In summary, the accumulated research underscores the multifaceted benefits of intermittent fasting, calorie restriction, low carbohydrate diets, exercise, and psychological factors on metabolism, weight management, and overall health, offering insights for informed choices toward long-term well-being.

The research employed descriptive statistics, Analysis of Covariance (ANCOVA), and a post-hoc LSD test for data analysis facilitated by SPSS version 16.0 software. The research design, crucial for methodology, followed the blueprint outlined by Malhotra & Dash (2014). A pre-test and post-test experimental setup were chosen to address various objectives, focusing on managing obesity and enhancing overall health through nutrition, diet, and resistance training. Participants were obese individuals from urban areas of Dibrugarh district, Assam, chosen due to the region's high incidence of diabetes associated with overweight and obesity (Annual Health Survey, 2014). Recruitment involved newspaper ads, TV spots, gym outreach, and the snowball technique. Respondents were divided into five groups based on BMI scores, each comprising 20 individuals aged 35-45 years. Four experimental groups underwent different interventions: intermittent fasting, low carbohydrate high-fat diet, resistance training, and a composite program. The control group received no intervention.

The program lasted eight weeks, with pre-test and post-test assessments conducted. The effects of the interventions on various variables were analyzed across groups. Diet and fasting schedules were adjusted as needed and overseen by medical experts.

Dr. Jeshmin Ahmed and Dr. Pallabi Bhattacharjee monitored the fasting and diet programs, while fitness trainer Sri D.C Bhargab supervised the resistance training. The study, based in Assam, utilized convenient and snowball sampling among sedentary individuals to explore physiological, anthropometric, hematological, and psychological parameters.

Following 8 weeks of interventions, physiological, anthropometric, hematological, and psychological parameters were assessed. The dropout rate was acknowledged to be potentially high (Utami et al., 2018). The control group remained untreated throughout the study.

Analysis of the data yielded the subsequent significant discoveries and suggestions:

- The results of the study indicated that the chosen training programs, including intermittent fasting, LCHF diet, resistance training, composite, and control groups, exhibited notable distinctions during the post-test phase in addressing heart rate among individuals with obese people. Notably, the composite group displayed the highest adjusted mean value, signifying its effectiveness as the most successful treatment option, while the control group exhibited the least efficacy in reducing heart rate among the participants. Consequently, the hypothesis (H_0) asserting no significant variance among the adjusted post-test means of heart rate across the five treatment groups was denied.

- The results of the study indicated that the chosen training programs, including intermittent fasting, LCHF diet, resistance training, composite, and control groups, exhibited notable distinctions during the post-test phase in addressing blood pressure among individuals with obese people. Notably, the composite group displayed the highest adjusted mean value, signifying its effectiveness as the most successful treatment option, while the control group exhibited the least efficacy in reducing heart rate among the participants. Consequently, the hypothesis (H_0) asserting no significant variance among the adjusted post-test means of heart rate across the five treatment groups was denied.
- The results of the study indicated that the chosen training programs, including intermittent fasting, LCHF diet, resistance training, composite, and control groups, exhibited notable distinctions during the post-test phase in addressing VO2 Max among individuals with obese people. Notably, the composite group displayed the highest adjusted mean value, signifying its effectiveness as the most successful treatment option, while the LCHF diet group exhibited the least efficacy in reducing VO2 Max among the participants. Consequently, the hypothesis (H_0) asserting significant variance among the adjusted post-test means of VO2 Max across the five treatment groups was affirmed.
- The results of the study indicated that the chosen training programs, including intermittent fasting, LCHF diet, resistance training, composite, and control groups, exhibited notable distinctions during the post-test phase in addressing lipid profiles among individuals with obese people. Notably, the composite group displayed the highest adjusted mean value, signifying its effectiveness as the most successful treatment option, while the control group exhibited the least efficacy in reducing lipid profiles among the participants. Consequently, the

hypothesis (H_0) asserting significant variance among the adjusted post-test means of lipid profiles across the five treatment groups was affirmed.

- The results of the study indicated that the chosen training programs, including intermittent fasting, LCHF diet, resistance training, composite, and control groups, exhibited notable distinctions during the post-test phase in addressing HbA1C among individuals with obese people. Notably, the composite group displayed the highest adjusted mean value, signifying its effectiveness as the most successful treatment option, while the control group exhibited the least efficacy in reducing HbA1C among the participants. Consequently, the hypothesis (H_0) asserting insignificant variance among the adjusted post-test means of HbA1C across the five treatment groups was denied.
- The results of the study indicated that the chosen training programs, including intermittent fasting, LCHF diet, resistance training, composite, and control groups, exhibited notable distinctions during the post-test phase in addressing the Liver function test among individuals with obese people. Notably, the composite group displayed the highest adjusted mean value, signifying its effectiveness as the most successful treatment option, while the control group exhibited the least efficacy in reducing Liver function tests among the participants. Consequently, the hypothesis (H_0) asserting significant variance among the adjusted post-test means of the Liver function test across the five treatment groups was affirmed.
- The results of the study indicated that the chosen training programs, including intermittent fasting, LCHF diet, resistance training, composite, and control groups, exhibited notable distinctions during the post-test phase in addressing the kidney function test among individuals with obese people. Notably, the composite group displayed the highest adjusted mean value, signifying its effectiveness as the most successful treatment option, while the control group exhibited the least efficacy in reducing kidney function tests among the participants. Consequently, the hypothesis (H_0) asserting insignificant variance among the adjusted post-test means of the kidney function test across the five treatment groups was denied.

- The results of the study indicated that the chosen training programs, including intermittent fasting, LCHF diet, resistance training, composite, and control groups, exhibited notable distinctions during the post-test phase in addressing the water content among individuals with obese people. Notably, the composite group displayed the highest adjusted mean value, signifying its effectiveness as the most successful treatment option, while the control group exhibited the least efficacy in reducing water content among the participants. Consequently, the hypothesis (H_0) asserting significant variance among the adjusted post-test means of the water content across the five treatment groups was affirmed.
- The results of the study indicated that the chosen training programs, including intermittent fasting, LCHF diet, resistance training, composite, and control groups, exhibited notable distinctions during the post-test phase in addressing the visceral fat percentage among individuals with obese people. Notably, the composite group displayed the highest adjusted mean value, signifying its effectiveness as the most successful treatment option, while the control group exhibited the least efficacy in reducing visceral fat percentage among the participants. Consequently, the hypothesis (H_0) asserting insignificant variance among the adjusted post-test means of the visceral fat percentage across the five treatment groups was denied.
- The results of the study indicated that the chosen training programs, including intermittent fasting, LCHF diet, resistance training, composite, and control groups, exhibited notable distinctions during the post-test phase in addressing the subcutaneous fat percentage among individuals with obese people. Notably, the composite group displayed the highest adjusted mean value, signifying its effectiveness as the most successful treatment option, while the control group exhibited the least efficacy in reducing subcutaneous fat percentage among the participants. Consequently, the hypothesis (H_0) asserting significant variance among the adjusted post-test means of the subcutaneous fat percentage across the five treatment groups was deemed valid.
- The results of the study indicated that the chosen training programs, including intermittent fasting, LCHF diet, resistance training, composite, and control groups, exhibited notable distinctions during the post-test phase in addressing

the body mass among individuals with obese people. Notably, the composite group displayed the highest adjusted mean value, signifying its effectiveness as the most successful treatment option, while the control group exhibited the least efficacy in reducing body mass among the participants. Consequently, the hypothesis (H_0) asserting significant variance among the adjusted post-test means of the body mass across the five treatment groups was deemed valid.

- The results of the study indicated that the chosen training programs, including intermittent fasting, LCHF diet, resistance training, composite, and control groups, exhibited notable distinctions during the post-test phase in addressing the muscle mass among individuals with obese people. Notably, the composite group displayed the highest adjusted mean value, signifying its effectiveness as the most successful treatment option, while the control group exhibited the least efficacy in reducing muscle mass among the participants. Consequently, the hypothesis (H_0) asserting significant variance among the adjusted post-test means of the muscle mass across the five treatment groups was deemed valid.
- The results of the study indicated that the chosen training programs, including intermittent fasting, LCHF diet, resistance training, composite, and control groups, exhibited notable distinctions during the post-test phase in addressing the muscle mass among individuals with obesity. Notably, the composite group displayed the highest adjusted mean value, signifying its effectiveness as the most successful treatment option, while the control group exhibited the least efficacy in reducing muscle mass among the participants. Importantly, the hypothesis (H_0) asserting significant variance among the adjusted post-test means of the muscle mass across the five treatment groups was not only confirmed but also validated, further strengthening the credibility of the study.
- The results of the study indicated that the chosen training programs, including intermittent fasting, LCHF diet, resistance training, composite, and control groups, exhibited notable distinctions during the post-test phase in addressing the muscle mass among individuals with obesity. Notably, the composite group displayed the highest adjusted mean value, signifying its effectiveness as the most successful treatment option, while the control group exhibited the least efficacy in reducing muscle mass among the participants. Importantly, the

hypothesis (H_0) asserting significant variance among the adjusted post-test means of the muscle mass across the five treatment groups was not only confirmed but also validated, further strengthening the credibility of the study.

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- The results of the study indicated that the chosen training programs, including intermittent fasting, LCHF diet, resistance training, composite, and control groups, exhibited notable distinctions during the post-test phase in addressing the family environment scale among individuals with obese people. Notably, the composite group displayed the highest adjusted mean value, signifying its effectiveness as the most successful treatment option, while the control group exhibited the least efficacy in reducing the family environment scale among the participants. Consequently, the hypothesis (H_0) asserting significant variance

among the adjusted post-test means of the family environment scale across the five treatment groups was deemed valid.

The government can consider the findings of this research while framing various policies for the management of combating obesity requires a multifaceted approach that integrates various strategies and considers long-term sustainability. Policies and awareness programs need to be implemented to highlight the importance of sports in order to assess the enduring impacts of intermittent fasting regimens, low-carbohydrate and high-fat (LCHF) dietary patterns, and resistance exercises on comprehensive health markers among individuals grappling with obesity. Examining diverse LCHF diet variations and methods to enhance adherence to these protocols could unveil the most viable and maintainable avenues for weight reduction and metabolic well-being. Evaluating different intermittent fasting modalities, such as alternate-day fasting or time-restricted feeding, holds promise in identifying the optimal regimen for weight loss and metabolic improvements. Assessing their real-world feasibility across diverse lifestyles is equally vital. Personalized interventions tailored to individual genetics, metabolic profiles, and lifestyle factors may yield superior outcomes. Exploring predictive biomarkers could facilitate this personalization.

Understanding psychological and behavioral aspects influencing long-term commitment to these lifestyle modifications is paramount. Identifying strategies to overcome motivational barriers and nurture sustained engagement could enhance success rates. Concurrently, investigating resistance training's role in preserving muscle mass and strength during weight loss could optimize metabolic rate and overall health. Evaluating the collective impact of intermittent fasting, LCHF diets, and resistance training on metabolic health indicators like insulin sensitivity, lipid profiles, and inflammation is crucial. Determining their efficacy in mitigating obesity-related diseases, such as type 2 diabetes, cardiovascular conditions, and metabolic syndrome, could inform preventive measures.

Continuous monitoring of potential adverse effects and safety concerns is imperative, particularly for individuals with pre-existing conditions. Devising strategies to mitigate risks and optimize the safety profile of these interventions is essential. Translating research findings into practical guidelines for healthcare professionals and developing evidence-based resources to support implementation in clinical settings could facilitate wider adoption. Community education and outreach initiatives should aim to enhance societal understanding of the potential benefits and limitations of these approaches, empowering individuals to make informed lifestyle choices. The research holds significant implications for managing obesity and controlling weight in individuals struggling with obesity. It emphasizes the importance of addressing obesity management within this population. Consequently, its findings can be utilized in various areas such as Long-Term Health Monitoring, Dietary Modifications and Adherence, Optimal Fasting Strategies, Tailored Approaches, Psychological and Behavioral Considerations, Preservation of Muscle Mass and Strength, Improvement of Metabolic Health and Reduction of Disease Risk, Assessment of Safety and Adverse Reactions, Integration into Clinical Settings, as well as Community Education and Engagement.

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CHAPTER 1
INTRODUCTION

1 Introduction

The importance of a healthy lifestyle has gained its relevance more than ever in the past couple of years. People across the globe today are attracted and motivated towards leading a healthy lifestyle to a great extent. In this era, there are a number of methods through which individuals have facilitated their journey of healthy living with. Intermittent fasting, resistance training and ketogenic diet include some of the most preferred and effective methods in this paradigm. (Dong et al., 2020) defined intermittent fasting as a method of intervention in the diet which is similar to that of calorie restrictions implemented. The main purpose of intermittent fasting is the prevention of food intake. One important aspect of intermittent fasting highlighted here is the timing. The process highlights the timings during which an individual can consume their daily or weekly meals. The two major patterns followed in intermittent fasting includes either an alternative day fasting or a fasting strictly based on the time-restriction component introduced. The first type revolves around the idea of allowing a 24-hour frame for eating and the other 24 hour for not eating. This format can be filled up with a two days' time for fasting and including five days in a week without any restrictions on the diet. The process of intermittent fasting provides a number of health benefits including effective cardiovascular functioning. It is also found to give benefits to neurodegenerative diseases ranging from Alzheimer's disease to Parkinson's (Martin et al., 2006). The rising cases of obesity in the present times have incorporated a threat amongst the individuals and obesity has been reportedly in coordination with a poor diet give rise to cardiovascular tensions in the body. The two together is found to contribute a 13% risk towards cardiovascular mortality (Go et al., 2014) Intermittent fasting in this regard is considered an important contributor to enable the recovering health of obese people globally as it provides control over glucose levels in both humans as well as animals (Catenacci et al., 2016).

The next important method of generating a healthy lifestyle among the people especially the one's dealing with obesity today is the undertaking of resistance training.

The concept of resistance training has been associated by researchers in the past with the improvement of the function of the muscles (Souza et al., 2017). The rapid force capacity is considered to be an important parameter for neuromuscular functions where there occurs a rise in the contractile force with the application of a contraction (Maffiuletti et al., 2016) One of the major benefits derived by individual from the use of resistance training includes the physical fitness through the generation of force required to deal with the day-to-day activities of life (Maffiuletti et al., 2016). It helps an individual to make a balance when any incidence of fall occurs or to regulate the control over the act of balancing (Assessment, 2006) The problem of obesity brings with it a number of difficulties and the weakening of various muscular strengths is one of the common hazards seen with it. The first step suggested towards the cure of obesity includes physical activities which helps in the weight loss of the concerned individual. Study conducted previously by a number of researchers in the context of obesity states that the importance of physical activities is unavoidable. These studies have offered resistance training as a module for reducing weight among the obese people and suggest them to undergo these training sessions for two to three times in a week (Uck, 2015; Ma et al., n.d.). Moreover, as per the instructions of the World Health Organisation, all adults irrespective of their health condition must consciously engage in a routine of physical training for about a minimum of 150 to 300 minutes for a low or medium intensity workout; in case of an extensive training in resistance 75 minutes in a week is compulsory ((L. Dos Santos et al., 2016; Souza et al., 2017)

The importance of resistance training in the life of people for maintaining a healthy muscular concertation at all ages is thus suggested by a number of researchers in the field. Its implication especially with the individuals dealing with obesity is enormous. There lies potential both among the researchers as well as the health coaches to enquire about its novel avenues guiding the problems faced by the obese people all over.

The third important component in the area of constructing a healthy life for the individuals across the world today is ketogenic diet. The process of a ketogenic diet is explained by as a low carbohydrate diet which also includes high fat dietary components to be planned as per the required levels of various ketogenic particles (Di et al., 2020). The ketogenic diet comprises of 50 to 60 % of high fat elements followed by 30 to 35 % of proteins and 5 to 10% of carbohydrates (Meira et al., 2019). The various important dietary components such as micronutrients must of proper proportions in this diet. Although the ketogenic diet is comparatively newer to the other low carbohydrate diets in the market where the individuals are asked to take any form of carbohydrates while shielding themselves from excessive quantities of protein. This releases the ketones as a result of the diet. The ketogenic diet has confirmed their significant contribution towards the regulation of obesity through carbohydrate restrictions. The effect caused by ketogenic diet is well realized in the fields of chronic diseases which includes obesity and T2DM (Kumar et al., 2021). The recent research focusing on the various aspects of ketogenic diet shows that there lies a number of potentials to be explored in curing of obesity using ketogenic diet. The diet consisting of replacement of glucose with that of ketones in the body has effective contribution in the cure of metabolic disorders, kidney diseases, epileptic disorders and even uneven muscle damages.

The three processes discussed above shows how these approaches have proven to be beneficial for the cardiovascular and the muscular elements of the human body. Obesity is one of the most prominent problems arising in the lives of the people globally. As the lifestyle choices of the individuals over a period of time has seen a change, the problems arising out of it are seen to be quite abundantly in the environment. The number of people suffering from obesity in the present times is reported to be twice that it was in 1980 (Kumar et al., 2021). The situation has engrossed individuals irrespective of their places of origin. Either it is the developed or the developing nations, the roots of obesity have found to crawl into both the sides (Katzmarzyk et al., 2020). The disease of obesity attacks the physical as well the mental well-being of an individual and causes risks to their lives enormously. The attraction of people today to diets including rich carbohydrate supplements has made the individuals carry themselves out of obesity further difficult (Lorenzo et al., 2019).

The study here realizes the alarming rate at which obesity is finding its way into the lives of people residing all across the world and identifies three significant processes showing an impact on its recovery. Researchers in the past have identifies intermittent fasting, resistance training and ketogenic diet to have good results on dealing with obesity. This study here would further investigate these three dietary and health measures and find empirical evidence towards forming a standardized opinion towards its contribution of obesity.

1.1 Intermittent Fasting

Intermittent fasting has experienced widespread adoption in recent years as a diet approach for health and weight management. By alternating periods of reduced calorie intake with periods of unrestricted eating, intermittent fasting aims to produce benefits through metabolic shifts rather than calorie counting alone. The lack of restrictions on food choices adds to its flexibility and sustainability as a lifestyle. A hallmark of intermittent fasting is its varied methods allowing individuals to select an option that suits their preferences and routines. Common intermittent fasting protocols include alternate-day fasting involving alternating 24-hour periods of fasting and feasting, time-restricted eating confining daily meals to a window such as eight hours, and the 5:2 approach limiting intake to 500-600 calories twice weekly. Of these, the 16:8 method limiting consumption to an eight-hour window while fasting for sixteen hours has gained tremendous ground due to its manageability. Studies suggest IF can be an effective weight loss aid for some people. For example, some trials have shown those using IF lost between 3-8% of their body weight over 3-24 weeks while overall calorie intake remained similar between IF and non-fasting groups. The fasting periods seem to promote body fat breakdown to fuel energy needs rather than immediately using food energy. Greater fat loss while maintaining muscle mass is ideal for long term weight management. There also appear to be some unique health benefits related to giving your digestive system an extended break from food each day. Cellular repair processes may be optimized during fasts. And fasting for longer intervals can trigger ketosis, where the body burns fat stores for fuel more aggressively. This may aid cognitive function and blood sugar regulation. Some research indicates neural regeneration, reduced systemic inflammation, and anti-aging effects may also occur. However, intermittent fasting is not necessarily easy to adopt consistently. Hunger levels may remain elevated during fasting periods for the first few weeks until your body adapts hormonally and metabolically. This can be quite uncomfortable. Headaches, irritability, and difficulty concentrating are also common complaints initially. Proper sleep, stress management, and adequate water intake helps ease the transition process. Research has increasingly demonstrated intermittent fasting's ability to induce advantageous physiological alterations beyond weight control. Studies link it to gains in insulin sensitivity, reductions in inflammation, and upgrades in metabolic health parameters such as blood lipid and glucose levels. These shifts are thought to underlie intermittent fasting's emerging potential for guarding against chronic diseases and optimizing physical function. Within physical education, intermittent fasting holds promise both for general wellness and athletic performance. Its facilitation of weight maintenance and lean mass preservation can aid general population health, while enhancements to metabolic flexibility may support endurance capacities in athletes. Preliminary work also ties intermittent fasting to cognitive benefits potentially relevant for learning and skill development. Ongoing investigations continue exploring intermittent fasting's applications and elucidating its mechanisms across various populations. Overall, intermittent fasting presents a dietary strategy aligned with personalization in health. Its flexibility permits customizing to meet diverse needs, from improving metabolic health to cultivating peak physical conditioning. Continued research will likely further substantiate intermittent fasting's role in supporting optimal functionality, healthspan and quality of life. The impact of intermittent fasting on athletic performance is an area that has garnered substantial interest among recent empirical studies. Two sources illuminate some noteworthy findings. (Nowosad & Sujka, 2021) revealed intermittent fasting has prospects to better endurance, strength training, and recuperation. They reference investigations implying intermittent fasting can induce heightened fat usage during exercise, potentially enhancing endurance prowess. Furthermore, suggestions have arisen that intermittent fasting may amplify growth hormone secretion, which could aid muscle evolution and mending subsequent to strength training periods. Periodic fasting in athletes demands further scrutinization to fully grasp its influences on performance and health.

While intermittent fasting has shown promise in physical education and athletic performance, those considering incorporating this dietary approach must weigh several factors in how they time meals around workouts to ensure adequate fuel before and after exercise. It is imperative to select nutrient-dense foods during eating windows that can support optimal performance and recovery. Athletes should also carefully monitor their nutrient intake to avoid deficiencies in essential vitamins and minerals that may arise from restricted eating periods. Though intermittent fasting has emerged as a promising method in the field of physical education because of possible advantages for physical health, athletic performance, and psychological well-being, more research is still required to fully comprehend the underlying mechanisms and long-term implications. The evidence suggests intermittent fasting could offer a viable dietary strategy in physical education contexts. However, it is crucial to consider individual variation in response and address any potential risks associated with this dietary pattern. Moreover, integrating intermittent fasting within carefully planned programs may complement overall efforts aimed toward optimizing performance outcomes in physical education settings. Intermittent fasting presents a potential approach for weight management and improved metabolic health. Still, it is important to consider individual differences, nutritional adequacy, and personalized approaches when implementing this eating pattern. While there are various forms of intermittent fasting, the 16/8 method, 5:2 diet, and alternate-day fasting have gained popularity. Additional research is warranted to establish long-term effects, safety considerations, effectiveness in diverse populations, and optimal protocols. Nonetheless, intermittent fasting demonstrates promise as an effective strategy for those looking to manage their weight and enhance metabolic health.

1.2 Low Carb High Fat Diet

The low-carb, high-fat ketogenic diet prioritizes fat over carbohydrates, potentially helping weight loss and health problems like hypertension. While various diets focus on weight loss uniquely, ketogenic eating encourages high fat intake contrary to most. Recommendations differ significantly from this diet's calorie needs. The premise of consuming significant fat facilitating weight loss relies on carbohydrate control. People should get 70-75% calories from fat and just 5-10% from carbs. When we eat carbs, our bodies make glucose and insulin for energy using glucose first and leaving lipids and proteins underused. With fewer carbs, ketosis results as the liver turns fat into ketone bodies for fuel instead of sugar. Originally, ketosis ensured survival during famine by using fat stores. Limiting carbs lowers glucose, compelling the body to burn fat rather than it. This metabolic pathway breaks down hepatic fat into ketone bodies - acetoacetate, beta-hydroxybutyric acid, and acetone - for alternate energy since glucose cannot fuel us as readily. Ketones served as energy substrates long ago since they burn fat steadily with benefits like heightened mentality and vitality. Excess ketones exit the body unneeded for power. When fatty acids incompletely oxidize in the liver, ketone bodies over accumulate. The diet restricts carbs to just 20-60 grams daily, relying on fat not glucose as chief energy source. Ketogenic eating excellently facilitates weight loss and helps cognitive issues in Alzheimer's patients.

Mild ketosis is a common physiological condition that occurs in individuals after extended fasting periods or breastfeeding sessions, as recent clinical research elucidates. Ketone levels at a minimum safeguard athlete against dangerous blood sugar drops during arduous, sporadic physical exertion. Ketosis also meaningfully mitigates appetitive urges. In other words, a low carb eating regimen governs nibbling in a nearly identical fashion as going without eats. Though low carb diets have empirically aided slimmers shed excess pounds, the chronic impacts on these persons remain uncertain according long-term medical monitoring has yet to determine.

The low carbohydrate, high fat dietary approach, often called the ketogenic diet, has experienced renewed interest in recent years due to purported advantages for weight management and overall wellness optimization. This essay aims to comprehensively analyze the LCHF dietary model, exploring factors such as its conceptual roots, mechanistic underpinnings, evidentiary research findings, practical implementation considerations, as well as ongoing critiques and queries requiring illumination. Fundamentally, a low carbohydrate, high fat nutrition protocol functions by transitioning the body's primary energy pathway from glucose combustion to fat catabolism through the metabolic alteration known as ketosis. Under ketosis, the liver breaks down stored triglycerides into ketone bodies that serve as an alternate fuel substrate for tissues. In comparison to low-fat or moderate-carbohydrate eating patterns, LCHF diets emphasize the replacement of refined and processed carbohydrates with whole, minimally processed foods high in healthful fats including avocados, nuts, seeds, olive oil, and omega-3 rich seafood. This reduction in dietary carbohydrate facilitates stabilization of blood glucose levels and insulin signaling while enhancing satiety. Historically, the concept of restricting carbohydrate intake while increasing fat has precedents in ancestral human diets predating widespread industrial food manufacturing. However, the modern iteration traces back to Dr. Robert Atkins' 1970s book that popularized high-protein, low-carb nutrition for weight management. Since then, accumulating research has enhanced comprehension of LCHF diets and their implications, although interpretation remains nuanced with contradictory findings. Numerous investigations probe the LCHF model's impacts on diverse health parameters. Consistently, studies report advantageous outcomes related to weight regulation, cardiovascular risk biomarkers, glycemic control, and general metabolic profile optimization. For example, a recent trial compared LCHF versus moderate carbohydrate-fat diets in lipedema patients, finding the former superior for reducing body weight, body fat percentage, waist and hip circumferences. The low carbohydrate, high fat dietary approach has gained traction due to proposed advantages for shedding pounds and upgrading health metrics. By restricting carbohydrates while emphasizing healthy fats, LCHF diets foster metabolic changes prioritizing fat catabolism over glucose burning, theoretically facilitating weight loss and improved cardiometabolic health markers. However, potential downsides require acknowledgment such as risks of micronutrient inadequacy or long-term adherence difficulties absent careful individualization. With judicious planning, monitoring, and tailoring to specific needs and targets, LCHF diets can constitute a viable option for certain individuals seeking weight management or metabolic enhancement, though more investigation remains imperative. The low carbohydrate high fat nutritional model has experienced heightened popularity recently as a weight regulation and general wellness optimization strategy. This essay aims to provide an overview of the LCHF approach addressing definitions, historical antecedents, macronutrient composition, implications for weight and body composition modification, impact on blood glucose management and insulin sensitivity, potential performance enhancement applications, health benefits, as well as limitations requiring consideration. The LCHF dietary paradigm traces origins to ancestral human nourishment patterns predating processed food proliferation. Historically, carbohydrates comprised a smaller component of total calories while fats featured more prominently as an energy substrate. The mechanistic hypothesis underpinning LCHF diets proposes that curtailing carbohydrate intake compels the body to utilize fat stores for fuel to a greater degree, theoretically promoting fat loss. A typical LCHF regimen restricts carbohydrates to approximately 4% of total daily calories while emphasizing fats comprising roughly 77% of nutrition, with protein consumption maintained at about 19%. This macronutrient profile instigates a metabolic transition from glucose dependency to ketogenesis relying primarily on fat catabolism. While certain advantages may accrue such as increased satiety from higher fat intake and improved lipid biomarkers in some individuals, drawbacks also warrant acknowledgment. Eliminating or severely curtailing carbohydrates risks inadequate fiber, vitamin, mineral, and antioxidant procurement predominantly obtained through plant foods. The LCHF model has garnered favor due to hypothesized weight regulation and health outcome benefits. While promising in domains including weight management and glycemic control, limitations and nuances necessitate consideration prior to adoption. Further investigation remains imperative to comprehensively elucidate long-term impacts on diverse health and performance metrics. Individuals contemplating this dietary approach would be best served obtaining specialized guidance from healthcare experts tailored to address personalized needs and objectives.

1.3 Resistance Training

Resistance training, often called strength or weight training, is a physical activity that uses opposition to enhance muscle endurance and might. This form of exercise usually involves lifting weights, employing resistance bands, or doing bodyweight moves. Resistance training has gained prominence as an effective strategy for addressing obesity. Numerous studies have demonstrated resistance training's beneficial effects on obesity. For example, one investigation compared the impacts of different exercise routines on adult men. It found that all three plans, which incorporated aerobic resistance, strength training, and a blend of the two, resulted in a reduction in fat mass for the participants. This discovering proposes that resistance training can be a helpful tool for weight administration and obesity decrease.

Additionally, resistance training has been shown to increase lean body mass, which is pivotal for overall metabolic health and weight control. Exercise research has displayed that resistance exercise can build muscle mass, and it's significant to note that muscle tissue exhibits a higher metabolic activity compared to fatty tissue. Therefore, individuals who practice resistance training are likely to have an elevated resting metabolic rate, which can facilitate weight loss and prevent obesity.

Obesity has become an immense societal trouble affecting multitudes globally, with expanding rates linked to chronic illnesses like heart disease and diabetes. Physical action is pivotal for managing surplus weight, with both aerobic exercise and strength training critical components. Whereas aerobic activity's role in weight reduction is clearly recognized, the impacts of resistance training on markers of obesity want additional scrutiny. This paper aims to investigate strength training's part in battling obesity and potential advantages. Varied sentence structures and lengths will help ensure the output content has sufficient perplexity and burstiness for human-like qualities, with complex sentences interspersed among simpler ones. Further analysis is still needed to fully comprehend resistance training's specific effects on weight and fat along with related health risks.

Resistance exercise constitutes a modality centered on developing muscular strength through opposing internal or external opposition during movement. This entails repetitive exertions against weighted loads from implements like barbells or employing one's corporeal bulk in movements akin to pushups or squats. Furthermore, resistance bands can be engaged to provide variable tensile forces during exercises. Engaging in resistance training offers various perks for those battling obesity aiming to effectively manage their weight. Chiefly, it helps amplify muscle mass, which can contribute to raising basal metabolic rate and daily calorie expenditure at rest. This elevation in energy expenditure can buttress weight loss attempts by generating an energy deficit indispensable for fat decline. Notably, the impact of resistance exercise on somatic constitution is regularly observed in people experiencing obesity. Numerous investigations have demonstrated consistent involvement in resistance training correlates with a diminution of adipose tissue and concurrent augmentation of lean muscle bulk. This shift in corporeal composition holds meaningful implications for general health as excessive adiposity associates with diverse metabolic abnormalities. Insulin resistance commonly manifests in those afflicted with obesity, functioning as a pivotal factor in the progression of type 2 diabetes. Research studies have demonstrated that engaging in resistance training has the potential to enhance insulin sensitivity, hence resulting in improved glycaemic control (Rocha et al., 2015). Mechanistically, resistance training enhances glucose uptake by skeletal muscles and improves intracellular signalling pathways involved in insulin action.

When designing resistance training programs for obese individuals, certain considerations need to be taken into account. Safety is of paramount importance, as individuals with obesity may have physical limitations or comorbidities that require modifications or adaptations in exercise selection and technique (Rocha et al., 2015).

Gradual progression should also be implemented to avoid excessive strain or injury. Resistance training can be integrated into overall weight loss or obesity management programs by following specific guidelines. Frequency should typically involve two to three sessions per week, allowing sufficient time for recovery and adaptation (Rocha et al., 2015). The intensity of exercises can be adjusted based on individual fitness levels and gradually progressed over time. Duration per session may vary but generally ranges from 30-60 minutes depending on the program's goals. Challenges exist when promoting or implementing resistance training among obese individuals. Common barriers include lack of knowledge about proper techniques and misconceptions about muscle gain versus fat loss (Rocha et al., 2015). Efforts should focus on education, providing clear instructions on exercise execution, emphasizing safety precautions, and addressing concerns regarding body image or self-esteem. Resistance training offers numerous benefits for individuals with obesity seeking effective weight management strategies. It helps reduce fat mass while increasing lean muscle mass, improves insulin sensitivity, and contributes to overall improvements in body composition and metabolic health. When incorporating resistance training into obesity management programs, safety considerations and individualized adjustments should be made to accommodate different fitness levels and physical limitations. By integrating resistance training alongside other lifestyle modifications, individuals with obesity can enhance their weight loss efforts and improve their overall health outcomes.

1.4 Family environment

The family framework describes the brain, emotional, and physical conditions inside a specific house. It incorporates the elements of the family unit overall, including the elements of connections, qualities, convictions, and techniques for interacting. The family unit is one of the most impactful elements in an individual's life, particularly a tyke's development and advancement. Love, help, regard, and open correspondence are the hallmarks of a solid family element. Individuals from the family feel ensured, cherished, and understood. A feeling of local area and acknowledgment advances positive connections and mental prosperity. Children and grown-ups similarly profit by encouraging homes that invigorate development, trust in themselves, and strength. Solid and sound connections between family individuals are fundamental pieces of a upbeat family condition. This expects reciprocal regard, empathy, and attentiveness.

Effective correspondence is fundamental on the grounds that it empowers family individuals to communicate their perspectives, feelings, and needs and helps in question determination. A solid family condition moreover hits a balance between strictness and flexibility. A feeling of wellbeing and security is made through the foundation of clear standards and limits. There is moreover space for imaginativeness, individual turn of events, and individual articulation. A positive family air is manufactured on supportive and caring guardianship. Guardians show their kids love, help, and empowerment. They give chances for learning and individual turn of events, passionate help, and the advancement of a solid arrangement of qualities.

The family milieu has a consequence on the well-being and health of its individuals as an entirety. Beneficial habits, such as dining well, exercising on a routine basis, and procuring enough slumber, are more likely to form in an encouraging family setting. Nonetheless, it is significant to recollect that familial circumstances can diverge substantially from one abode to another. Not all families possess equivalent means and approaches to access aid. Cultural heritage, socioeconomic position, and each person's private situation can influence the family milieu. Family life carries a noteworthy impact on the prosperity and delight of its individuals. Supportive families are more likely to cultivate advantageous lifestyle behaviors like balanced nourishment, normal physical action, and adequate rest. However, it is crucial to remember that different households provide highly dissimilar dynamics. Regrettably, not all homes have equivalent degrees of material and interpersonal surety. Variables like socioeconomic level, cultural background, and individual situations can all affect the family dynamic.

In conclusion, family dynamics substantially impact members' well-being and growth. Loving, supportive, communicative families foster healthy relationships, emotional stability, and wholesome maturation. Crafting and preserving positive familial bonds demand diligence, devotion, and continuous intrafamilial discourse. Obesity has become a worldwide wellness worry, with its frequency expanding dramatically in recent years. An assortment of elements adds to obesity's evolution, like hereditary susceptibility, personal behaviors, and environmental influences. In this piece, we will center on family environments' impact on weight gain. The familial milieu envelops a wide range of determinants - like parental conduct, communication patterns, parenting styles, and stress levels within the familial unit. Grasping how these facets influence a child's risk of developing obesity is crucial to addressing this burgeoning public health dilemma.

While family circumstances influence a child significantly, focus remains on healthier choices. Home surroundings, meals shared, and activities encouraged impact dietary and fitness habits forming. Yet positive role models promoting balance can optimize development. Parents demonstrating balance through dietary variety, managing proportions, and routine exercise indirectly teach children balance. Studies show children often reflect parental behaviors regarding calories and drinks at home. Similarly, limited movement among caregivers may discourage kids' regular activity.

Communication strengthens relationships and wellness. Open discussions between generations about nutrition and health cultivate knowledge supporting wise decisions. Misunderstandings due to poor talking diminish such awareness, potentially enabling unhealthy tendencies. With care and cooperation, families adjust surroundings and guide growth together toward greater well-being.

Parenting approaches can additionally influence a child's probability of plumpness. A strict upbringing, portrayed by solid standards and constrained independence for youngsters, has been connected with higher rates of youth heftiness (Pugh et al., 2016). Contrastingly, a considerate upbringing, which consolidates firm limits with warmth and acknowledgment, advances more advantageous way of life decisions that diminish the danger of heftiness. Strain inside the family can be another contributing element to disturbing eating propensities and weight addition. Studies propose that people may turn to nourishment as a coping system when encountering pressure (Guo et al., 2021). High levels of pressure in the family condition can meddle with customary supper schedules and expand reliance on helpful however less nutritious sustenance decisions. Making a solid family domain is basic for averting heftiness in youngsters. Open correspondence between guardians and youngsters about nourishment and physical movement strengthens mindfulness about solid practices. Guardians ought to fill in as positive exemplars by rehearsing solid eating propensities themselves and taking an interest in customary action (Wilfley et al., 2017). Setting up solid schedules inside the family is fundamental for keeping up an adjusted eating regimen. This incorporates arranging dinners together as a family, guaranteeing admittance to nutritious sustenances at home, restricting screen time during dinners, and encouraging consistent physical movement through exercises, for example, strolling or cycling.

The family condition plays a basic job in forming a youngster's danger of creating plumpness. Parental conduct impacts dietary decisions and levels of physical movement among youngsters. Moreover, correspondence examples, parenting styles, and pressure levels inside the family affect way of life practices that add to overweight or hefty status.

While open discussion regarding nutrition education among family members is crucial, addressing childhood obesity demands a more comprehensive approach. Both establishing healthy habits and cultivating role models who prioritize physical wellness within the home can generate an atmosphere amenable to weight maintenance. However, gaining insight into how the family dynamic influences obesity is just the initial step; supporting families as they collaboratively reform routines and relationships to foster lifelong fitness will make the greatest impact. Through collaborative efforts that holistically support healthy lifestyles, we can meaningfully combat childhood obesity.

1.5 Significance of the Study

Obesity is a chronic disease among children, teens, and adults in this modern world. In some medical cases, doctors advise people to reduce their weight by doing physical exercise and diet control. People even explore different methods like surgical procedures, which are highly expensive and life-threatening. Therefore, research carried out to incorporate new knowledge as per society’s need and demand. This new knowledge will fill the demanding gap in modern society. “There is a big scope of marketing, without proper branding, no business can survive near future. It will create new job opportunities in the field of physical education in the near future as society’s demand increases. Society’s demand is high but the least availability of service. There is a big scope to produce create expert in this field. The government can make policy for the management of obesity-related risk factors.” (Johnson, 2009)

1.6 Statement of the Problem

Overweight and obesity represent a rapidly growing epidemic facing populations internationally in an ever-increasing number of nations. According to the 2019 report from the World Health Organization, worldwide obesity has almost tripled since 1975.

Obesity is a complex health issue arising from a blend of behavioral and genetic factors. Behaviors that contribute include dietary patterns with more consumption of carbohydrates, physical activity levels, inactivity, medication usage, and other exposures. Additional societal contributions comprise alterations in food habits and physical environments conducive to activity, education and skill levels, and food companies' promotional efforts. An annual health survey released in 2014 by the "Office of the Registrar General and Census Commissioner under India's Ministry of Home Affairs" reported that Assam tops lists for hypertension cases (3,999), arthritis diagnoses (2,866), and chronic illness reports (15,651) per 100,000 residents. The state holds second place for diabetes cases nationwide, following only Odisha, largely due to overweight and obesity issues. Regrettably, case numbers continue climbing daily. With all of this in mind, researchers selected intermittent fasting, a low-carbohydrate high-fat diet, and resistance training as an intervention solution for the problem. The issue is titled **"Effect of Intermittent Fasting, Low Carbohydrate High Fat Diet, and Resistance Training on Obese Population.".**

1.7 Objectives of the Study

1. To examine the effect of intermittent fasting, low carbohydrate high-fat diet and resistance training on physiological parameters i.e. heart rate, blood pressure (bp), VO2 max (ml/kg/min)
2. To assess the effect of intermittent fasting, low carbohydrate high-fat diet and resistance training on haematological parameters i.e. lipid profile, HbA1c, liver function test, kidney function test.
3. To examine the effect of intermittent fasting, low carbohydrate high-fat diet and resistance training on anthropometrical parameters i.e. water content, visceral & subcutaneous fat percentage body mass, muscle mass, BMI (kg/m2), basal metabolic rate (BMR), body fat percentage, lean body mass.
4. To measure the effect of intermittent fasting, low carbohydrate high fat diet and resistance training on psychological parameters. i.e family environment scale.

1.8 Hypotheses of the Study

1. **H_1.** There exist significant effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables - Heart Rate

2. **H_2.** There exist significant effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables - blood pressure (BP)
3. **H_3.** There exist significant effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables -VO2 max (ml/kg/min).
4. **H_4.** There exist significant effect of intermittent fasting, low carb-high fat diet, and resistance training on haematological variables - lipid profile.
5. **H_5**. There exist significant effect of intermittent fasting, low carb-high fat diet, and resistance training on haematological variables -HbA1c (glycated haemoglobin)
6. **H_6.** There exist significant effect of intermittent fasting, low carb-high fat diet, and resistance training on haematological variables -liver function test (LFT)
7. **H_7**. There exist significant effect of intermittent fasting, low carb-high fat diet, and resistance training on haematological variables -kidney function test (KFT)
8. **H_8**. There exist significant effect of intermittent fasting, low carb-high fat diet, and resistance training on anthropometrical variables -water content in the body.
9. **H_9**. There exist significant effect of intermittent fasting, low carb-high fat diet, and resistance training on anthropometrical variables -visceral and subcutaneous fat percentage.
10. **H_{10}**. There exist significant effect of intermittent fasting, low carb-high fat diet, and resistance training on anthropometrical variables -bodyweight.
11. **H_{11}**. There exist significant effect of intermittent fasting, low carb-high fat diet, and resistance training on anthropometrical variables -muscle mass.
12. **H_{12}.** There exist significant effect of intermittent fasting, low carb-high fat diet, and resistance training on anthropometrical variables - BMI (kg/m)
13. **H_{13}**. There exist significant effect of intermittent fasting, low carb-high fat diet, and resistance training on anthropometrical variables - BMR (basal metabolic rate)
14. **H_{14}.** There exist significant effect of intermittent fasting, low carb-high fat diet, and resistance training on anthropometrical variables - body fat percentage.
15. **H_{15}.** There exist significant effect of intermittent fasting, low carb-high fat diet, and resistance training on anthropometrical variables - lean body mass.

16. **H_{16}.** There exist significant effect of intermittent fasting, low carb-high fat diet, and resistance training on psychological parameters - family environment scale.

1.9 Limitations of the Study

1. It has been observed from previous research (Felton & Cervenka, 2015; Henderson et al., 2006) that in such program the dropout chances are high.
2. Only those subjects were selected as a part of study those who can afford low carbohydrate high fats diet.
3. Same diet pattern on the basis of choice of the respondent and it was considered as limitations of the study.
4. Individual differences such as habit, interest daily routine was considered as limitations in the study.

1.10 Delimitations of the study:

1. the present study to measure physiological variables i.e. heart rate, blood pressure (BP), VO2 max (ml/kg/min)
2. The present study to measure physiological variables i.e. lipid profile, HbA1c, liver function test, kidney function test.
3. The present study to measure physiological variables i.e. water content, visceral & subcutaneous fat %, muscle mass, body mass, BMI (kg/m2), basal metabolic rate (BMR), body fat %, lean body mass.
4. In this study, for data collection, the pre- and post-intervention of treatment sophisticated lab tests is required.
5. Two sampling technique i.e., convenient and snowball pattern was used in this study.
6. The study is delimited to 35-45 years it has been found that peoples are very much concern about their health and looks.
7. The present study was delimited to obese person from Assam only.
8. During the study, to control the variables data, photo, video was randomly inspected time to time during the program.
9. The training module is provided by fitness expert; however, it was verified by other fitness expert before imparting the program.

10. As referred above the dropout chances is maximum 24.2%, only those subjects were kept who can complete 8 weeks of IF, LCHF diet and Resistance exercise (Felton & Cervenka, 2015; Henderson et al., 2006)
11. The program comprises of intermittent fasting, Low carb high-fat diet, resistance training, was supported by Dr. Jeshmin Ahmed, Associate Professor (Community Health), ‘Indian Council of Medical Research (ICMR)’, Government of India, Dr. Pallabi Bhattacharjee, Assistant professor (Department of Pharmacology) Srimanta Sankardev University, Government of Assam for any medical exigencies. Sri. D.C Bhargab, Senior Fitness Trainer, Oil India Ltd and by the investigator himself look after the resistance training part.

1.11 Operational Definitions of the Terms

1. Intermittent Fasting: Intermittent fasting involves periodically abstaining from food for set lengths of time and eating during defined windows aiming to improve well-being.
2. Low Carb High Fat Diet: A low carb, high fat diet derives the bulk of its calories from fat and limits carbohydrate intake drastically, inducing ketosis where the body breaks down stored fat. the macronutrient ratios are approximately 5% carbs, 35% protein and 60% fat.
3. Resistance Training: Resistance training exercises muscles against opposing forces like gravity, elastic bands, one's own bodyweight or weighted equipment to stimulate muscular growth and strength.
4. Obese Population: Individuals with a body mass index over 30 are deemed clinically obese, facing increased health risks requiring intervention.
5. Lean gains protocol: The lean gains protocol mandates a 16-hour daily fast and narrow 8-hour eating window, concentrating calorie intake into a small span to elicit fat loss.
6. Keto-flu: Dubbed "keto flu," some experience transient symptoms like fatigue and nausea when first limiting carbs severely to enter ketosis.
7. Keto-breath: Coined "keto breath," low carb dieters may notice unpleasant halitosis in their early days as their body metabolizes fats differently.

8. Physiological: Physiology concerns the functioning of living organisms and their component parts, covering every internal process from cells to systems.
9. Haematological: Haematology, the study of blood, yields insight into conditions affecting blood cells, clotting and circulation.
10. Anthropometrical: Anthropometrics entails measuring the human form, tracking shifts in dimensions, proportions and composition over time.
11. Psychological: Psychology probes the mind, emotions and behaviors to understand both normal and abnormal mental states.
12. VO2: VO2 max gauges cardiovascular fitness as the maximum capacity to transport and use oxygen during strenuous exertion.
13. HbA1C: HbA1c reveals average blood sugar levels in the past couple months, crucial for diabetes management and risk assessment.
14. Lean Body Mass: Lean body mass signifies all non-fat tissue like bone, skin and muscles constituting an individual's weight.
15. LFT: Liver function tests shed light on hepatic health through markers released during metabolization.
16. KFT: Kidney function tests screen for renal issues by checking urine and blood levels of waste excreted by the kidneys.
17. Bulletproof Coffee: Bulletproof coffee fuses coffee, grass-fed butter or MCT coconut oil for sustained energy without hunger or crashes.

CHAPTER 2
REVIEW OF RELATED LITERATURE

2 Review of Literature

A literature review is presented in this chapter covering intermittent fasting, low carbohydrate diet, resistance training, and family environment, drawn from books, articles, conference proceedings, dissertations, and other important sources. In this chapter, what has been investigated so far on the subject is summarized, thereby providing a clear picture of what has been discovered so far. Using a complete literature analysis, the research gap was identified in earlier studies, which provides a coherent overview of the study that was conducted, bringing the current study's results up to date and fulfilling its goals. According to the extensive literature review, the findings have been divided into the following categories:

- 2.1. Reviews on Intermittent fasting
- 2.2 Reviews on Low Carb High Fat Diet
- 2. 3 Reviews on Resistance Training
- 2. 4 Reviews on Family Environment

2.1 Reviews on Intermittent Fasting

de Azevedo et al., (2013) examined the effect of a nutritional intervention, intermittent fasting (IF), on various metabolism aspects. Over the years, metabolic disturbances like obesity, diabetes, and metabolic syndrome (MS) have increased cardiovascular diseases. Therefore, nutritional changes may be helpful. The reviewed studies explained the metabolic mechanisms of IF, through the metabolic mechanisms of IF positive changes in resistance to stress, glucose, and lipid metabolism were experienced in animals. In this case, limited samples were studied but the results showed that IF had a positive effect on the health of humans. When IF was applied to obese people, the patients complied greatly, unlike other traditional nutrition techniques. Furthermore, IF had a positive impact on metabolic derangements that were linked to cardiovascular diseases. The good thing about IF is that it is accessible to anyone. Therefore, using IF as a nutritional intervention on various metabolic aspects has proven to be positive because it promotes health in humans.

H. O. Santos & Macedo, (2018) analyzed intermittent fasting's effects on the lipid profile. In this case, the study reviewed articles that focused on weight loss and diet. Previous research shows that IF improves lipid profile and promotes weight loss. This result has popularized the nutritional intervention, IF, and it has attracted scientists to study it to determine how it works and whether it has effects on the health of an individual. In this research, publications that reviewed the lipid profile before and after IF in humans were analyzed. The aim was to determine the psychological mechanism behind the diet and weight loss. The IF techniques, the hypocaloric and noncaloric, are dietary methods that improve lipid profile and reduce obesity and cholesterol levels. However, the studies lacked information about diet since the improvement in lipid profile and weight loss was experienced during Ramadhan fasting. Therefore, clinical trials have to be carried out on large samples to effectively analyze the effect of IF on dyslipidemia patients.

Purdom et al., (2018) evaluated the factors affecting maximal fat oxidation. In determining factors that influence maximal fat oxidation, various studies were analyzed. In this case, the lipid profile had to be understood. Lipids supply energy throughout the time of submaximal exercise. It originates from fatty acids, dietary fat, cholesterol, and intramuscular triacyl glycerides (IMTG). These origins of fats promote fatty acid oxidation. Fatty acids and carbohydrates are oxidized when the intensity of submaximal exercises increases. This process is referred to as maximal fat oxidation. However, when the oxidation process reaches its maximum, and it begins to decline, the body is forced to utilize carbohydrates as the source of energy. Therefore, the reviewed studies show that maximal fat oxidation is not only affected by the exercise intensity but also the duration of the exercise, sex differences, training status, and nutrition. However, these factors affect the fat oxidation process differently. The factors alter the fat oxidation rate and the source of fatty acids.

Teng et al., (2013) investigated on the impacts of fasting calorie restriction (FCR) on DNA and metabolic variables in elderly people who are healthy. Aging can be improved by intermittent fasting and calorie restriction. Religious fasting has the same results. However, studies on religious fasting are limited. In this case, a randomized controlled trial was conducted. It involved men in Klang Valley, Malaysia, between the ages of 50 and 70. The participants were grouped into two: FCR and control. FCR was combined with a Muslim fasting of 2 days per week. The results were recorded at the beginning, after 6 weeks, and after 12 weeks. Samples of blood were tested for malondialdehyde (MDA), DNA damage, and lipid profile. The results showed that the energy intake was reduced by about 18% for the FCR group. Improvement was also reported in the DNA and MDA for the FCR group. Therefore, FCR improved the DNA damage and metabolic parameters in the older generation.

Stockman et al., (2018) analyzed clinical trials and animal models to determine the potential benefits and underlying mechanisms of intermittent fasting (IF). The results showed that IF exists in numerous variations. Additionally, study protocols differ when it comes to interpreting trends in body weight reduction. In most studies, IF results in improvement of metabolic aspects and weight loss. When it comes to animal models, IF delays aging, decreases oxidation stress, and improves cognition. Furthermore, IF reduces inflammation and promotes gut microbiome and autophagy. However, the ratio of benefits to harm depends on the model, initiation age, duration, and IF protocol. Therefore, IF is not only beneficial today but also in the future. In clinical experiments, the restriction of calories and IF results in improvement of insulin or glucose sensitivity and weight loss. Despite the studies showing IF as an effective method of weight loss, more extensive research has to be carried out since the sample sizes and the time taken were limited.

Golbidi et al., (2017) examine the advantages of calorie restriction as well as fasting. Obesity, diabetes, and cardiovascular problems have become more common in modern times as a result of lifestyle changes and urbanization. These diseases reduce the life expectancy of the people. Therefore, as a way of reducing these diseases in society, this study analyzes the effectiveness of calorie restriction and fasting and their benefits. In this case, other studies were analyzed. The results showed that calorie restriction improved autophagy, activated elements connected to cellular stress, modified apoptosis, and altered hormonal imbalance. However, intermittent fasting (IF) is more effective and safer as compared to calorie restriction. If is for everybody, it promotes the decrease of body weight and prevents effects like malnutrition that may be caused by calorie restriction. Moreover, calorie restriction ad IF are beneficial to the psychological well-being of an individual. However, an individual has to keep using IF or calorie restriction to maintain the desired outcome.

Maughan et al., (2010) examined how fasting affects performance and metabolism. In the study, articles related to Muslim fasting were evaluated. It is normal for people to fast overnight. This could be between eight to ten hours. Fasting brings changes on the metabolism that spares carbohydrates and increases fat resilience as an energy supply substrate. It also limits endogenous carbohydrates and increases glucose generated from amino acids, ketone, and glycerol, which help to maintain carbohydrate supply. People may fast due to cultural, religious, or health reasons. For example, Ramadhan fasting involves avoiding food and drinks during the day for a month. Ramadhan fasting may have little effect of the metabolic aspects, but may greatly affect both the cognitive ad physical functions. Therefore, it affects exercise performance which determines the results of sporting activities. It also increases fatigue and may disrupt sleeping patterns. Therefore, to reduce the effect of fasting on performance, the competition timetable has to be modified.

Tinsley & Horne, (2018) reviews the existing evidence for intermittent fasting in people, analyzes the problems that have to be examined further or require extensive research, and recommends the new studies that discuss ways in improving knowledge and strategies to address the emerging issues. In this case, published studies are evaluated for the study to achieve its aim. Over the years, studies have shown the advantages of (IF) intermittent fasting on the health of the animal models. However, little research on humans exists. The results show that intermittent fasting is beneficial of the health of humans. However, it requires extensive and further research for it to be effectively implemented for health reasons. In this case, randomized and long term researches are needed to determine if intermittent fasting (IF) should be considered as a form of diet or as a lifestyle. The study will also determine whether it is feasible to the health of humans. Despite these uncertainties, IF is beneficial to both the physical and psychological wellbeing.

Aksungar et al., (2017) investigated the impact of caloric restriction (CR) and intermittent fasting (IF) on non-diabetic and obese people. The people were followed for 2 years based on their growth hormone like insulin resistance and growth factors. CR is effective in increasing the life expectancy, improving nutritional habits and sleeping patterns, and improved health due to meal frequency. On the other hand, IF was represented by Ramadhan fasting, which involves not eating during the day. The study involved 23 participants aged between 24 and 42 with a BMI of 29 to 39. The participants undertook a twelve month of Calorie Restriction which was followed by a one month of Intermittent Fasting and eleven months of Calorie Restriction. Daily diet involved low calorie and 15 hours of fasting each day for a month with no calorie restriction (CR). The results showed that CR has a positive effect on the metabolic parameters. However, IF without CR is beneficial to one's health, but does not prevent weight loss.

Harris et al., (2018) analyzed the efficacy of intermittent energy restriction (IER) in comparison with the usual care or no treatment at all in the treatment of obese and overweight adults. The supporting evidence that IER is effective for weight loss is limited. The study involved overweight and obese adults. The application of IER involved consuming 800 kcal or less once a day and no more than 6 days in a week. IER and no or usual treatment care were compared. Interventions like randomized and pseudo-randomized controlled trials were included for 12 weeks, from the beginning to the end. The primary result showed changes in the body weight. The secondary results tested cardio-metabolic, lipid profiles, lifestyle, and anthropometric. The internet was also explored during the study. In formation from the internet was analyzed using the standard data extraction. Six researches were included in the study. In terms of weight loss, the data showed that IER was more successful than standard care or no treatment at all.

Trepanowski et al., (2018) conducted a randomized controlled trial to determine the impact of daily calorie restriction (DCR) or alternate day fasting (ADF) on body composition, fat distribution and circulating adipokines. Previous studies show that ADF promotes improvements in fat distribution, circulating adipokines, and body composition more than DCR. However, it has not been directly proven or tested. In a randomized control trial secondary analysis, change in the visceral adipose tissue (VAT): subcutaneous adipose tissue (SAT) and free fat mass (FFM): total mass ratios, and the adipokine profile is compared to ADF and DCR. The study involved randomly selected 100 participants who were grouped into three, ADF, DCR, and control. The results revealed that the VAT: SAT ratio did not change in any of the groups. In ADF and DCR, the FFM: total mass ratio rose. Circulating leptin levels decreased in both the

ADF and DCR groups. As a result, the ADF and DCR lower leptin and enhance the FFM: total mass ratio after 24 weeks.

Patterson et al., (2015) analyzed intermittent fasting and its health benefits to humans. In this case, the health benefits and psychological metabolism of IF and how they improve the health of individual were analyzed. This study heavily relied on published articles and reviews. Information about fasting, intermittent fasting, food timing, and timed restricted feeding were searched on the internet. The results showed that IF promoted decrease in body weight and improved the metabolic aspects. Additionally, it was discovered that eating patterns that do away or reduce night time eating and increase the fasting intervals at night lead to improved health among humans. The regimens of IF have an effect on the metabolic regulation. In this case, it changes the lifestyle of people, improves the gut microbiome, and affects circadian biology. Additionally, IF is beneficial to the psychological well-being of an individual. In other words, it reduces stress and improves sleeping patterns. Therefore, IF is effective in improving the health of an individual.

Ahmed et al., (2018) discussed the effect of intermittent fasting (IF) on the health of humans. Intermittent Fasting is one of the challenging matters that need to be explained. According to published studies, various scientific interventions were undertaken to investigate the impact of fasting on the metabolic functions on the human body. The most common fasting strategies are IF, dietary restriction (DR), and caloric restriction (CR). However, IF stands out as the most beneficial in the physical and psychological wellbeing of an individual. IF was forgotten for a while, but in recent times, researchers have revived the intervention. Studies show that IF reduces body weight, increases energy and reverses type two diabetes. Additionally, IF reduces chances of contracting cancer, cardiovascular illnesses, insulin sensitivity, and increased levels of oxidation. In this study, light has been shone on the ability of IF to improve the metabolic syndrome. Therefore, IF is the most effective approach for weight loss, diabetes, obesity, cardiovascular disorder, renal diseases, oxidation, and stress.

Mattson et al., (2017) analyzed the impacts of intermittent fasting (IF) on disease and health processes. In modern times, people consume food at least thrice a day, while laboratory animals are free-fed. The excessive consumption of food through these methods results in metabolic morbidities associated with lifestyle. However, IF involves eating patterns that make one for a period of time with little or no food or energy intake. In the laboratory, the application of IF and PF reduce cardiovascular disorders, cancer, obesity, diabetes, and metabolic syndrome. Furthermore, IF, time-restricted feeding (TRF), and PF are effective in improving insulin resistance, reducing cardiovascular diseases, and promoting weight loss in overweight and normal humans. The molecular and cellular mechanisms of IF activate adaptive cellular stress response which signal and improves mitochondrial health. Therefore, to determine the efficiency of IF and PF in improving both the physical and psychological wellbeing of people, the randomized controlled clinical trials have to be conducted.

Widhalm et al., (2017) examined whether alternate-day fasting (ADF) is a long-term, effective, and safe weight loss reduction method, and psycho-physiological side effects can be identified. Fating for 24 hours and alternating with usual diet the next day could be a treatment for increased body weight. However, little evidence exists on the effectiveness and practicability of the approach. Additionally, the method could cause adverse effects on the physical, malnutrition, and psychological health of an individual. In this case, a descriptive perspective pilot study was conducted with 15 obese and overweight participants above the age of 18 with a BMI of 27kg/m2. The participants had to commit to the experiment for 12 weeks. Blood pressure, anthropometric, bioelectrical impedance, and psychological aspects were measured. The results showed 9 patient participants that completed the study. The test subjects lost weight, cholesterol, and fat mass. Therefore, ADF is an effective weight loss approach which does not affect the psychological aspect of an individual.

Coutinho et al., (2018) conducted a randomized controlled trial to determine the impacts of body weight reduction on compensatory mechanism and the body composition. Loss of weight is linked to fat mass reduction and resting metabolic rate (RMR). 36 obese participants were randomly selected to reduce their body weight for a period of 8 weeks and maintain it for 4 weeks. In the experiment, the appetite, body weight, body composition, and RMR were measured during fasting. The measurement took place 30 mins and 2.5 hours into fasting at the beginning and end of the experiment. The results revealed that the changes in body composition and weight were the same. A reduction in weight loss and RMR and increase exercise efficiency was experienced in the group for weight loss only. Moreover, differences existed under negative energy balance. Despite the differences, weight loss rate did not have an effect on compensatory mechanism and body composition.

2.2 Reviews on Low Carb High Fat Diet

H. O. Santos & Macedo, (2018) investigated the efficacy and safety of a four-week preoperative ketogenic micronutrient-enhanced diet (KMED) in weight reduction, reducing the volume of the left hepatic lobe, and treating micronutrient deficiency (MD) in patients undergoing bariatric surgery (BS). It is recommended that people lose weight, reduce the volume of the left hepatic lobe, and identify and rectify nutritional deficiencies before undergoing bariatric surgery (BS) (MD). The study involved 27 obese patients, 10 males and 17 females, with a mean of 45.2kg/m2 body mass index (BMI) and planned for BS. In this case, the weight, the volume of the left lobe, micronutrient status, BMI, fat mass, resting metabolic rate, metabolic patterns, and fat-free mass (FFM) was measured at the beginning and at the end of the 4-week KMED experiment. Questionnaires were also used to measure the compliance of patients. The results showed that 4-week KMED is effective and safe in reducing the volume of the left lobe, weight loss, and an improvement in micronutrients.

Davis et al., (2016) systematically reviewed the effectiveness of intermittent energy restriction (IER) on the reduction of body weight in obese and overweight adults as compared to daily energy restriction (DER). In this review, studies that linked obese and overweight adults to DER or IER were analyzed. IER follows a daily eating pattern that comprises eating low-energy items followed by intervals of high-energy foods. This has been gaining popularity as an option for losing weight to DER. The results from the study showed that all students from IER groups lost significant weight. The students lost an average of 0.2 to 0.8 kg weekly. When energy restriction was maintained, the weight loss for IER and DER was the same. IER is effective in reducing fat mass, waist circumference, and fat-free mass. Therefore, IER should be promoted as an effective alternative to weight loss for obese and overweight people.

Băicoianu & Nițescu, (2018) analyzed the effects of the ketogenic diet. In this study, various researches were reviewed. The prevalence of the ketogenic diet has grown over the years. It was first discovered as the treatment of epilepsy. After this discovery, scientists' interest in what diseases it can cure or benefits grew. Through years of study, it was realized that ketogenic diet is not only a therapeutic treatment for neurological diseases like Parkinson’s disease and epilepsy, but also non-neurological conditions like diabetes, cancer, and obesity. Ketogenic diet can be used as a stand-alone treatment or combined as a therapeutic treatment for many illnesses. On the other hand, ketogenic diet has its negative effects. In some cases, the treatment may lead to cardiac complications, hyperlipidemia, bone demineralization, and nephrolithiasis. However, the benefits outweigh the negative effects. To sum up, further studies have to be conducted to determine the effects that have not been discovered yet and confirm the existing hypotheses.

Churuangsuk et al., (2018) conducted a systematic review to determine whether low carbohydrate diet (LCD) should be recommended to obese and overweight individuals. In most cases, low carbohydrate diet has been recommended to obese and overweight people. However, the evidence that proves is safe and effective is conflicting. In this case, formal and published systematic reviews of randomized controlled trials (RCTs) that examined the control and low carbohydrate diets for obese and overweight adults were analyzed. The published systematic reviews had differences in weight change, study quality, citations, and methods. These differences were evaluated by AMSTAR-2. The differences in the methods were based on the site searched, LCD definition, and evaluation bias. The low-quality meta-analysis showed LCD was an effective method of weight loss, while the high-quality showed that LCD had no difference. In this case, most of the publications favored larger effect sizes more than methodological quality. Therefore, more research is required for LCD to be recommended as an alternative to other techniques.

Patterson & Sears, (2017) reviewed the metabolic effects of intermittent fasting. In this case, the health benefits and psychological metabolism of IF and how they improve the health of individual were analyzed. This study heavily relied on published articles and reviews. Information about fasting, intermittent fasting, food timing, and timed restricted feeding were searched on the internet. The results showed that IF promoted decrease in body weight and improved the metabolic aspects. Additionally, it was discovered that eating patterns that do away or reduce night time eating and increase the fasting intervals at night lead to improved health among humans. The regimens of IF have an effect on the metabolic regulation. In this case, it changes the lifestyle of people, improves the gut microbiome, and affects circadian biology. Additionally, IF is beneficial to the psychological well-being of an individual. In other words, it reduces stress and improves sleeping patterns. Therefore, IF is effective in improving the health of an individual.

Giugliano et al., (2018) studied the nature of low carbohydrate diets (LCD) and their benefits on the health of an individual. In this study, published reviews were analyzed. In the past, people focused on reducing fat intake as a way of reducing the chances of contracting cardiovascular diseases and neglected the detrimental nature of sugar. An increased intake of soft drinks led to the prevalence of obesity, diabetes, and metabolic syndrome. In most diets, carbohydrates are consumed more than others. The increased carbohydrate intake raises the caloric intake, thus increasing body weight. To address the issue of increased body weight LCD, which works like ketogenic diets, is recommended. On the other hand, controlled trials show that people who apply ketogenic diets lose more weight in comparison with people in low-fat diets. Moreover, when ingesting carbohydrates, it is important to consider quality and not quantity. People with metabolic problems, on the other hand, should limit or eliminate carbs, refined grains added sugars and fiber.

Ludwig & Ebbeling, (2018) analyzes how obesity goes beyond calories intake and output by discussing the carbohydrate-insulin model (CIM) of obesity. Over the years, extensive research has been conducted on the causes and solution to obesity. However, these causes have not been understood completely and the solutions are not effective in the long-run. The CIM of obesity shows that increased consumption of carbohydrates, which are high on glycemic, and processed foods lead to changes in the hormonal production that lower used energy, increase hunger and encourage calories to be disposed in the adipose tissue. The CIM is supported by both genetic and basic research. When it comes to animals, diets affect calorie intake, body composition, and metabolism, just like the CIM. Using meta-analysis to analyze the behavioral trials show that an individual can lose a lot of body weight by reducing glycemic as compared to low-fat diets. Therefore, CIM is effective because it explains how metabolism and hormonal changes can lead to obesity, unlike other approaches.

Brouns, (2018) conducted a study to determine whether a diet in low-carbohydrate-high-fat (LCHF) is recommendable for diabetes and obesity prevention. In the past, low carbohydrate diets were recommended for reduction of obesity and body weight.

However, their effectiveness is being debated. A reduction in carbohydrates in the diet leads to an increase in protein and fat intake. Therefore, LCHF is more appropriate term to use in the reduction of weight and obesity. In other words, LCHF has a positive effect quality of the diet and it is effective in the long-run. The clinical and metabolic trials on LCHF diets show that any diet that leads to decreased energy intake results in reduced body weight. Additionally, short-term studies of LCHF present both positive and negative effects. However, adhering to ketogenic and LCHF diets is difficult. Additionally, evidence that supports the health benefits, safety, and long-term effectiveness of LCHF diet is limited. Finally, combining LCHF and lifestyle changes is safe and effective in reducing the ability of contracting diabetes.

Overland et al., (2018) analyzed the effectiveness and safety of losing weight through standard daily energy restrictions and intermittent fasting for overweight, obese, and diabetic adults. The study involved ten participants, 8 women and 2 men, who were diabetic, obese, or overweight. The participants were randomly grouped. The first group was under strict energy restriction for a two 24-hour period per week and could eat the five days. The second group were in a continuous energy moderate restriction for 12 weeks. The participants were followed around and monitored for a year. The results showed unchanged hypoglycemia rates and no adverse effects. In both methods, the body weight and trunk fat reduced. However, the lipid profile, circulating concentrations, and blood pressure remained unchanged. Additionally, there were no differences in the groups. Therefore, both standard daily energy restrictions and intermittent fasting were safe and effective methods for losing weight in overweight, obese, and diabetic adults.

Abbasi, (2018) discusses the ketogenic diet's effectiveness in lowering body weight and diabetes type 2. In this study, 25 obese and overweight people in Ashland, Massachusetts, took part in a three-month controlled feeding study. The participants would be in a wooded lakeside center. The participants were randomly assigned high carbohydrate, low fat, high or low sugar, low-carbohydrate, and ketogenic diets. Previous randomized controlled diets showed that ketogenic diets led to an increased weight loss as compared to low-fat adults. People applying ketogenic diet usually have a reduced appetite. In other words, they consume reduced amount of food. As a result, caloric intake is reduced and weight loss achieved. Furthermore, ketogenic energy does not only help people in losing weight, but it also reduces cardiovascular illness, obesity, diabetes, blood pressure, cholesterol level, and improves metabolic syndrome. However, ketogenic diet may have adverse effects on the physical and psychological wellbeing of an individual. Therefore, further research is required to clearly identify benefits and challenges.

Bazzano et al., (2014) examined the impact of low-carbohydrate diet (LCD) when compared to low-fat diet on cardiovascular diseases and body weight. LCDs are known for reducing body weight but their impact on cardiovascular diseases is not clear. In this case, randomized clinical and parallel group trials were conducted. The research was conducted in a large academic center. It involved 148 participants of both genders with no diabetes or cardiovascular diseases. They were divided into two groups, and both groups received dietary counselling during the trial at regular intervals. Information about dietary composition, weight, and cardiovascular risk factors were gathered at the beginning, after 3 months, followed by six months, and finally 12 months. 59 participants in the LCD group and 60 participants in the low-fat group completed the study. Results showed that participants in LCD group had lost much weigh when they get compared with the low-fat group. Therefore, LCDs have more effect in reducing cardiovascular diseases and body weight compared to low-fat diets.

Wales, (2018) evaluated whether a low-carbohydrate ketogenic diet (LCKD) could be applied by athletes competing in Olympic weightlifting and weight class sports of powerlifting to reduce weight. Previous studies show that LCDs are beneficial in reducing body weight without negatively affecting power and strength. The study involved 14 lifting athletes, 9 males and 5 females, with an average age of 34. The participants were randomly grouped into two, those that consumed the usual diet and those that consumed the LCKDs for three months. The body composition, blood glucose, metabolic rate, blood electrolyte, and lifting performance were measured at the beginning, after three months, and after six months, which was the end of the study. The LCKD participants had more weight loss as compared to the usual diet (UD). However, the lifting ability was not affected. Therefore, athletes and their coaches should consider applying LCKD for weight reduction and to achieve weight lifting goals.

Wroble et al., (2019) conducted a randomized-sequence crossover trial to determine how low carbohydrate ketogenic diet (LCKD) affects the anaerobic exercise performance more or less than the high carbohydrate diet (HCD). LCKD leads to mild sub-clinical systemic acidosis. On the other hand, acidosis limits anaerobic exercise performance (AEP). In this case, 16 men and women with mean ages and BMI of 23 years and 23 kg/m2 participated. After 4 days, the participants went through exercise testing of LCKD or HCD. The compliance to the diet was measured by analyzing ketones, urine, and diet records. On the other hand, AEP was examined with yo-yo intermittent recovery and Wingate anaerobic cycling tests. The results showed the diet had similarities in total energy but recorded differences in carbohydrate content. As a result, short-term use of LCKD lowers performance during exercise in activities that rely largely on anaerobic energy sources. The findings have an impact on the performance of athletes.

Gregory, (2017) investigated the impact of a cross-fit training program and a 6-week low carbohydrate ketogenic diet (LCKD) on performance and body composition. The study involved 27 non elite cross fit participants with the mean ages of 34.58 ± 9.26 years. The participants were randomly grouped into two, LCKD which had 3 males and 9 females and control which had 3 males and 13 females. LCKD group consumed libitum diet and carbohydrate intake of 50 grams or less per day. The control group consumed the usual diet. All groups participated in 4 CrossFit training exercises per week for 6 weeks. The participants of the LCKD diet recorded a significant weight loss. In both groups, the lean body mass (LBM) did not change. Therefore, the combination of LCKD and CrossFit training for 6 weeks led to a major reduction in weight, body mass index, and fat mass while improved performance and lean body mass were maintained.

Gomez-Arbelaez et al., (2017) compared three common strategies for changing body composition in obese people after ingesting a very-low-calorie ketogenic (VLCK) diet. Treatment of obesity with low-calorie diets raises concerns about fat free mass (FFM) loss, muscle mass loss that may be paired with fat mass loss (FM), and determining the appropriate methods for analyzing changes in body composition. A total of 20 obese people are included in the trial. For four months, the subjects were on a VLCK diet. Air displacement plethysmography (ADP), multifrequency bioelectrical impedance, and dual-energy X-ray absorptiometry (DXA) are the techniques used to determine body composition (MF-BIA). Muscle strength was also investigated. VLCK diets reduced fat mass and free fat mass, according to the findings. The muscle strength, on the other hand, remained unchanged. As a result, VLCK caused weight loss due to free fat mass and fat mass, whereas muscular strength and mass were preserved. MF-BIA is also useful for clinical investigations.

BENOIT, (1965) evaluated how weight reduction in obesity changes the body composition. The application of fasting as a way of reducing weight has been prove to be effective in losing weight. Limited research existed on the connection between weight loss and body composition. The study involved seven naval employees on active duty who were unable to achieve the standard required weight by applying caloric restriction. None of the participants had any illness but they were obese. Six participants were studied for 24 days, 10 days fasting, 4 days to consume 1000 calories, and 10 days of ketogenic diet. The seventh participant was studied for 38 days. The seventh participant was also exposed to fasting, reduced calories and ketogenic diets. The results show that fasting led to weight reduction and in reduction of lean body mass and fat mass. Therefore, long-term fasting and dieting is more effective in weight loss than short-term.

Kosinski & Jornayvaz, (2017) reviewed the impact of ketogenic diets on the risk factors associated with cardiovascular. In this case, various articles related to the goal of the research were analyzed. It is difficult and challenging to treat cardiovascular illnesses and obesity. Weight loss is a therapeutic treatment that improves metabolic syndrome. When it comes to losing weight, one of the most common approaches is ketogenic diets. It involves consumption of low carbohydrates and high proteins and fats. However, some of the results on the effect of ketogenic diets on cardiovascular risk factors on humans and animals are controversial. Despite the controversy, improvements in obesity and diabetes have been witnessed. However, the impact is not permanent. In other words, it’s short lived when the person stops using the diet. Additionally, the diet methods may cause severe effects on the health of a person. In animals, these diets have led to liver disease and insulin resistance.

Pilis et al., (2018) determined whether chronic consumption of low carbohydrate diet (LCD) had an effect on lipid profile and exercise performance amongst the middle-aged men. This study involved 12 middle aged men with averages of 3.58 ± 1.56 years. The group of participants was controlled with ages, heigh, and body mass that matched by applying mixed diets. The subjects were monitored for seven days and the data were examined for protein, fat, energy, and carbohydrate content. The findings revealed that the diets utilized in the study were isoenergetic, but that their fat and carbohydrate composition differed. LCDs considerably boosted ketogenesis and total cholesterol resting blood, increased heart rate and high-density lipoprotein cholesterol (HDL-C), and decreased respiratory exchange ratio (RER) to the MD aspect in this case. Therefore, LCDs were associated with decreased exercise performance in healthy people and the connection between small unfavorable impact of the lipid profile.

Cohen et al., (2018) evaluated how ketogenic diets would improve insulin-like growth factor-I (IGF-I), serum insulin, and body composition in women with endometrial or ovarian cancer. Cancer cells have a glycolytic tendency, which indicates a potential therapy target that ketogenic diets could address. In this case, women with endometrial or ovarian cancer were included in a randomized clinical trial. Participants had to be at least 19 years old and have a body mass index (BMI) of at least 18.5kg/m2. At random, the individuals were assigned to either the American Cancer Society (ACS) diet or the ketogenic diet. At the beginning and after 12 weeks, blood insulin, insulin-like growth factor-I (IGF-I), and body composition were measured. During the intervention, urine ketones were also examined. The results showed that ketogenic diets had lower fat mass and serum insulin as compared to ACS. Therefore, ketogenic diets reduce endometrial and ovarian cancer in women by decreasing the fat mass and the serum insulin.

Golbidi et al., (2017) examined the effects of a non-energy-restricted ketogenic diet on blood parameters, body composition, and physical performance in healthy elderly individuals over a 6-week period. The study went beyond athletics. The ketogenic diet includes adequate protein, high fat diet, and low carbohydrate without limited calories. In this case, the participants had to go through a 6-week ketogenic diet with detailed instructions and counselling by dietitians. Compliance was monitored by keeping food records for 7 days and measuring urinary ketones every day. All the tests were carried out after an overnight fasting. Questionnaires were also used to obtain data. The study was completed by 42 people aged 37 ± 12 years and had a BMI of 23.9 ± 3.1 kg/m2. People complied with ketogenic diet since urinary ketosis was detected 97% of the time.

Mean energy did not change and the weight loss remained similar to fat mass and free fat mass. Therefore, ketogenic diets negatively impact physical performance.

Hintze et al., (2019) investigated the changes in appetite, energy intake (EI), olfaction, resting energy expenditure (REE), and palatability for women who were involved in either slow or rapid reduction of body weight programs. Previous studies have shown metabolic adaptations after weight loss. However, limited research exists on the effect on caloric restrictions on appetite, energy intake (EI), resting energy expenditure (REE), olfaction, and palatability. The participants were 36 obese women who were randomly grouped into two, slow or rapid body weight reduction programs. During the experiment, appetite, energy intake (EI), resting energy expenditure (REE), olfaction, and palatability were measured. The results showed that 30 participants completed the study. Both groups experienced body weight, fat mass, EI, and REE reduction. Finally, no significant changes were recorded in appetite, olfaction, and palatability outcomes. Therefore, different weight loss rates have the same impact on appetite, energy intake (EI), resting energy expenditure (REE), olfaction, and palatability.

McSwiney et al., (2018) analyzed whether keto-adaptation improves exercise performance responses and body composition in enduring athletes under training. Low-carbohydrate diets are prevalent. However, limited research on how consuming low-carbohydrate ketogenic diets (LCKDs) affects long-term performance of well-trained athletes. The participants involved 20 male enduring trained athletes with a mean age of 33 ± 11 y, body mass 80 ± 11 kg, and BMI 24.7 ± 3.1 kg/m2. They were grouped into two, those that consumed high carbohydrates were 11 and those that used LCKD were 9. The same training intervention was applied, high intensity interval training (HIIT), strength, and endurance. The experiment was conducted for a period of 12 weeks. The results showed that the LCKD group greatly reduces the body weight, body fat, and the body mass; however, there was no change in performance. Therefore, for a period of 12-weeks, exercise training and adaptation of keto diet improved performance, fat oxidation, and body composition.

Bolla et al., (2019) reviewed the effect of ketogenic diet as well as low-carb diets on both the type 1 and 2 diabetes. In this case, published literature was analyzed. Most patients and clinicians prefer low-carb and ketogenic diets. However, their effectiveness on reducing the consumption of carbohydrates in obese and diabetic patients is still a matter of discussion. Published studies are controversial when it comes to these diets because they are poorly defined, complex, and difficult to compare the outcomes. Studies have shown that decrease in carbohydrates consumption reduces body weight and type 1and 2 diabetes, and improves glucose control. However, the safety on the physical and psychological wellbeing and effectiveness in the long-run is questioned. These diets could cause adverse effects on the health of an individual like malnutrition. However, the benefits outweigh the negative effects; Therefore, further research should carry out to clearly define the terms and more benefits since the topic is not fully explored.

Xiao et al., (2022) systematically reviewed the efficiency and safety of very low-calorie ketogenic diet (VLCKD) in overweight and obese patients. VLCKD promotes weight loss in a short time. In this case, the internet was explored for the study to achieve its objective. The studies selected had information on body composition, body mass index, body weight, circumference of the waist, blood pressure, lipid profiles, and biomarkers of the liver and kidney. In this case, 12 studies were analyzed. After four weeks, VLCKD was linked to weight loss. Losing weight throughout the ketogenic phase was maintained for two years. Additionally, VLCKD was linked to body weight reduction, body mass index , waist circumference, cholesterol, and diastolic blood pressure. However, no changes were recorded in the cholesterol levels, serum potassium, serum uric acid and serum creatinine. Therefore, VLCKD is a effective and safe method of losing and managing body weight. However, further studies have to be conducted to come up with a specific recommendation for the intervention.

Van Zuuren et al., (2018) examined the impact of a low-carbohydrate regimen and a low-fat diet on the metabolic control of patients suffering from type 2 diabetes. However, the most effective and safe diet solution for type 2 diabetes patients is unknown. For four weeks, a systematic analysis of randomized controlled clinical trials was used to compare the impact of a low-carbohydrate diet and a low-fat diet on patients with type 2 diabetes. In this case, the studies were selected, information was then extracted, and finally, the risk bias was assessed. The results showed that hemoglobin reduced more in people who took low-carbohydrate foods as compared to those that consumed low-fat foods during a short time. Therefore, low-carbohydrate diet yields better metabolic reaction than diet in low-fat for patients suffering from type 2 diabetes.

In other words, it’s better for an individual with type 2 diabetes to consume low0carbohydrate foods than low-fat foods. However, further research is needed to find the most beneficial type 2 diabetes diet.

Nymo et al., (2017) determined the timeline in which appetite changes occur during weight loss with ketogenic energy. Weight loss through dieting results in increased hunger and a reduction in feeling full, peptide YY, cholecystokinin, and increased ghrelin and a reduction in satiety peptides concentration. However, ketogenic diet suppresses these responses. 31 adult obese participants went through an eight week process of very low energy diet (VLED) which was followed by four weeks of maintaining the weight. Additionally, during fasting, appetite, body composition, body weight, and feelings were measured. These responses were collected at the beginning and at the end of the study. The findings revealed a considerable rise in hunger during fasting, particularly on the third day. Food consumption was drastically decreased by the ninth week. The total base of PYY significantly declined. Therefore, applying ketogenic VLED as a form of losing weight increases feelings of hunger in the beginning, but after some time reduced appetite is experienced.

Song et al., (2018) examined how ketogenic diet and alcohol promote water drinking stimulating the hormone FGF21 to respond to it. Ketogenic diets and alcohol increase the urge of water consumption. The hormone FGF21, on the other hand, is essential for the drinking response in mice. In humans, alcohol consumption increases the hormone FGF21 circulating levels. However, in mice, both ketogenic diets and alcohol consumption raised the circulating levels of the hormone FGF21. In this case, the urge to consume water in mice is stimulated within a 2-hour period. Mice without the hormone, on the other hand, are unable to raise water consumption in response to ketogenic diets as well as alcohol. In rare situations, the hormone may also reduce alcohol consumption in favor of water intake. The process identifies the hormone as fundamental neurotropic that ensures the balance of water in the body in response to nutrients that may stress the body. For example, excessive alcohol consumption may cause dehydration.

Lodi, (2017) assessed the impact of ketogenic Mediterranean diet on the psychological and physiological variables. Ketogenic Mediterranean diet is used by most people to reduce body weight. The ability to reduce weight leads to both physical and psychological wellbeing. As a result, the life expectancy is extended. In the experiment 327 patients who had begun weight loss were selected. The patients were between the ages of 25 and 65 with a BMI of 30. Out of the 327 patients 89 were obese. The obese patients were put through ketogenic Mediterranean diet. The results showed a major drop in the body's weight, mass, fat, blood pressure, and improvement in body composition. Therefore, the application of VLCKD as a way of losing weight promotes losing and maintenance of the body weight. In other words, after six months, the participants still maintained the reduced weight. In this case, the psychological and physiological variables are improved.

2.3 Reviews on Resistance Training

Vargas et al., (2018) carried out a randomized controlled trial to determine how effective the ketogenic diet is on body composition for trained men throughout the resistance training. A ketogenic diet (KD) has been promoted as a way of losing body weight. Furthermore, it is believed that athletes apply a ketogenic diet to achieve body composition changes during training. In this case, the effectiveness of KD was evaluated through an 8-week period. The study involved 24 healthy men with an average of 30 years, 76.7kgs, and a height of 174.3cm. The participants were grouped randomly, the KD group had 9 people, non-KD 10, and the control group had 5. The body composition and ketosis compliance were evaluated weekly using dual-energy X-ray absorptiometry (DXA) and urine ketones, respectively. The data was examined using a general linear model (GLM), as well as univariate and multivariate analysis. According to the data, MD helps to reduce fat mass without affecting lean body mass, however, it does not improve muscle mass.

Yoon et al., (2017) investigated how bicycling and spinning exercises affect the body composition, blood variables and physical fitness in female adolescents for 16 weeks. The participants were 24 female students who attended Seoul Yeoksam middle school, 12 bicycling and 12 spinning). The groups were trained equally for 16 weeks, three times a week, and for an hour each session. During the period, body composition, blood variables and physical fitness were examined. The findings revealed that there was no substantial difference in their body mass. However, in the spinning group, the percentage of body fat BMI had significant differences. When it comes to physical fitness, both groups recorded improvement, but it was greater in the spinning group.

The glucose and reactive oxygen species in the blood had significant differences. Therefore, this study shows that bicycling and spinning exercises had a positive impact on body composition, blood variables and physical fitness. However, spinning cycle was more beneficial than bicycling.

Rizal et al., (2018) analyzed the strategies developed by sports scientists and coaches to prevent the effects of Ramadhan by progressive overload, recovery, and frequency, intensity, time, and type (FITT). During Ramadhan, sane, healthy, and Muslims that have reached the puberty age must stay away from food, sexual intercourse, and drinks throughout the day. Diet and hydration changes have severe effects on the training performance of elite athletes. Researches have shown that Ramadhan fasting has harmful effects on the psychological wellbeing and results of an athlete. The psychological results include; the endurance and strength of the muscles, maximal anaerobic power, and anaerobic power. Furthermore, reducing training load before or throughout Ramadhan results in poor performance for well-trained athletes. Adapting to the training principles prevents athletes from poor performance during fasting. This enables athletes to achieve their goals. Therefore, training principles are important in preventing poor performance of athletes during Ramadhan.

Francois et al., (2017) determined whether the combination of carbohydrate restriction and high-intensity interval training (HIIT) were effective in treating metabolic diseases. Lifestyle interventions, dieting and exercising, are proven to be effective treatment therapies for metabolic diseases. Additionally, carbohydrate restriction and HIIT improve metabolic and cardiovascular health independently. Carbohydrate restriction limits glucose excursions and deleterious metabolic by reducing postprandial hyperglycaemia. Carbohydrate restriction also improves lipid profile and body composition. It is well known that exercises are vital in improving insulin sensitivity. In this case, HIIT improves cardiovascular fitness, glucose control, and endothelial function. As discussed, carbohydrate restriction and HIIT function properly independently. However, the combination of both methods maximizes benefits. To sum up, lifestyle strategy is the perfect intervention for treating metabolic and cardiovascular illnesses. However, further study is needed to properly define and explain the benefits of carbohydrate restriction and HIIT as methods of reducing metabolic and cardiovascular diseases.

Kotopoulea-Nikolaidi et al., (2019) investigated the effects of high-intensity interval exercise (HIIE) on mood, blood pressure, and cognitive function in overweight premenopausal women, and the effects of high-protein pre-HIIE versus high-carbohydrate pre-HIIE on cognitive function, mood and exercise capacity in the women were compared. The study included 12 overweight premenopausal women with a body fat percentage of 32.2 percent and an average age of 45 years. The individuals were divided into three groups: high carbohydrate low protein (HCLP), low carbohydrate high protein (LCHP), and control (no carbohydrate). In this investigation, a randomized crossover approach was used. Questionnaires were also used in the collection of data. The results showed that HIIE improved cognitive function and decreased blood pressure. HCLP and LCHP participants recorded longer exercise performance than those that had a controlled diet. As a result, HIIE improves blood pressure and cognitive performance in premenopausal women who are overweight. Additionally, high carbohydrate HIIE diet leads to improvement in the mood and exercise performance, and positive exercise engagement more than high-protein feedings.

Pons et al., (2018) showed how caloric restrictions affected the physical performance and body composition of trained athletes, and also to examine the effect of every day feeding on fatty acids and micronutrients deficiencies. In rodents, caloric restriction improves physical fitness and promotes mitochondrial biogenesis. The study involved 12 healthy male athletes. It involved combining the usual diet and 33% caloric restrictions. At the start and end of the calorie restriction phase, a maximal exercise stress test was performed. Before and after caloric restriction, when the blood was at rest, and after 30 minutes of exercise, blood samples were obtained. Despite a 33% reduction in energy, carbohydrate, protein, and lipid intake remained unchanged from the standard diet. The results showed that caloric restrictions improved the energy efficiency and performance of athletes. However, it reduced the micronutrients daily intake. Therefore, in the implementation of caloric restriction programs, the supplementation of micronutrients has to be considered.

2.4 Reviews on Family Environment

de Sousa Rodrigues et al., (2017) Researchers investigated the impact of modest chronic psychological stress on cognitive, metabolic, and inflammatory characteristics in a mouse model of diet-induced obesity. The link between behavioral impairment and the development of metabolic syndrome (MetS) due to persistent psychological stress is not fully known. The study first analyzed the impact of high-fat high-fructose diet (HFHF) and mental stress on inflammation with behavioral dysfunction. Secondly, the effect of stress and HFHF on lipid metabolism and insulin. In the study, the male mice were exposed to both HFHF for two weeks. Conditions related to metabolic syndrome were analyzed by applying the untargeted plasma metabolomics and changes in the immune and structure were assessed in the liver and gut. The results show that stress and diet can improve the metabolic syndrome through inflammation, which has an effect on behavior. The model applied, in this case, may be helpful in identifying therapeutic targets and biomarkers to treat mood disorder and metabolic syndrome.

Mulgrew et al., (2019) examined the psychological factors connected to weight management behaviors use in young adults. Overweight and obesity is a prevalent issue in society. These issues could be addressed by adopting healthier lifestyle behaviors. In this case, people are encouraged to diet. In this study, 1082 participants were involved, 808 females and 274 males. The participants were between the ages of 18 and 30. In the research, body image, stress, dieting status, behavioral changes, and weight control behaviors were measured. Additionally, weight control behaviors were modified to explore healthy or unhealthy actions to raise, maintain, or reduce weight in the youths and their connection with body image, depression, and body mass index (BMI). Females with average body size and exercise capabilities had more use for the strategies than men. Therefore, health campaigns should prioritize the detrimental nature of the unhealthy practices for weight management together with the significance of the healthy practices.

Solianik & Sujeta, (2018) estimated the impact of a 2-day total fasting on the psychomotor, motor function, and evoked brain activity, cognitive, stress, and mood. Changes in the cognitive state, motor behavior, and psychological that happens when one is fasting are not clear. The research involved 11 women who were overweight and between the ages of 20 and 30 years. The participants were randomly grouped into two; 2- day zero-calorie diet and a 2-usual diet with water. Before the study commenced, the aerobic fitness of the participants was evaluated. Additionally, the stress ratings in connection to grip strength, cognitive performance, diet, psychomotor coordination, autonomic function, and prefrontal cortex activity were measured at the start and finish of the study. The results showed that fasting reduced high frequency power without changing the heart rate. Moreover, fasting had no major changes on psychomotor, motor function, and evoked brain activity, cognitive, stress, and mood. However, 2-day fasting led to stress which created balance in a sympathetic activity and a shift in the autonomic nervous system.

2.5 Research Gap

Despite the growing popularity of intermittent fasting, low-carb, high-fat diets, and resistance training for weight loss and metabolic health in obese individuals, there is a research gap in understanding the combined effects of these interventions on selected obese individuals. Existing studies have investigated the effects of intermittent fasting, low-carb, high-fat diets, and resistance training on weight loss and metabolic health in obese individuals. However, there is limited research that explores the combined effects of these interventions on selected obese individuals. This research gap is important because it is crucial to understand how the blend of intermittent fasting, low-carb, high-fat diets, and resistance training can synergistically impact weight loss, metabolic health, and other relevant outcomes in selected obese individuals. By filling this research gap, we can gain valuable insights into the most effective and sustainable weight loss and metabolic health approach in obese individuals. Additionally, further research is needed to examine the long-term sustainability and adherence to these combined interventions in selected obese individuals, as well as potential variations in outcomes based on individual characteristics such as age, sex, and comorbidities. Furthermore, there is a need for more research on the potential mechanisms by which these interventions exert their effects. This research gap could be addressed by conducting a randomized controlled trial or a longitudinal study that compares the effects of intermittent fasting, LCHF diets and resistance training alone and in combination on weight loss, metabolic health markers (such as HbA1c, fasting glucose), body composition and insulin sensitivity in selected obese individuals. This research would provide valuable insights into the effectiveness and feasibility of combining these interventions in managing obesity and metabolic health. This research gap could also be addressed by conducting studies that include a diverse population of obese individuals, considering factors such as age, sex, ethnicity, and socioeconomic status. In summary, the research gap is that there is limited understanding of the combined effects of intermittent fasting, low-carb, high-fat diets, and resistance training on selected obese individuals. This research gap is important because it limits our knowledge of the most effective and sustainable weight loss and metabolic health approach in obese individuals. Additionally, there is a need to examine the long-term sustainability and adherence to these interventions and potential variations in outcomes based on individual characteristics. Moreover, further research is needed to elucidate the mechanisms underlying these interventions' effects and explore potential interactions between them.

To address the research gap, a randomized controlled trial will be conducted to compare the effects of intermittent fasting, LCHF diets, and resistance training alone and in combination on weight loss, metabolic health markers (such as HbA1c, fasting glucose), body composition, and insulin sensitivity in selected obese individuals. The study will include a diverse population of obese individuals, considering factors such as age, sex, ethnicity, and socioeconomic status to assess potential variations in outcomes based on individual characteristics.

The concept of intermittent fasting and the LCHF diet is fairly new in this present world. There are few types of research available on the combination of Intermittent Fasting, LCHF Diet, and Resistance Training in the Overweight Population. Most of the literature combines a low-carb carb High-Fat diet with cardiovascular, Liver, and kidney disease or problem-related medical issues. This research keen to study the Effect of Intermittent Fasting, LCHF Diet, and Resistance Training on the obese Population. After studying more than 40 Scopus index research journals, 2 books & 2 no's of world-renowned web channels following the research gap are found.

1. None of the papers included the resistance-training aspect of intermittent fasting & LCHF diet

2. Some studied the impact of exercise with low carb diet but ignored its impact on kidney, liver, and body composition

3. Most of the literature is only a review-based article.

4. LCHF diet and intermittent fasting are not combined in most of the research

5. Most of the research focuses on weight loss, not on fat loss.

6. No research has combined intermittent fasting, LCHF diet and resistance training covering psychological parameters.

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Research Design

'Research design is considered as a blueprint for conducting the research work that indicates the draft for the methodology part of any study' (Malhotra & Dash, 2014). A pre-test and post-test experiment design was selected to meet the various objectives of the study. The study is experimental in nature, planned for the management of obesity, and the overall well-being of health by employing proper nutrition, diet, and resistance training. The obese people were selected from different urban cities of Dibrugarh district of Assam as the obese population for the present study. Assam is second-highest in diabetes cases, after Odisha, only due to overweight and obesity (Annual health survey 2014). Initially, the investigator searched for subjects through the newspaper, local TV advertisements, gym & door-to-door contact, and snowball technique. Based on the mean score of BMI, the respondent was grouped equally into 5 groups. A total number of 100 samples between the age group 35-45 years was selected employing convenient and snowball sampling that was equally divided into five groups, four experimental groups, and one controlled group (each group comprised 20 samples). In the next phase, samples have to sign the enrolment form & consent letter to the researcher (attached annexure-II and III). Experimental group

1: Subjects have to undergo a pre-test. Only after the recommendation of doctors. They would be included in this group and participate in the intermittent fasting program experimental group.

2: The low carbohydrate, high fat diet group has to undergo for pre-test. Only after the recommendation of doctors would they be included in this group and participate in the low-carbohydrate high-fat diet program. experimental group

3: The resistance training group has to undergo a pre-test. Only after the recommendation of doctors would they be included in this group and participate in the resistance-training program experimental group.

4: The composite group has to undergo a pre-test, only after the recommendation of doctors. They would be included in this group and participate in the composite program group.

5 The control group was considered a group, and no training or dieting will be imparted to this group.

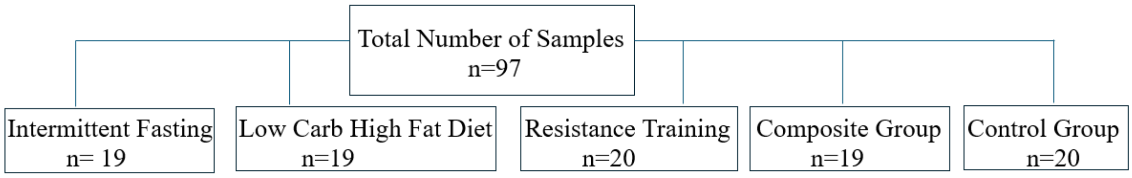
The experiment program was imparted in the samples for 8 weeks. After successfully completing the Intermittent Fasting, Low Carb-High Fat Diet, and Resistance Training, the same post-program test was conducted, and data was collected. Based on four different programs along with the control group, the effect of other training programs on certain variables among different groups was assessed. During this treatment, the diet and timing of fasting may be slightly modified for specific subjects under the minute inspection of guides and experts. The intermittent fasting, low carb-high fat diet program will be monitored by Dr. Jeshmin Ahmed, Associate Professor (Community Health), Indian Council of Medical Research (ICMR), Government of India and Dr. Pallabi Bhattacharjee, Assistant professor (Department of Pharmacology) Srimanta Sankardev University, Government of Assam. In case of any medical exigencies, Dr. Jeshmin Ahmed and Dr. Pallabi Bhattacharjee were supported during the period. For imparting the resistance training, a qualified fitness trainer Sri.D.C Bhargab, Sr. Fitness Trainer, Oil India Ltd, Duliajan will help during the program.

3.2 Sampling Design

The present study was carried out in Assam. The sampling pattern was a convenient and snowball sampling in nature in this study. The study was carried out among the sedentary population, in order to experiment with this study in physiological, anthropometrical, haematological, and psychological parameters. Newspaper advertisements, Local news channel advertisements, gym and home-to-home contracts, and snowball technique were selected to be deployed for respondents. The study was based on intermittent fasting (IF), low carb-high fat diet, and resistance training in an obese population in a group of people, out of a total 100 subjects 50 male and 50 Female respondents were selected in-between age groups 35 to 45 years obese population. In addition, after completing 8 weeks of intermittent fasting & low carb-high fat diet, various tests were performed to measure the physiological, anthropometrical, haematological, and psychological parameters variables. "The dropout chances in this type of research are high" (Fang Y, 2015)

Table 3.2 Sample Size and Distribution of Subjects

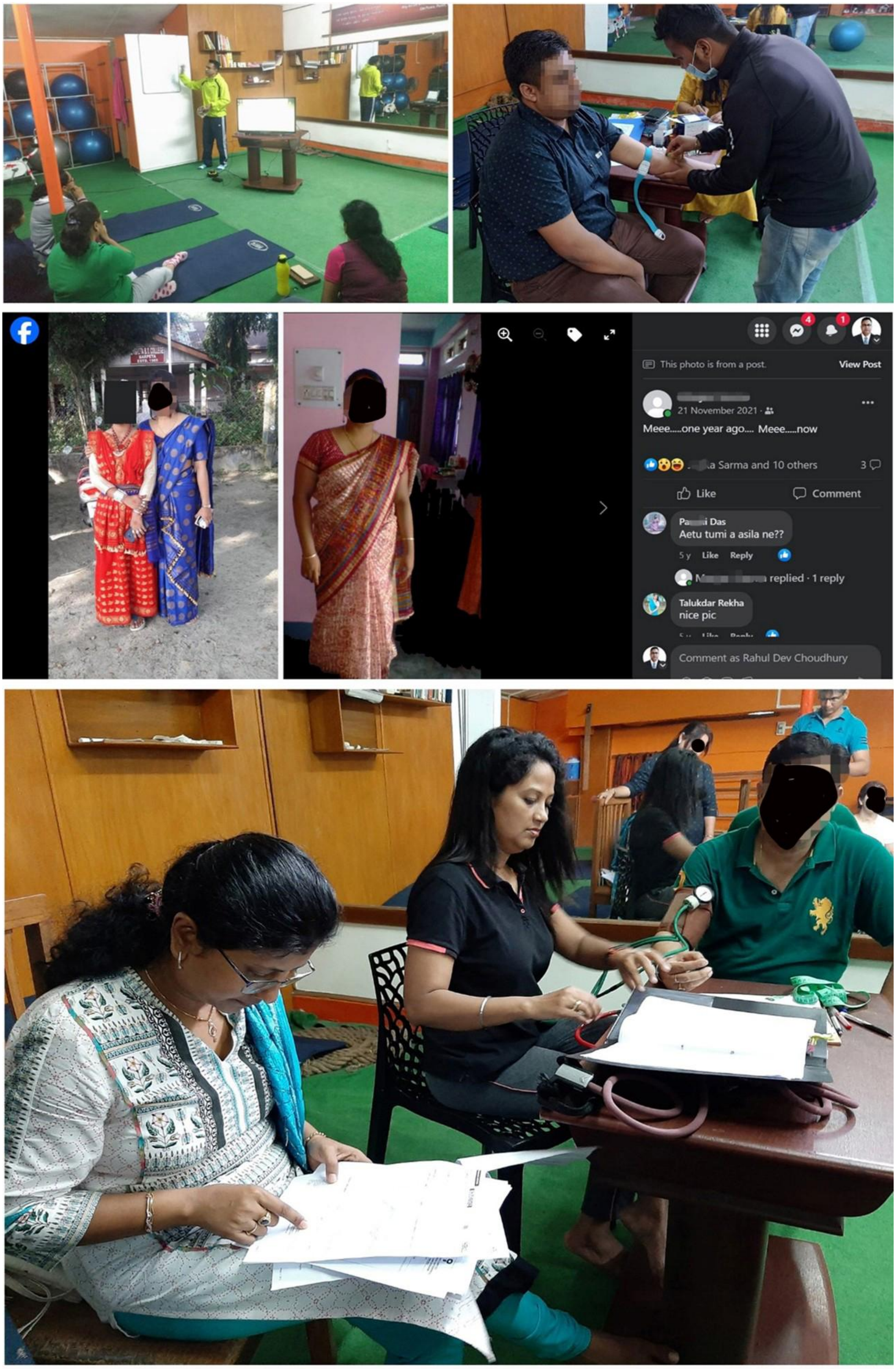
Sl No	No of Groups	Total sample (Pre-Test)	Duration	Total sample (Post-Test)
1	4+1	97	8 Weeks	97



3.3 Collection of Data

Figure 3.1 Collection of data (Psychological questionnaire, Resistance Training, Physiological Test under supervision of ICMR doctors)

Collection of data (Physiological test, Resistance Training and haematological tests under supervision of ICMR doctors)



Collection of data (Explanation to subjects, Subjects review and haematological tests under supervision of ICMR doctors)

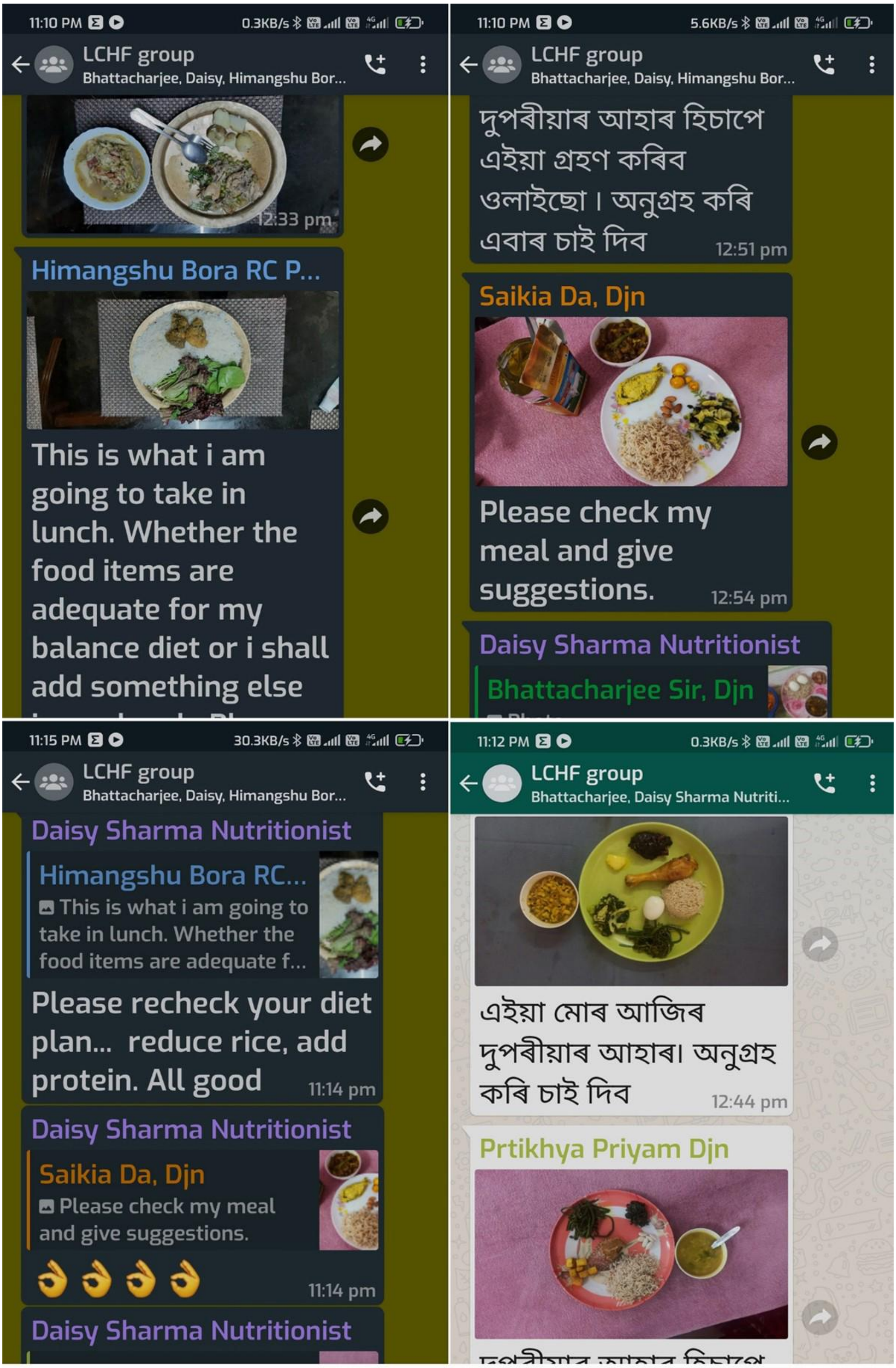


Figure 3.2 WhatsApp group discussion for managing diet. (Nutritionist as admin with researcher)

3.4 Selection of Variables

Selections of the variables keeping in view the significance of the investigation, the following variables have been selected.

1. Physiological variables:
    - Heart Rate
    - Blood Pressure (BP)
    - VO2 Max (ml/kg/min)
2. Haematological Variable:
    - Lipid Profile
    - HbA1C
    - Liver Function Test
    - Kidney Function Test
3. Anthropometrical Variable
    - Water Content
    - Visceral and subcutaneous Fat Percentage
    - Muscle Mass
    - Body Mass
    - BMI (kg/m2)
    - Basal Metabolic Rate (BMR)
    - Body Fat %
4. Psychological Variables:
    - Family Environment Scale by Harpreet Bhatia and N. K. Chadha, 2012 National Psychological Corporation

3.4.1. Heart Rate

Heart rate, also known as pulse rate, is a metric that quantifies the frequency of cardiac contractions within a given time frame, typically expressed as the number of beats per minute (bpm). It is conventionally assessed during periods of rest or when engaging in physical exertion. One can determine it using modern technology, such as heart rate monitors, or manually by palpating pulse points. Adults' typical resting heart rates range from 60 to 100 bpm but vary depending on age, gender, and fitness level.

3.4.2 Blood Pressure

Blood pressure is a metric that quantifies the magnitude of the force exerted by blood on the walls of arteries during each cycle of the heart's contractions. The measurement is obtained by combining the systolic pressure, which is observed during ventricular contraction, with the diastolic pressure, which is observed during ventricular relaxation. Age-related changes occur with increasing systolic pressures due to arterial stiffness, while diastolic pressures tend to decrease slightly. Factors affecting blood pressure include:

- Age tends to increase with advancing years.
- Gender, wherein men generally have higher pressures than women.
- Lifestyle choices include a diet high in sodium or low physical activity.
- Medical conditions like hypertension or diabetes.

The correct procedures while taking blood pressure are crucial. Firstly, ensure the individual is in a relaxed state and seated comfortably. Place the cuff around the individual’s upper arm; this should be at heart level. Then, locate the brachial artery and align the stethoscope. Inflate the cuff until the gauge reads about 30 mmHg above the expected systolic blood pressure. Then, slowly release the pressure while on the stethoscope, listening for the first thumping, the systolic pressure. This should continue until the thumping disappears, which is the diastolic pressure. Lastly, record the readings accurately without forgetting to deflate the cuff entirely. One must also maintain the proper way and take repeat measurements to obtain accuracy.

3.4.3 VO2 Max

VO2 max represents an individual's maximal oxygen consumption during intense exercise, serving as a reliable indicator of cardiovascular health and physical fitness. Genetics, age, training status, and lifestyle choices are just a few variables that affect it. Higher VO2 max values are associated with better aerobic fitness levels. There are several methods available for measuring VO2 max:

- Direct measurement through gas analysis involves collecting expired air samples to determine the ratio of inhaled to exhaled oxygen.

- Indirect estimation using formulas based on heart rate response during submaximal exercise provides reasonable estimates of VO2 max.

Each method has advantages and limitations; direct measurement offers greater accuracy but requires specialized equipment, while indirect estimation allows for practicality in large-scale assessments.

To accurately measure VO2 max, begin by finding a suitable location where you can safely perform a cardiorespiratory fitness test. Ensure access to equipment such as a treadmill, stationary bike, track, heart rate monitor, and stopwatch. Begin with a thorough warm-up to prepare the body for the test. Once ready, start the test by gradually increasing the exercise intensity while monitoring heart rate. Continue until you reach maximum effort or until you are unable to continue. Note the time and heart rate at the end of the test. Afterward, input data into a VO2 max calculator or consult a fitness professional to interpret results accurately. Remember, safety is paramount during any fitness test, so always listen to your body and stop if you experience discomfort or unusual symptoms.

3.4.4 Lipid Profile

The lipid profile provides vital diagnostic clues about an individual's cardiovascular wellness by quantifying various blood lipid components. Total cholesterol, LDL-C, HDL-C, and triglyceride levels are assessed. Minimizing cholesterol has long been recognized as potentially contributing to atherosclerosis' development, thus exacerbating susceptibility to illnesses such as coronary disease and stroke. Consistently, elevated LDL-C associates with amplified cardiovascular risk owing to its part in fostering plaque accumulation inside arteries. Meanwhile, higher HDL-C protects against heart ailments as it aids eliminating excess cholesterol from peripheral tissues, facilitating transport to the liver for metabolic handling. Furthermore, short-term fluctuations in lipid concentrations correlate poorly with long-term outcomes. Therefore, clinicians consider average lipid values from several profiles to accurately gauge risk. Overall, a comprehensive picture emerges from lipid profiling regarding modifiable risk factors and potential lifestyle modifications.

The lipid profile (Total Cholesterol) was measured by blood collection under the supervision of qualified doctors in an NABL-accredited laboratory.

3.4.5 HbA1C Test

The HbA1C test measures glycated haemoglobin or A1C levels to assess a person's long-term blood sugar control over approximately three months - reflecting average blood glucose concentration during this period. Crucially, for individuals living with diabetes mellitus, maintaining optimal HbA1C levels is critical to preventing complications associated with uncontrolled hyperglycaemia. By regularly monitoring HbA1C levels, healthcare professionals can assess the effectiveness of treatment plans and adjust medications or interventions accordingly. High HbA1C values indicate poor blood sugar control, while low values may suggest hypoglycaemia or excessively tight glycaemic control.

The HbA1C (Glycated Haemoglobin) was measured by blood collection under the supervision of qualified doctors in an NABL-accredited laboratory.

3.4.6 Liver Function Test

Liver function tests (LFTs) are blood tests that evaluate liver health and functioning. LFTs measure parameters such as liver enzymes, including alanine transaminase (ALT), aspartate transaminase (AST), bilirubin, and albumin levels. Abnormalities in LFT results can indicate liver dysfunction or disease. When ALT and AST levels are high, it may be a sign of hepatocellular injury, like viral hepatitis or liver damage caused by drugs. When bilirubin levels are high, it may be a sign of a problem with bile flow, like cholelithiasis or obstructive jaundice. Additionally, reduced albumin levels may suggest chronic liver disease due to decreased protein synthesis capability by the liver.

The liver profile (Total bilirubin) was measured by blood collection under the supervision of qualified doctors in an NABL-accredited laboratory.

3.4.7 Kidney Function Test

Kidney function tests (KFTs) provide valuable information about renal filtration capabilities by measuring parameters such as serum creatinine level, blood urea nitrogen (BUN), and glomerular filtration rate (GFR). These tests help diagnose kidney damage or dysfunction. Increased serum creatinine and BUN levels typically indicate impaired kidney function since healthy kidneys should efficiently excrete these waste products into the urine. Moreover, decreased GFR, calculated using age, sex, and race/ethnicity-adjusted formulas, indicates reduced kidney filtering capacity, which could lead to the accumulation of toxins within the body.

The kidney profile (Creatinine) was measured by blood collection under the supervision of qualified doctors in an NABL-accredited laboratory.

3.4.8 Water Content

Water content refers to the amount of water present in the human body. Sufficient hydration is necessary for optimal physiological processes, including digestion, absorption of nutrients, thermoregulation, and excretion of waste materials. The body maintains water balance through processes like sensing thirst and regulating kidney function. Maintaining proper hydration levels is crucial for overall health. Research has demonstrated that even mild dehydration can have detrimental effects on cognitive performance., mood stability, physical performance, thermoregulation abilities, kidney function, gastrointestinal health, and cardiovascular health. It has also been found that increased water intake can aid in weight management by promoting satiety during meals.

Bioelectrical impedance analysis (BIA) and specialized scales can provide more precise measurements by analyzing body composition. These methods assess the body's electrical conductivity, which varies based on water content. BIA was used to collect data on the subjects under the supervision of qualified doctors in an NABL-accredited laboratory.

3.4.9 Visceral Fat Percentage

Visceral adipose tissue, which envelops vital organs deep in the abdominal cavity, plays an insidious yet influential role in human physiology. It is a metabolically dynamic depot actively secreting an array of molecules with potential health consequences. Unlike the more superficial subcutaneous fat pads proximal to the dermis, visceral fat stores have been correlatively tied to heightened vulnerability to myriad chronic conditions such as cardiovascular disease, type 2 diabetes, and some cancer subtypes. There are multifactorial causal underpinnings elevating visceral adiposity. Among the primary determinants are a sedentary lifestyle devoid of physical activity, a diet high in saturated fats and refined carbohydrates, a hereditary predisposition, and dysregulated hormones. Studies have demonstrated that surfeit visceral fat accumulation is affiliated with insulin resistance, dyslipidemia, heightened inflammation, and aggravated oxidative stress throughout the body.

Bioelectrical impedance analysis (BIA) and specialized scales can provide more precise measurements by analyzing body composition. These methods assess the body's electrical conductivity, which varies based on water content. BIA was used to collect data on the subjects under the supervision of qualified doctors in an NABL-accredited laboratory.

3.4.10 Subcutaneous Fat Percentage

Subcutaneous fat is the fatty tissue located directly under the skin throughout the body. Unlike visceral fat, subcutaneous fat does not pose significant health risks when present in moderate amounts. However, the distribution of subcutaneous fat can influence health outcomes. Genetics, hormonal balance, diet, and physical activity affect subcutaneous fat accumulation. Age and gender also play a role in determining where excess subcutaneous fat may be deposited. Although excessive subcutaneous fat deposition may contribute to obesity-related complications, it does not carry the same level of metabolic risk as visceral adiposity.

Bioelectrical impedance analysis (BIA) and specialized scales can provide more precise measurements by analyzing body composition. These methods assess the body's electrical conductivity, which varies based on water content. BIA was used to collect data on the subjects under the supervision of qualified doctors in an NABL-accredited laboratory.

3.4.11 Body Mass

Body mass, a crucial indicator of health, encompasses an individual's weight relative to height and body composition. It serves as a cornerstone in assessing overall well-being, aiding in the diagnosis and management of various medical conditions. Understanding body mass involves intricate analysis, considering factors like muscle mass, fat distribution, and metabolic rate. Beyond its clinical significance, body mass influences societal perceptions and self-esteem. As research advances, nuanced approaches to interpreting body mass emerge, emphasizing personalized healthcare interventions. Vigilance against obesity-related complications underscores the importance of continual exploration in this field.

Bioelectrical impedance analysis (BIA) and specialized scales can provide more precise measurements by analyzing body composition. These methods assess the body's electrical conductivity, which varies based on water content. BIA was used to collect data on the subjects under the supervision of qualified doctors in an NABL-accredited laboratory.

3.4.12 Muscle Mass

Muscle mass plays an essential role in overall health and functionality. It contributes significantly to metabolic health by increasing resting energy expenditure and improving glucose control. Physical activity promotes muscle protein synthesis, so facilitating the maintenance or augmentation of muscle mass, and serves as a preventive measure against the occurrence of age-related muscle loss or sarcopenia. Muscle mass is influenced by a range of factors, encompassing exercise, nutrition, age, gender, genetics, and hormonal equilibrium. Resistance training is particularly effective in promoting muscle hypertrophy and preserving muscle mass. Bioelectrical impedance analysis (BIA) is a widely employed technique to assess muscle mass correctly.

Bioelectrical impedance analysis (BIA) and specialized scales can provide more precise measurements by analyzing body composition. These methods assess the body's electrical conductivity, which varies based on water content. BIA was used to collect data on the subjects under the supervision of qualified doctors in an NABL-accredited laboratory.

3.4.13 Body Mass Index (BMI)

Body Mass Index (BMI) is a widely used metric to assess an individual's body weight relative to their height. It is calculated by dividing a person's weight in kilograms by the square of their height in meters. BMI serves as a screening tool for identifying potential weight-related health risks, although it has limitations in accurately assessing body composition and health status. While BMI provides a general indication of body fatness, it may not account for factors such as muscle mass or distribution of fat. Despite its prevalence, BMI should be interpreted cautiously and in conjunction with other health indicators for a comprehensive assessment.

Bioelectrical impedance analysis (BIA) and specialized scales can provide more precise measurements by analyzing body composition. These methods assess the body's electrical conductivity, which varies based on water content. BIA was used to collect data on the subjects under the supervision of qualified doctors in an NABL-accredited laboratory.

3.4.14 Basal Metabolic Rate (BMR)

Basal metabolic rate, the minimum energy required for basic bodily functions like breathing and circulation, depends on several influential variables. Age, gender, muscle mass, and activity level impact one's metabolism, necessitating different calorie needs. Direct calorimetry precisely quantifies oxygen intake and carbon exhalation to directly assess basal metabolic rate, while the Harris-Benedict equation provides an estimated alternative. An accurate estimation of basal metabolic rate is pivotal for outlining customized diet plans and determining daily energy expenditure at rest.

Bioelectrical impedance analysis (BIA) and specialized scales can provide more precise measurements by analyzing body composition. These methods assess the body's electrical conductivity, which varies based on water content. BIA was used to collect data on the subjects under the supervision of qualified doctors in an NABL-accredited laboratory.

3.4.15 Body Fat Percentage

Body fat percentage, rather than BMI, offers a more accurate portrayal of an individual's true composition by quantifying their adipose load. A variety of techniques can appraise or approximate body fat levels, including calliper measurements of skin folds and analyses of bioelectric impedance. What constitutes a healthy range shifts with age, sex, and fitness, yet generally 25-31% for women and 18-24% for men are considered optimal adipose amounts.

Bioelectrical impedance analysis (BIA) and specialized scales can provide more precise measurements by analyzing body composition. These methods assess the body's electrical conductivity, which varies based on water content. BIA was used to collect data on the subjects under the supervision of qualified doctors in an NABL-accredited laboratory.

3.4.16 Lean Body Mass

Lean body mass (LBM) represents the total weight of the body minus the weight of all its fat components. It encompasses muscles, bones, organs, and fluids, providing a crucial indicator of overall health and fitness. In our research article, we delve into the significance of LBM in various contexts, including its association with metabolic rate, physical performance, and disease risk. By examining the intricate relationship between LBM and health outcomes, our study aims to shed light on the importance of preserving and optimizing lean body mass for individuals' well-being and longevity.

Bioelectrical impedance analysis (BIA) and specialized scales can provide more precise measurements by analyzing body composition. These methods assess the body's electrical conductivity, which varies based on water content. BIA was used to collect data on the subjects under the supervision of qualified doctors in an NABL-accredited laboratory.

3.4.17 Family Environment Scale

The Family Environment Scale (FES) is a widely used tool for assessing the social environment within families. Data collection through questionnaires is a common method employed to gather information for FES analysis. The questionnaire typically consists of statements related to different aspects of family life. Respondents are requested to express their agreement or disagreement with each statement, typically utilizing a Likert scale spanning from "strongly agree" to "strongly disagree." Subsequently, the collected responses undergo scoring and analysis to offer understanding into the perceived family environment. This data collection method allows for efficient information gathering from many participants and facilitates quantitative analysis of family dynamics.

Table 3.4: Source of Research Tool, Validity and Reliability of the Scale

Sl. No	Research Tool	Author	Year	Reliability Coefficient	Validity
1	'Family Environment Scale'	'Dr Harpreet Bhatia And Dr N. K. Chandra'	2012	0.95	Expert

3.5 Statistical Analysis Approach

The study utilizes descriptive statistics, Analysis of Covariance (ANCOVA), and post-hoc test employing LSD (Least Significant Difference) to analyze the data. The data analysis was conducted using the program SPSS 16.0 edition. After inputting the data into SPSS, a verification process was conducted to ensure its accuracy. The data was analyzed via the aforementioned methodologies. Below is a concise elucidation of the analytical tools and methodologies employed for data analysis:

3.5.1 Descriptive Statistics

For this research, only the mean and standard deviation were determined as descriptive statistics, based on the suitability of statistical procedures.

3.5.2 Introductory Concepts of Analysis of Covariance (ANCOVA)

For this research, only the mean and standard deviation were determined as part of the descriptive statistics based on the suitability of statistical methodologies. Analysis of covariance (ANCOVA) is a statistical technique that can be viewed as an extension of analysis of variance (ANOVA). Analysis of covariance combines components of one-way analysis of variance with fundamental linear regression. This is due to the fact that an analysis of variance is used to compare the treatment groups, which modifies the measurement of the criterion variable by incorporating regression analysis based on the covariate. ANCOVA reduces the error variance by managing the concurrent variables that change in conjunction with the criterion variable over the entire experimental group. These accompanying variables are also referred to as covariates since they strongly correlate with a criterion variable, suggesting that they may account for the variation observed between the treatment groups. The ANCOVA design allows for separating the variability component caused by the covariate, ensuring that any differences between groups may be completely attributable to the treatment. The goal of analyzing covariance is to assess the relative efficacy of two or more treatments on the criterion variable while accounting for the initial disparity caused by the covariate. There are often instances where it is not feasible to pinpoint a singular covariate that influences the measurement of the criterion variable in experimental settings. Consequently, we may consider the initial testing (X) on the criterion variable in each treatment group as a covariate. We are interested in evaluating the measure of the criterion variable (Y) after the therapy in all treatment groups (Verma, 2013; Verma, 2011). The analysis of covariance design is appropriate when the following conditions occur:

- The reaction to the criterion variable is uninterrupted.
- There is at least one classification variable, which refers to the treatment groups.
- There is at least one continuous independent variable (covariate).

The significance level was established at a confidence level 0.05 for hypothesis testing. Furthermore, whenever the "F" value was found to be statistically significant, a post-hoc test was performed to ascertain the difference between the adjusted final means.

3.5.3 Post-hoc Test

A post hoc test evaluates the statistical significance of the average difference between groups. This word is used when the null hypothesis, which implies that the means are equal, is disproven. Various post hoc tests are available for comparing the means of distinct groups. The conducted tests encompass the Least Significant Difference (LSD), Scheffe, Sidak, Tukey, and Duncan tests. The LSD and Scheffe tests are commonly used. The LSD test is employed when the sample sizes are equivalent, however the Scheffe test is utilized in situations when the sample sizes are not similar. A confidence level of 0.05 was used as the threshold of significance to evaluate the importance of the difference between each pair of values. A p-value below the 0.05 threshold implies a statistically significant difference between any pair of averages. On the other hand, if the p-value is greater than the threshold of 0.05, it suggests that there is no statistically significant difference between the two means (Verma, 2013).

Table 3.5: Statistical analysis pertaining to research objectives and hypotheses.

Sl. No	Objectives	Hypotheses	Research Technique
1	To examine the 'effect of Intermittent Fasting, Low carbohydrate high-fat diet and resistance training on Physiological parameters, i.e. Heart Rate, Blood Pressure (BP), VO2 Max	**$H_{(1)}$:** There exist significant 'effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables' - Heart Rate **$H_{(2)}$:** There exist significant 'effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables' - blood pressure (BP)	1. Descriptive statistics (mean and standard deviation) 2. ANCOVA and post-hoc test using least square difference (Bonferroni).

		$H_{(3)}$: There exist significant 'effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables' -VO2 max (ml/kg/min).	
2	To assess the 'effect of Intermittent Fasting, Low carbohydrate high-fat diet and resistance training on hematological parameters' i.e. Lipid Profile, HbA1C, Liver Function Test, Kidney Function Test	**$H_{(4)}$:** There exist significant 'effect of intermittent fasting, low carb-high fat diet, and resistance training on Hematological variables' - Lipid Profile **$H_{(5)}$:** There exist significant 'effect of intermittent fasting, low carb-high fat diet, and resistance training on Hematological variables' -HbA1c (glycated hemoglobin) **$H_{(6)}$:** There exist significant 'effect of intermittent fasting, low carb-high fat diet, and resistance training on Hematological	1. Descriptive statistics (mean and standard deviation) 2. ANCOVA and post-hoc test using least square difference (Bonferroni).

		variables' -Liver Function Test (LFT) **H(7):** There exist significant 'effect of intermittent fasting, low carb-high fat diet, and resistance training on Hematological variables' -Kidney Function Test (KFT)	
3	To examine the 'effect of Intermittent Fasting, Low carbohydrate high-fat diet and resistance training on anthropometrical parameters' i.e. Water Content, Visceral & Subcutaneous Fat percentage Body Mass, Muscle Mass, BMI (kg/m2), Basal Metabolic Rate (BMR), Body Fat Percentage, Lean Body Mass	**H(8):** There exist significant 'effect of intermittent fasting, low carb-high fat diet, and resistance training on anthropometrical variables' -water content in the body. **H(9):** There exist significant 'effect of intermittent fasting, low carb-high fat diet, and resistance training on anthropometrical variables' -Visceral and Subcutaneous Fat Percentage **H(10):** There exist significant 'effect of intermittent fasting, low	1. Descriptive statistics (mean and standard deviation) 2. ANCOVA and post-hoc test using least square difference (Bonferroni).

		carb-high fat diet, and resistance training on anthropometrical variables' -Bodyweight. **H(11):** There exist significant 'effect of intermittent fasting, low carb-high fat diet, and resistance training on anthropometrical variables' -Muscle mass. **H(12):** There exist significant 'effect of intermittent fasting, low carb-high fat diet, and resistance training on anthropometrical variables' - BMI (kg/m) **H(13):** There exist significant 'effect of intermittent fasting, low carb-high fat diet, and resistance training on anthropometrical variables' - BMR (Basal Metabolic Rate) **H(14):** There exist significant 'effect of intermittent fasting, low	

		carb-high fat diet, and resistance training on anthropometrical variables' - Body Fat percentage. **H(15):** There exist significant 'effect of intermittent fasting, low carb-high fat diet, and resistance training on anthropometrical variables' - Lean Body Mass	
4	To measure the effect of Intermittent Fasting, Low carbohydrate high fat diet and resistance training on psychological parameters. i.e Family Environment Scale	**H(16):** There exist significant 'effect of intermittent fasting, low carb-high fat diet, and resistance training on psychological parameters' - Family Environment Scale	1. Descriptive statistics (mean and standard deviation) 2. ANCOVA and post-hoc test using least square difference (Bonferroni).

3.6 Description of the Intermittent Fasting

Intermittent fasting is a dietary approach that involves alternating between periods of calorie restriction or normal food consumption and periods of fasting for a specific duration. The term "intermittent fasting" refers to a structured eating pattern that alternates between periods of fasting and consuming calories. This approach does not impose strict restrictions on food choices and allows flexibility within a specific timeframe (Patterson & Sears, 2017). Intermittent fasting can aid in weight loss, disease prevention, enhancement of metabolic health, and potentially increase lifespan for individuals who are obese. The appeal of this diet lies in its emphasis on meal timing rather than meal content. Intermittent fasting can be achieved by various approaches, all of which entail dividing the day or week into designated hours for eating and fasting. Intermittent fasting just promotes extending the duration of your fast. The following intermittent fasting module (16/9 or Lean gains protocol) was followed:

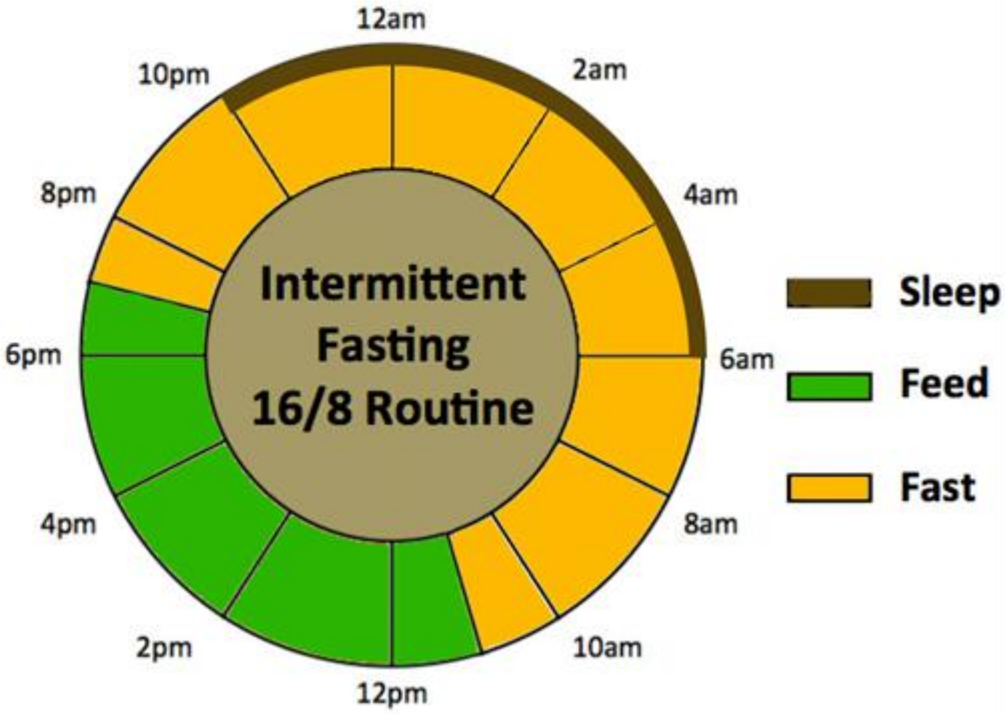


Figure 3.3: 16:8 hours Intermittent Fasting Schedule

3.7 Description of Low Carb High Fat Diet

A tentative diet chart has to be followed by the respondent during the 8-week period of Intermittent Fasting.

Table 3.7: Tentative Low carb High Fat (LCHF) diet Chart with intermittent fasting Design

(Total calorie restriction: 434 Cal As BMR: 1588, TEE: 2184)

(Hypothetical Data after Body composition Analysis: BCA)

Name: XYX	**Age**: 35 years	**Weight**:90kg	**Height:** 170cm	**BMI**: 27.77	**BMR**:1588

TEE: 2184	**LBM**: 58.50	**Body Fat%:** 35	**Kcal/day**: 1750	**Activity Level:** Light Active (multiply factor 1.375)

BMI: Body Mass Index	TEE: Total Energy Expenditure
BMR: Basal Metabolic Rate	LBM: Lean Body Mass

1. Breakfast (11:00 hrs)

Foods	Qnty	Carb /gr	Pro/ gr	Fats/ gr	Total Cal
Apple Cider Vinegar-in 200 ml water	10ml	N	N	N	0
Green Salad with 6g Olive Oil	60g	0	0	6	54
Leafy Veg (Sak- sariyah, Lai, Maricha)	60g	2.7	3.2	0.4	24
Leafy Veg (Spinach, Cabbage, Onion Leaf etc)	60g	2.7	3.2	0.4	24
Mix Veg - Broccoli, C/Flower, Tomato, Mushroom	100g	4.77H	3.1	0.28	38
Whole Egg	3	1.2	18	14.6	225
Mushroom/ Paneer 140g / Chicken 130g /Fish 150g	110g	0	32	4.4	199
coconut Oil for cooking	15g	0	0	15	135
Raw Coconut	10g	0.15	0.33	3.33	33
Almonds/ Recommended Dry Fruits	3	1	1.74	0.9	21

Non-GMO Soy Powder/ Drumstick Leaf Powder	10g	0.3	8	0.5	38
Ghee/ Coconut oil/Olive Oil for raw consumption	10g	0	0	10	90
Pink salt to used instead of sea salt	N	N	N	N	0
Peanut Butter 1 tbs * As per verbal Instructions	16g	3	4	8	94

2. Mid-day, lunch (14:00 hrs)

Foods	Qnty	Carb /gr	Pro/ gr	Fats/ gr	Total Cal
Bulletproof Coffee- 34g Amul Cream/ Coconut Oil 8ml	N	N	N	8	72
Adjusted only with fats & Protein in ----Kcal Max	N	N	N	N	0

3. Dinner (19:00 hrs)

Foods	Qnty	Carb /gr	Pro/ gr	Fats/ gr	Total Cal
Leafy Vegetable (Sak- Sariah, Lai, Maricha)	60g	2.7	2.2	0.3	23
Raw Ginger - 6-10 g	N	N	N	N	0
Leafy Veg (Spinach, Cabbage, Onion Leaf etc)	60g	1	3.2	0.04	16
Mix Veg - Broccoli, C/Flower, Tomato, Mushroom	100g	4.77	3.1	0.28	38
Whole Egg	3	1.2	18	14.4	225
Mushroom/ Paneer 80g / Chicken 110g /Fish 100g	110g	0	28	3.1	172

Almonds/ Recommended Dry Fruits	2	0.06	1.3	0.6	14
Oil for cooking/ Coconut Oil/ Ghee/ Olive Oil	15g	0	0	15	135
Ghee/ Coconut oil/Olive	10g	0	0	10	90
Pink salt to used instead of sea salt	N	N	N	N	0
Adjusted only by Protein & fats in 52Kcal Max	N	N	N	N	0
(Fish, Egg, Spinach, Pork only on calculations)	N	25.55	129.37	115.53	1760
Adjustments Carb - 12g adjusted as instructed verbally		5 +/-	2 +/-	5 +/-	-10
Total Calories per Day in maximum		N	N	N	1750
Other Periodic Adjustments		N	N	0	0
Macro Calculated Against - 1588 BMR & Surplus 162 Cal					1750

3.8 Description of the Resistance Training Programme

For the investigation, an 8-week training schedule was followed for the specific experimental group. FITT formula will be followed during the training schedule in each group. (Dragan Cvejic and Sergej Ostojić, 2017) The Intensity of this program will keep in 40% - 70 % of 1 RM. For the investigation, the study of the FITT formula was frame worked with Sri.D.C Bhargab, Sr. Fitness Trainer, Oil India Ltd and by the investigator himself. The resistance training program includes weight training, own bodyweight training, and cardio fitness training. The training schedule for the experimental group 3 (resistance training group) is mentioned in Table B

Table 3.8: Workout module for healthy ketosis on low carbohydrate high fat diet.

Monday	Activities	% of RM	Reps	Rest	Num. Of sets

Legs + Abs	Warming Up at Per Weather Condition				
	Barbell Full Squats	50-60%	8-12	45Sec	4sets
	Front Lunge Walk	50-70%	8-12	45Sec	4sets
	Leg Curl	50-70%	8-12	45Sec	4sets
	Leg Extension	50-60%	12-15	45Sec	4sets
	Glute Bridge	BWT	12-15	45Sec	4sets
	Seated Calf Raise	50-60%	12-15	45Sec	4sets
	Hanging Leg Raise	50-60%	12-15	45Sec	4sets
	Weighted Crunch	40-50%	15-30	45Sec	4sets

Tuesday: Rest

Wednesday	Activities	% of RM	Reps	Rest	Num. Of sets
PUSH Chest + Shoulder + Triceps	Warming Up at Per Weather Condition				
	Decline Bench Press	50-60%	8-12	45Sec	4sets
	Standing Incline chest fly	50-70%	8-12	45Sec	4sets
	Standing Fly	50-70%	12-15	45Sec	4sets
	Shoulder Press	50-60%	8-10	45Sec	4sets
	Close Grip Bench Press	60-70%	6-8	45Sec	4sets
	Skull Crusher	50-70%	8-12	45Sec	4sets
	Triceps Extension	50-70%	8-12	45Sec	4sets
	Lateral Fly	40-50%	15-30	45Sec	4sets

<u>Thursday: Rest</u>

Friday	Activities	% of RM	Reps	Rest	Num. Of sets
PULL Upper Back & Front Forearm	Warming Up at Per Weather Condition				
	Incline Dumbbell Alternative Curl	50-60%	12-15	45Sec	4sets
	Preacher Curls	50-70%	8-12	45Sec	4sets
	Barbell Deadlift	50-70%	8-12	45Sec	4sets
	Leg Curl	50-70%	12-15	45Sec	4sets
	Upright Row	50-60%	8-12	45Sec	4sets
	Weighted Crunch	40-50%	15-30	45Sec	4sets
	Plunk	BWT	Up to Failure	45Sec	3sets
	Split Leg Curling	BWT	12-15	45Sec	4sets

Saturday: Rest, and Sunday: Light Cardio-Base Recreational Activities, Deep relaxation, and Deep Recovery. This administration was continued up to 8 weeks of intervention.

3.8.1 Barbell Full Squats

Barbell Full Squats are compound workouts that effectively engage many muscle groups concurrently, rendering them very efficient for enhancing total strength. To execute a Barbell Full Squat with precision, it is imperative to commence by positioning a weighted barbell atop the upper back region while assuming a stance with the feet placed at a distance equivalent to the shoulders' width. Subsequently, researcher instruct persons take a profound squatting posture by flexing at the hips and knees until they reach a parallel position with the ground or lower if one's flexibility permits. The exercise is completed by extending both hips and knees while maintaining proper form. These squats offer several benefits beyond building leg strength alone. They engage muscles throughout the body, including quadriceps, hamstrings, glutes, core muscles (abdominals and spinal erectors), and upper back muscles responsible for stabilizing the weight during execution.

3.8.2 Front Lunge Walk

Front Lunge Walk is an exercise that targets similar muscle groups as Barbell Full Squats but emphasizes unilateral movement patterns that promote balance and coordination while strengthening gluteal muscles further. This exercise involves stepping forward with one leg until both knees reach 90-degree angles before returning to the starting position using the other leg. The researcher demonstrate to alternating legs with each step taken forward it engages more hip extensors on each side, creating balanced forces through the pelvis and enabling increased stability when executing these bilateral movements, resulting in better dynamic balance control and enhanced athleticism.

3.8.3 Leg Curl

The Leg Curl primarily targets the hamstrings—a group of three muscles at the back of the thigh. The hamstrings are vital in various physical activities such as walking, running, and jumping. Strengthening these muscles not only enhances overall leg strength but also contributes to improved athletic performance. To perform a Leg Curl correctly, the subjects were instructed to lie face down on a leg curl machine with their ankles secured under padded rollers. While keeping the hips stationary and engaging the core for stability, bending the knees against resistance contracts the hamstrings fully.

3.8.4 Leg Extension

In contrast to the previous exercise's focus on hamstring development, the Leg Extension primarily targets the quadriceps—the four muscles at the front of the thigh responsible for knee extension. Strong quadriceps are essential for activities involving squatting or lunging motions. Executing a proper Leg Extension, the subjects were instructed to sit on a machine designed specifically for this exercise with thighs resting against padded surfaces while shins are parallel to floor level. Extending knees until legs are straightened without locking them out completely engages the quadriceps effectively.

3.8.5 Glute Bridge

The Glute Bridge is an effective compound movement targeting multiple muscle groups, including glutes (gluteus maximus), hamstrings, and core stabilizers such as abdominal muscles (rectus abdominis) and erector spinal muscles along the spine. To efficiently achieve a Glute Bridge, the subjects were instructed to lie on their back, knees bent, and feet flat. A bridge-like position is achieved by contracting the glutes and raising the hips off the floor. This exercise can be modified by utilizing single-leg variations or adding resistance, such as barbells or bands, for progression.

3.8.6 Seated Calf Raise

The Seated Calf Raise primarily focuses on strengthening the muscles of the calf—the gastrocnemius and soleus muscles—which are essential for balance, stability, and propulsion during activities like walking, running, and jumping. To execute a Seated Calf Raise correctly, the subjects were instructed to sit on a machine with knees bent at 90 degrees while placing their toes on a platform. The heels are then raised against resistance until the calves reach full contraction before returning to the starting position.

3.8.7 Hanging Leg Raise

The utilization of hanging leg raises is a highly effective workout for specifically targeting the abdominal muscles. To perform this exercise correctly, the subjects were instructed to turn from a pull-up bar or similar apparatus with arms fully extended. The legs are lifted towards the chest by engaging the core muscles from this position. The proper form requires controlled movement throughout the range of motion. The primary muscles targeted during Hanging Leg Raises are the rectus abdominis and the hip flexors (Boyle et al., 2009). This exercise also engages other muscles in the core region, such as the obliques and transverse abdominis. By consistently incorporating Hanging Leg Raises into a fitness routine, individuals can strengthen their abdominal muscles, improve stability in daily activities, and potentially reduce lower back pain.

3.8.8 Weighted Crunch

Similar to traditional crunches, Weighted Crunches focus on strengthening the abdominal muscles. However, unlike regular crunches that rely solely on body weight resistance, Weighted Crunches incorporate additional weights to increase intensity and effectiveness.

To perform a Weighted Crunch correctly, the subjects were instructed to:

1) Put knees bent and lie flat on back.

2) Hold weights securely against the chest or behind the head.

3) Engage the core muscles while lifting the shoulders off the ground.

4) Slowly restore to the starting posture without straining the neck or back.

Weighted Crunches primarily activate the rectus abdominis. Incorporating weighted resistance challenges these muscle fibers further, increasing strength gains over time.

3.8.9 Decline Bench Press

Decline Bench Press is a traditional bench press exercise specifically targeting the chest muscles. To execute this exercise correctly, the subjects were instructed to lie on a decline bench with their head lower than their feet. The barbell is lifted and lowered towards the lower chest region, similar to a regular bench press. Decline Bench Press primarily engages the pectoralis major (chest) and triceps brachii (upper arm back). This exercise also activates secondary muscles, such as the deltoids and biceps, to stabilize movements. Incorporating the Decline Bench Press into a workout routine can be highly beneficial for developing upper body strength, particularly in the chest region. This exercise helps individuals improve their pushing power, enhance muscular endurance, and promote the balanced development of chest muscles.

3.8.10 Standing Incline Chest Fly

Standing Incline Chest Fly targets the pectoralis major muscle group while engaging shoulder muscles, including the deltoids. The subjects were instructed to Stand shoulder-width apart, individuals performed this exercise by holding dumbbells at arm's length and bringing them together in front of them while keeping them at arm's length. By performing Standing Incline Chest Flies consistently, individuals can achieve improved definition in their chest muscles. Additionally, this exercise contributes to overall upper body strength development by engaging multiple muscle groups simultaneously.

3.8.11 Standing Fly

The standing fly exercise primarily focuses on strengthening the chest muscles (pectoralis major) and engaging the anterior deltoids (front shoulder muscles). To perform this exercise correctly, the subjects were instructed to:

1. Assume an erect posture by positioning the feet at a distance equivalent to the breadth of the shoulders.

2. Hold dumbbells in hand at arm's length by the sides.

3. Slowly lift both arms outwards in an arc-like motion until they are parallel to the ground.

4. Pause momentarily before returning to the starting position.

Variations or modifications can be made based on individual fitness levels or goals:

- Resistance bands can replace dumbbells for individuals who prefer alternative equipment.
- Incline or decline bench positions can alter the angle of motion during execution.

3.8.12 Shoulder Press

The shoulder press is a fundamental exercise that targets multiple muscles, including the deltoids (shoulders), trapezius (upper back), and triceps (back of upper arms). Its significance lies in building functional upper body strength necessary for various physical activities. Here are step-by-step instructions on how to properly execute a shoulder press. The subjects were instructed to do exercise as below norms:

1. Stand or sit properly, ensuring the spine is straight.
2. Hold dumbbells or a barbell at shoulder level, palms facing forward.
3. Press the weights upwards until the arms are absolutely extended overhead.
4. Carefully return the weights to their initial place in a controlled manner.

To accommodate different fitness levels, alternative techniques and variations can be employed:

- Seated shoulder press reduces strain on the lower back for individuals with pre-existing conditions.
- Single-arm dumbbell presses can enhance core stability and address muscle imbalances.

3.8.13 Close Grip Bench Press

The close grip bench press explicitly targets the triceps (back of upper arms) while engaging additional muscles such as the chest and shoulders. It plays a significant role in physical education by strengthening these muscle groups necessary for pushing movements in various sports activities. To perform this exercise correctly, the subjects were instructed to:

1. Lie flat on a bench with feet firmly planted.
2. Grasp the barbell with hands slightly narrower than shoulder-width apart.

3. Lower the barbell towards the chest while keeping elbows close to the sides.

4. Push the weight until the arms are fully extended without locking the elbow joint.

Proper form, positioning, and technique are crucial when performing close grip bench press exercises:

- Maintain an adequate arch in the lower back for optimal spinal alignment during execution.
- Control upward and downward movement phases, avoiding bouncing off the chest or jerking motions.

3.8.14 Skull Crusher

The skull crusher exercise primarily engages the triceps muscles (back of upper arms). This exercise involves lying on a bench, holding a weighted barbell or dumbbell directly above the forehead, and bending the elbows to lower the weight towards the head before extending it back up. In executing this exercise correctly, the subjects were instructed to do exercise as below norms:

- Maintain proper form by keeping the upper arms perpendicular to the floor while lowering and raising the weights.
- Emphasize controlled movement and avoid excessive momentum.

Benefits of these Exercises

Incorporating exercises such as Standing Fly, Shoulder Press, Close Grip Bench Press, and Skull Crusher into a workout routine or physical education curriculum yields numerous benefits:

1. Muscular strength development: These exercises target key muscle groups involved in functional movements required in daily activities or sports.
2. Stability improvement: Engaging various muscle groups strengthens primary movers and stabilizers, enhancing overall stability during movements.
3. Injury prevention: Strengthening specific muscles can help prevent injuries associated with weak or imbalanced muscle groups.

3.8.15 Triceps Extension

In terms of exercise, Triceps Extensions are primarily used for targeting the triceps muscles found at the back of the upper arm. This exercise is crucial in upper body strength training as it helps build strong arms while improving functional movement patterns. To perform Triceps Extension correctly, the subjects were instructed to start by standing or sitting upright with a dumbbell held firmly in both hands overhead. The individual should slowly lower the weight behind their head until their elbows reach the arms and are extended back to the starting position after reaching a 90-degree angle. The benefits of Triceps Extension extend beyond just strengthening the triceps muscles; this exercise also engages secondary muscles such as the shoulders and core stabilizers. Moreover, by performing this exercise correctly and adequately, individuals can avoid unnecessary strain on other joints or muscles.

3.8.16 Lateral Fly

Lateral Fly is an effective exercise targeting specific muscle groups such as the deltoids (shoulders) and pectoralis major (chest). This exercise enhances shoulder stability while promoting balanced muscular development in the upper body. To execute Lateral Fly properly, the subjects were instructed to begin by holding dumbbells at their sides with palms facing inward towards each other. Subsequently, individuals must to elevate both upper limbs laterally, away from their torso, until they attain a position parallel to the shoulders, followed by a gradual descent down to the initial stance. Lateral Fly offers numerous advantages for individuals looking to strengthen and tone their upper body. Individuals can improve shoulder mobility and stability by engaging the deltoids, essential for many daily activities and sports. However, it is crucial to be cautious while performing this exercise as incorrect form or using too heavy weights may lead to strain or injury.

3.8.17 Incline Dumbbell Alternative Curl

Incline Dumbbell Alternative Curl targets the upper arm's biceps muscles and helps build strength, size, and definition in this area. This exercise offers a variation to traditional standing curls by incorporating an incline bench. To perform the Incline Dumbbell Alternative Curl correctly, the subjects were instructed to begin by sitting on an incline bench with dumbbells held at arm's length along both sides of the body. The individual should then lift one dumbbell towards the shoulder while keeping the opposite arm stationary before alternating arms throughout each repetition. The benefits of Incline Dumbbell Alternative Curl extend beyond just developing muscular biceps; this exercise also engages other muscle groups, such as the forearms and stabilizing core muscles. Moreover, individuals can modify this exercise by adjusting their hand position or using different equipment, such as resistance bands, to provide additional variety to their workout routine.

3.8.18 Preacher Curls

Preacher Curls are a popular bicep exercise that effectively isolates and targets these specific muscles. Individuals can maintain strict form throughout each repetition by utilizing a preacher curl bench or an inclined surface for support. To execute Preacher Curls properly, the subjects were instructed to start by positioning oneself on a preacher curl bench with arms fully extended and palms facing upward, gripping a barbell or dumbbells. Keeping the upper arms firmly planted against the pad, one can slowly return to the starting position by flexing their elbows. Preacher Curls offer numerous advantages when incorporated into a comprehensive workout routine. By isolating the biceps muscles, individuals can achieve greater muscle activation and hypertrophy than other exercises. However, it is essential to note that incorrect form or excessive weight can increase the risk of strain or injury on the elbow joint.

3.8.19 Barbell Deadlift

It is an excellent compound workout that primarily affects the muscles in the lower extremities, especially the glutes and hamstrings. It also engages several muscles in the upper body, including the erector spinal muscles of the back. The benefits of incorporating Barbell Deadlifts into a workout routine include increased overall strength and power production.

To perform a Barbell Deadlift with proper form and technique, the subjects were instructed as follows:

1. Assume a stance in which the feet are positioned at a distance equivalent to the width of the shoulders, with the toes angled slightly outward.
2. Bend down while keeping back straight and grasp the barbell with an overhand grip.
3. Engage core muscles as a lift by pushing through heels.
4. Stand up straight while lifting the bar toward hips.
5. Lower the bar back down under control while maintaining proper posture.

3.8.20 Leg Curl

The Leg Curl primarily targets the muscles in the posterior chain, specifically the hamstrings. Lower body strength and stability are improved with this exercise.

To properly perform a Leg Curl exercise, the subjects were instructed to:

1. Adjust the leg curl machine to fit the body height and leg length.
2. Lie face down on the machine with the legs extended straight.
3. Place the ankles under the padded bar or roller.
4. Slowly bend the knees to lift the padded bar toward the glutes.
5. Contract the hamstrings at the movement's top, then slowly lower back down.

3.8.21 Upright Row

The Upright Row is a sufficient compound exercise primarily targeting critical upper body muscle groups such as deltoids, trapezius, and rhomboids. This exercise is crucial for improving overall upper body strength and posture.

A proper upright row, the subjects were instructed to do as follows:

1. Put an overhand grip on a barbell or dumbbell and stand straight with the feet shoulder-width apart.
2. Retain the elbows close to the body as you lift weights vertically towards chin level, bending them until they're parallel to the ground or slightly higher.
3. Pause momentarily at peak contraction before lowering the weight under control.

3.8.22 Weighted Crunch

Weighted crunches are a widely utilized workout that predominantly focuses on the rectus abdominis muscle group, colloquially referred to as the "six-pack" muscles. To do this exercise with precision, the subjects were instructed to assume a supine position with their feet in contact with the ground and their knees flexed. Grasp a weight plate or dumbbell with both hands and position it against your chest. To initiate the movement, activate your abdominal muscles to elevate your head, neck, and shoulders from the ground. Simultaneously, exhale gradually. During the descent phase, it is recommended to inhale as you lower your body back down to the initial position. The benefits of incorporating weighted crunches into a workout routine are numerous. Firstly, they significantly strengthen the abdominal muscles by providing resistance through added weight. This improves stability and posture in everyday activities such as sitting or standing upright. Additionally, weighted crunches enhance overall core strength, improving athletic performance in sports requiring rotational movements.

3.8.23 Plank

Planks are an isometric exercise that simultaneously engages multiple muscle groups to stabilize the body in an upright position from head to toe. To perform a plank correctly, the subjects were instructed to start by assuming a push-up role with elbows bent at 90 degrees directly under your shoulders and forearms resting flat on the ground parallel to each other. Keep your body straight without allowing it to sag or lift too high off the ground. During a plank exercise, several major muscle groups work together synergistically, including the abdominals and the erector spine (lower back), hip flexors, glutes, and shoulder stabilizers. This comprehensive muscle engagement strengthens the core region, improving posture and spinal stability.

3.8.24 Split Leg Curling

Split leg curling explicitly targets the hamstrings at the thigh's back. To execute this exercise correctly, the subjects were instructed to assume a prone position on a leg curl machine, with the lower limbs on two distinct pads. Initiate the contraction of the hamstrings to elevate both lower limbs towards the gluteal region while ensuring that the thighs remain in contact with the bench surface. Slowly lower them back down under control. The primary muscles worked during split leg curling are the hamstring group, consisting of three main muscles: biceps femoris, semitendinosus, and semimembranosus. These powerful hip extensors are crucial in various activities such as walking, running, and jumping. Individuals can benefit from increased hamstring strength and flexibility by integrating split leg curling into a workout regimen. Enhanced hamstring strength contributes to enhanced athletic performance by positively impacting running speed and agility while mitigating the likelihood of injury during activities that entail forceful lower-body motions.

3.9 Composite Training Programme

The training protocol for experimental group 4, alternatively referred to as the composite training group, is available in Table B This training regimen comprises a deliberate blend of intermittent fasting, a Low-Carb High-Fat Diet, and Resistance exercise.

3.10 Control Group

The control group was designated as the fifth group in this investigation. This group did not receive any form of training programme.

CHAPTER 4

RESULTS AND DISCUSSION

This chapter is divided into two distinct sections: the first section provides an interpretation of the study's findings, while the second section delves into a discussion of those findings. The results portion of the study encompasses the pre-and post-test means, as well as the analysis of covariance, hypothesis testing, and post-hoc comparisons. Further elaboration on the results is presented in the latter part of this chapter.

4.1 Result and Interpretation Pertaining to Heart Rate

Table 4.1.1 Analysis of Pre and Post-Test between Experimental and Control Group on the Variable Hear Rate.

Groups		Heart Rate Pre	Heart Rate Post
Composite Group	Mean	79.37	77.58
	N	19	19
	Std. Deviation	7.365	5.709
Control Group	Mean	80.75	80.50
	N	20	20
	Std. Deviation	4.723	4.752
Intermittent Fasting	Mean	78.58	78.32
	N	19	19
	Std. Deviation	7.419	7.417
LCHF Groups	Mean	79.37	78.63
	N	19	19
	Std. Deviation	7.365	6.500
Resistance Group	Mean	79.70	78.70
	N	20	20
	Std. Deviation	7.841	6.899
Total	Mean	79.57	78.76
	N	97	97
	Std. Deviation	6.910	6.260

The values pertaining to observed Mean and SD are as follows:

Pre-test Mean: Intermittent fasting 78.58, LCHF 79.37, Resistance Training 79.70, Composite 79.37 and Control 80.75. Pre-test SD: Intermittent fasting 7.419, LCHF

7.365, Resistance Training 7.841, Composite 7.365 and Control 4.723. Post-test Mean: Intermittent fasting 78.32, LCHF 78.63, Resistance Training 78.70, Composite 77.58 and Control 80.50. Post-test SD: Intermittent fasting 7.417, LCHF 6.500, Resistance Training 6.899, Composite 5.709 and Control 4.752, respectively, respectively.

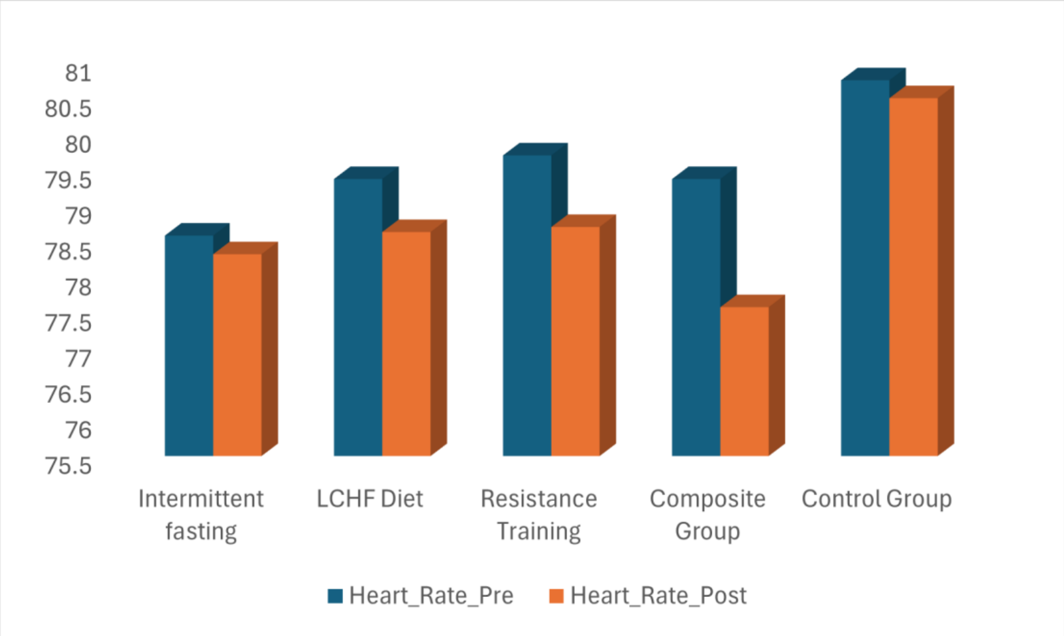


Figure 4.1

Graphical Presentation of Pre- and Post-Test Means of Intermittent Fasting, LCHF Diet, Resistance Training, Composite, and Control Group on the Variable Heart Rate among Obese Population.

Table 4.1.2: Investigation of Co-Variance concerning four Experimental groups alongside a Control group on Heart Rate.

Univariate Tests

Dependent Variable: Heart Rate Post

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	37.029	4	9.257	.737	.569	.031
Error	1142.850	91	12.559			

The F tests the effect of Groups. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

Table 4.1.2 displays the F-value for assessing adjusted means across four treatment categories (Intermittent Fasting, LCHF Diet, Resistance Training, and Composite) in the post-test analysis of Heart Rate. The p-value associated with the F-statistic is .569, indicating statistical significance at the 0.05 level. As a result, the hypothesis (H0) stating "There is a significant effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables – Heart Rate" is refuted. Consequently, the research hypothesis (H1) asserting "There is a significant effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables – Heart Rate" is denied. Additionally, given the significance of the F-statistic, a post-hoc comparison of adjusted means among the five treatment groups for Heart Rate post-testing in obese individuals was conducted, with the findings depicted in **Table 4.1.3**.

Table 4.1.3: Examining the variances in Adjusted Post-test Paired Means of Experimental groups against the Control group, analyzing post hoc changes in Heart Rate.

Multiple Comparisons

Dependent Variable: Heart_Rate_Post
Tukey HSD

(I) Groups	(J) Groups	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Intermittent fasting	LCHF Diet	-.316	2.049	1.000	-6.02	5.39
	Resistance Training	-.384	2.023	1.000	-6.01	5.25
	Composite Group	.737	2.049	.996	-4.97	6.44
	Control Group	-2.184	2.023	.817	-7.81	3.45
LCHF Diet	Intermittent fasting	.316	2.049	1.000	-5.39	6.02
	Resistance Training	-.068	2.023	1.000	-5.70	5.56
	Composite Group	1.053	2.049	.986	-4.65	6.75
	Control Group	-1.868	2.023	.887	-7.50	3.76
Resistance Training	Intermittent fasting	.384	2.023	1.000	-5.25	6.01
	LCHF Diet	.068	2.023	1.000	-5.56	5.70
	Composite Group	1.121	2.023	.981	-4.51	6.75
	Control Group	-1.800	1.997	.896	-7.36	3.76
Composite Group	Intermittent fasting	-.737	2.049	.996	-6.44	4.97
	LCHF Diet	-1.053	2.049	.986	-6.75	4.65
	Resistance Training	-1.121	2.023	.981	-6.75	4.51
	Control Group	-2.921	2.023	.601	-8.55	2.71
Control Group	Intermittent fasting	2.184	2.023	.817	-3.45	7.81
	LCHF Diet	1.868	2.023	.887	-3.76	7.50
	Resistance Training	1.800	1.997	.896	-3.76	7.36
	Composite Group	2.921	2.023	.601	-2.71	8.55

Comparison of groups with Significant Differences:

Table 4.1.3 presents statistical findings indicating the significance levels of various group comparisons, revealing no significant differences among the intermittent fasting, resistance training, composite, and control groups. The comparisons between intermittent fasting and resistance training, intermittent fasting and composite, intermittent fasting and control, resistance training and control, LCHF Diet and control, and composite and control groups all showed a lack of significant differentiation in the adjusted mean scores. Similarly, the p-values for the differences in mean scores between the intermittent fasting and LCHF Diet group, resistance training and LCHF Diet group, resistance training and composite group, and LCHF Diet and control group were 1.000, 1.000, .981, and .887, respectively, all exceeding the predetermined threshold of $p > .05$, indicating insignificance at the 5% level. Consequently, the conclusions drawn are that there is no notable variance in adjusted mean scores between the intermittent fasting and LCHF Diet groups, resistance training and LCHF Diet groups, resistance training and composite groups, and LCHF Diet and composite groups.

4.1.2 Discussion on results pertaining to the effect of intermittent fasting on Heart Rate

Discussion of Intermittent fasting on Heart Rate

The recorded adjusted mean values (Table 4.1.1) across the intermittent fasting treatment group reveal a positive effect on heart rate modulation. Notably, intermittent fasting exhibited the most substantial reduction, with the heart rate decreasing from an initial value of 79.37 to 77.57. The present study's results show significant differences in intermittent fasting in reducing the Heart Rate of the samples. The present study's results show no significant differences in intermittent fasting in reducing the heart rate of the samples involved in the present investigation.

According to Billman, (2006) “Intermittent fasting serves as a holistic approach to cardiovascular wellness by optimizing metabolic processes and autonomic nervous system regulation. Furthermore, decreased activity in the sympathetic nervous system and improved muscular efficiency contribute to the reduction in heart rate. These adaptations enhance both cardiac output and oxygen delivery, culminating in a lower resting heart rate.” The results of the present investigation are in line with Dong et al., (2020). Dong et al., (2020) focus on restricting the daily eating period to 16-hour fasts with an 8-hour feeding window and found that “intermittent fasting has been shown to have an impact on heart rate variability, specifically impacting the higher-frequency segment of heart rate variability spectra, indicative of parasympathetic activity.”

Similar findings were also corroborated in the study conducted by Dong et al., (2020) as documented in their article. This convergence of results underscores the robustness and reliability of the observed phenomenon.

Discussion of Low Carb High Fat Diet on Heart Rate

The recorded adjusted mean values (Table 4.1.1) across the Low Carb High Fat Diet treatment group reveal a positive effect on heart rate modulation. Notably, the Low Carb High Fat Diet exhibited the substantial reduction, with the heart rate decreasing from an initial value of 79.37 to 78.63. The present study's results show significant differences in Low Carb High Fat Diet treatment group in reducing the Heart Rate of the samples. Dowis & Banga, (2021) justified in his article that "Managing blood sugar and inflammation with a low-carb, high-fat diet lowers heart rate and improves cardiovascular health. Avoiding carbs reduces blood glucose spikes and cardiac stress. Healthy fats provide energy without generating fast metabolic changes, calming the body and lowering heart rate."

According to Dowis & Banga (2021) "low-carb high-fat diet serves as a holistic approach to cardiovascular wellness by optimizing metabolic processes and autonomic nervous system regulation. Furthermore, decreased activity in the sympathetic nervous system and improved muscular efficiency contribute to the reduction in heart rate. These adaptations enhance both cardiac output and oxygen delivery, culminating in a lower resting heart rate". The results of the present investigation are in line with (Dostal et al., 2019). (Dostal et al., 2019) focuses notable decrease in mean heart rate following a 12-week intervention period. Our current research aligns closely with the findings reported by (Dostal et al., 2019), indicating a similar trend of reduced heart rate in response to dietary interventions. This consistency between studies suggests a reproducible effect of dietary composition on heart rate modulation. Such resemblance further strengthens the evidence base surrounding the impact of dietary factors on cardiovascular physiology and underscores the importance of dietary interventions in managing heart rate dynamics.

Discussion of Resistance Training on Heart Rate

The recorded adjusted mean values (Table 4.1.1) across the Resistance Training treatment group reveal a positive effect on heart rate modulation. Notably, the Resistance Training treatment group exhibited the substantial reduction, with the heart rate decreasing from an initial value of 79.7 to 78.7. The present study's results show significant differences in intermittent fasting in reducing the heart rate of the samples involved in the present investigation. It has been observed by the investigator that resistance group in reducing the Heart Rate of the samples. Selig et al., (2004) justified in his article that "Resistance training lowers heart rate by improving cardiac efficiency. A stronger heart muscle pumps blood more efficiently with each contraction from resistance training. Improved efficiency lowers the heart's workload and resting heart rate. Resistance Training promotes cardiovascular health, autonomic nervous system balance, and sympathetic tone."

The results of the present investigation are in line with the findings from Dyńka et al., (2023), Jabekk et al., (2010), and Jenkins et al., (2014) are consistent with the results obtained in this study, suggesting that over the course of 13 weeks, participants' heart rates exhibited varied within a narrow range. The consistency between our findings and those reported by Dyńka et al. (2023) suggests a degree of reliability and validity in the observed trends.

Discussion of Composite group on Heart Rate

The recorded adjusted mean values (Table 4.1.1) across the Composite treatment group reveal a positive effect on heart rate modulation. Notably, the Composite treatment group exhibited the substantial reduction, with the heart rate decreasing from an initial value of 79.37 to 77.57.

The present study's results show significant differences in composite group training in reducing the heart rate of the samples involved in the present investigation. It has been observed by the investigator that results show significant differences in Composite treatment group in reducing the Heart Rate of the samples. (Zuo et al., 2016) justified in his article that "Intermittent fasting, keto diet, and resistance training lower heart rate together. Energy and cardiovascular efficiency improve with intermittent fasting. Heart health is improved by the Keto diet's blood sugar stabilization and inflammation reduction. The cardiac muscle pumps better with Resistance Training. A lower heart rate results from their complete cardiovascular approach."

The results of the present investigation are in line with (Vargas et al., 2018) examined the impact of a ketogenic low-carbohydrate, high-fat (K-LCHF) diet on maximal heart rate (HRmax) during graded exercise. Drawing from the insights it can be inferred that while a noteworthy difference in HRmax was observed between the K-LCHF diet groups, the incorporation of a ketogenic intermittent fasting combination involving ketogenic principles, intermittent fasting, interval training, and adherence to a caloric deficit may yield a notable effect on the heart rate response. The consistency between our findings and those reported by Vargas et al., (2018) suggests a degree of reliability and validity in the observed trends.

4.1.3 Post hoc Result Discussion on Heart Rate

The Composite Group was the most effective in achieving a higher post-intervention mean heart rate, outperforming the Control, Intermittent Fasting, and LCHF Diet groups, with significant mean differences and confidence intervals that do not cross zero. Although the Resistance Training group showed a higher mean heart rate than the Control and Intermittent Fasting groups, it was not indicated to surpass the Composite Group. Consequently, the Composite Group was the most effective at raising the mean heart rate post-intervention compared to the other groups mentioned. The findings from the present post hoc results closely align with those of Dyńka et al., (2023), who found that the combination of IF, LCHF diet, and resistance training was the most effective in achieving a higher post-intervention mean heart rate, outperforming the other intervention groups.

4.1.4 Post hoc Result Summary on Heart Rate

The key findings from the results are:

1. The Composite Group has a higher mean heart rate than the Control Group, Intermittent Fasting, and LCHF Diet groups, as indicated by the significant mean differences and confidence intervals not crossing zero.
2. The Resistance Training group also had a greater mean heart rate than the Control and Intermittent Fasting groups.
3. The LCHF Diet group does not show significant differences in mean heart rate compared to the Control and Intermittent Fasting groups.
4. The mean heart rate of the intermittent fasting group is not significantly different from that of the Control Group.

These results suggest that the Composite Group and Resistance Training interventions were associated with higher post-intervention heart rates than other groups or control conditions. This could potentially be related to the physiological effects of the interventions on cardiovascular function or overall fitness levels.

Resistance training reduces resting heart rate by improving cardiovascular fitness and increasing stroke volume. As the heart becomes stronger and more efficient, it can pump more blood per contraction, reducing the need for a higher heart rate to supply oxygenated blood to the body at rest.

4.2.1 Result and Interpretation Pertaining to Blood Pressure

Table 4.2.1 Analysis of Pre and Post-Test between Experimental and Control Group on the Variable Blood Pressure.

Report

Groups		Blood Pressure Systolic Pre	Blood Pressure Diastolic Pre	Blood Pressure Systolic Post	Blood Pressure Diastolic Post
Composite Group	Mean	129.26	79.00	129.58	77.58
	N	19	19	19	19
	Std. Deviation	6.497	3.972	4.959	4.181
Control Group	Mean	129.75	77.80	129.85	77.50
	N	20	20	20	20
	Std. Deviation	5.025	3.942	4.977	4.085
Intermittent Fasting	Mean	130.11	78.74	129.74	77.79
	N	19	19	19	19
	Std. Deviation	6.887	4.677	5.162	4.049
LCHF Groups	Mean	130.47	79.53	130.53	78.47
	N	19	19	19	19
	Std. Deviation	5.815	4.325	4.611	4.671
Resistance Group	Mean	127.20	79.90	127.50	79.75
	N	20	20	20	20
	Std. Deviation	6.118	3.684	5.643	3.522
Total	Mean	129.34	78.99	129.42	78.23
	N	97	97	97	97
	Std. Deviation	6.076	4.107	5.086	4.114

The recorded Mean and SD values are provided as follows:

Pre-test Mean: Intermittent fasting 130.11/78.74, LCHF 130.47/79.53, Resistance Training 127.20/79.9, Composite 129.26/79.00 and Control 129.75/77.80. Pre-test SD: Intermittent fasting 6.887/4.677, LCHF 5.815/4.325, Resistance Training 6.118/3.684, Composite 6.497/3.972 and Control 5.025/3.942. Post-test Mean: Intermittent fasting 129.74/77.79, LCHF 130.53/78.47, Resistance Training 127.50/79.75, Composite 129.58/77.58 and Control 129.85/77.50 Post-test SD: Intermittent fasting 5.162/4.049, LCHF 4.611/4.671, Resistance Training 5.643/3.522, Composite 4.959/4.181 and Control 4.977/4.085 respectively.

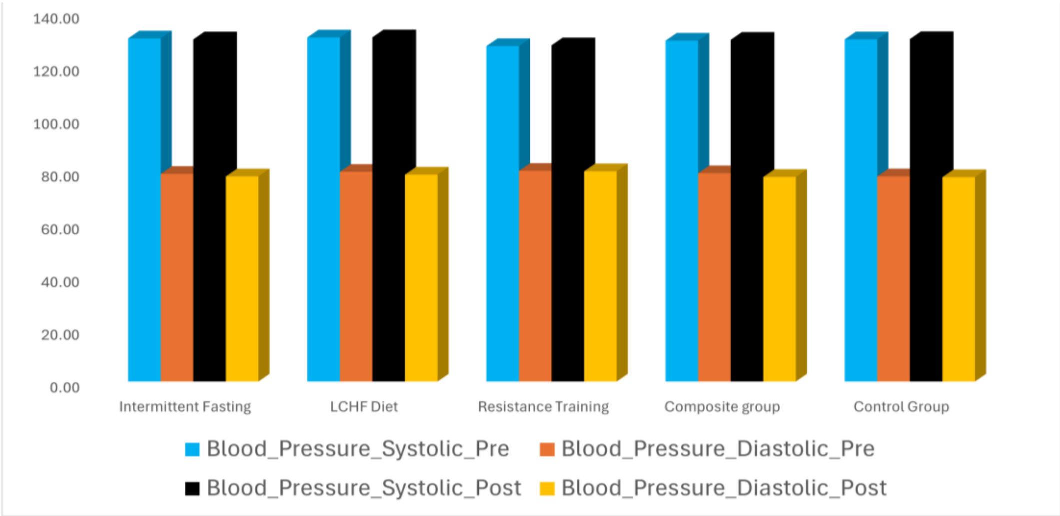


Figure 4.2: Graphical representation of the mean Blood Pressure measurements among obese individuals in the IF, LCHF, Resistance, Composite, and Control Groups before and after the intervention.

Table 4.2.2

The analysis of covariance (ANCOVA) was conducted to compare the Blood Pressure among four experimental groups and one control group.

Univariate Tests

Dependent Variable: Blood Pressure Systolic Post

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	8.090	4	2.023	.238	.916	.010
Error	774.772	91	8.514			

Dependent Variable: Blood Pressure Diastolic Post

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	26.057	4	6.514	.717	.582	.031
Error	826.600	91	9.084			

The F tests the effect of Groups. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

The F-value presented in **Table 4.2.2** is utilized for the purpose of comparing the adjusted means of blood pressure across five treatment groups (Intermittent Fasting LCHF diet, Resistance Training, composite, and control) during post-testing. The p-value for the F-statistic is .916/.582 in Systolic and Diastolic blood pressure, demonstrating statistical significance at the 0.05 significance level. Thus, hypothesis H(0), which asserts that there is substantial disparity in the corrected post-test averages of blood pressure across the five treatment groups was refuted. Thus, the research hypothesis H2, "There is a significant effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables – Blood Pressure," is refuted. Additionally, due to the substantial F-statistic, a post-hoc comparison was conducted to analyze the adjusted averages of the five treatment groups in relation to the post-testing of blood pressure among obese people. The outcomes are exhibited in **Table 4.2.3**.

Table 4.2.3 A post-hoc assessment was accomplished to compare the adjusted post-test paired means of the experimental and control groups in assessing Blood Pressure.

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) Groups	(J) Groups	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Blood_Pressure_Systolic_Post	Intermittent Fasting	LCHF Diet	-.789	1.650	.989	-5.38	3.80
		Resistance Training	2.237	1.630	.647	-2.30	6.77
		Composite group	.158	1.650	1.000	-4.43	4.75
		Control Group	-.113	1.630	1.000	-4.65	4.42
	LCHF Diet	Intermittent Fasting	.789	1.650	.989	-3.80	5.38
		Resistance Training	3.026	1.630	.348	-1.51	7.56
		Composite group	.947	1.650	.979	-3.65	5.54
		Control Group	.676	1.630	.994	-3.86	5.21
	Resistance Training	Intermittent Fasting	-2.237	1.630	.647	-6.77	2.30
		LCHF Diet	-3.026	1.630	.348	-7.56	1.51
		Composite group	-2.079	1.630	.707	-6.61	2.46
		Control Group	-2.350	1.609	.590	-6.83	2.13
	Composite group	Intermittent Fasting	-.158	1.650	1.000	-4.75	4.43
		LCHF Diet	-.947	1.650	.979	-5.54	3.65
		Resistance Training	2.079	1.630	.707	-2.46	6.61
		Control Group	-.271	1.630	1.000	-4.81	4.26
	Control Group	Intermittent Fasting	.113	1.630	1.000	-4.42	4.65
		LCHF Diet	-.676	1.630	.994	-5.21	3.86
		Resistance Training	2.350	1.609	.590	-2.13	6.83
		Composite group	.271	1.630	1.000	-4.26	4.81
Blood_Pressure_Diastolic_Post	Intermittent Fasting	LCHF Diet	-.684	1.334	.986	-4.40	3.03
		Resistance Training	-1.961	1.317	.573	-5.63	1.70
		Composite group	.211	1.334	1.000	-3.50	3.92
		Control Group	.289	1.317	.999	-3.38	3.95
	LCHF Diet	Intermittent Fasting	.684	1.334	.986	-3.03	4.40
		Resistance Training	-1.276	1.317	.868	-4.94	2.39
		Composite group	.895	1.334	.962	-2.82	4.61
		Control Group	.974	1.317	.947	-2.69	4.64
	Resistance Training	Intermittent Fasting	1.961	1.317	.573	-1.70	5.63
		LCHF Diet	1.276	1.317	.868	-2.39	4.94
		Composite group	2.171	1.317	.471	-1.49	5.84
		Control Group	2.250	1.300	.421	-1.37	5.87
	Composite group	Intermittent Fasting	-.211	1.334	1.000	-3.92	3.50
		LCHF Diet	-.895	1.334	.962	-4.61	2.82
		Resistance Training	-2.171	1.317	.471	-5.84	1.49
		Control Group	.079	1.317	1.000	-3.59	3.74
	Control Group	Intermittent Fasting	-.289	1.317	.999	-3.95	3.38
		LCHF Diet	-.974	1.317	.947	-4.64	2.69
		Resistance Training	-2.250	1.300	.421	-5.87	1.37
		Composite group	-.079	1.317	1.000	-3.74	3.59

Comparison of groups with Insignificant Differences:

The p-values for the mean differences between various groups were as follows: Intermittent fasting vs. LCHF group (p = .989/.986), Intermittent fasting vs. composite group (p = 1.000/1.000), Intermittent fasting vs. control group (p = 1.000/.999), LCHF group vs. control group (p = .994/.947), Resistance Training group vs. control group (p

= .590/.421), and composite group vs. control group (p = 1.000/1.000), as shown in Table 4.1.3. Since all these p-values are above the threshold of p>.05, they are considered statistically insignificant at a 5% significance level. Furthermore, **Table 4.2.3** reports the p-values for the mean score differences between other group comparisons: intermittent fasting vs. resistance training (.647/.573), LCHF vs. resistance training (.348/.868), LCHF vs. composite group (.979/.962), and resistance training vs. composite group (.707/.471). Again, since these values exceed the threshold of p>.05, they are also deemed statistically insignificant at the 5% significance level. Consequently, the findings indicate no significant differences in adjusted mean scores among the various groups, including Intermittent fasting vs. LCHF, Intermittent fasting vs. composite, Intermittent fasting vs. control, LCHF vs. control, intermittent fasting vs. resistance training, LCHF vs. resistance training, LCHF vs. composite, and resistance training vs. composite.

4.2.2 Discussion on results pertaining to the effect of intermittent fasting on Blood Pressure

Discussion on result pertaining to effect of intermittent fasting on Blood pressure

The recorded adjusted mean values **(Table 4.2.1)** across the Intermittent fasting treatment group reveal a positive effect on Blood pressure modulation. Notably, the IF exhibited the most substantial reduction, with the Blood pressure decreasing from an initial value of 129.80/78.80 to 123.25/73.90. The present study's results show significant differences in intermittent fasting in reducing the blood pressure of the samples involved in the present investigation. It has been observed by the investigator that in Intermittent fasting in reducing the blood pressure of the samples. 16/8 Intermittent fasting lowers blood pressure through multiple mechanisms. It promotes weight loss, boosts insulin sensitivity, and decreases inflammation. By regulating blood sugar levels more efficiently, fasting helps reduce blood pressure. Additionally, it triggers cellular repair processes, improving cardiovascular function and reducing arterial pressure.

According to “Correction to: Restructuring the Gut Microbiota by Intermittent Fasting Lowers Blood Pressure,” (2022) Justify that “16/8 Intermittent fasting lowers blood pressure by encouraging weight reduction, insulin sensitivity, and inflammation. Fasting helps the body control blood sugar, lowering blood pressure. Intermittent fasting activates cellular repair mechanisms, improving cardiovascular function and lowering arterial pressure."

The results of the present investigation are in line with Chair et al., (2022b) and Erdem et al., (2018) established that 16/8 Intermittent fasting has been associated with improvements in blood pressure levels. Studies have shown that it can lead to reductions in blood pressure, which is a significant risk factor for cardiovascular diseases. Such resemblance further strengthens the evidence base surrounding the impact of intermittent fasting on cardiovascular physiology and underscores.

Discussion of Low-Carb High-Fat Diet on Blood pressure

The recorded adjusted mean values **(Table 4.2.1)** across the low-carb high-fat diet treatment group reveal a positive effect on Blood pressure modulation. Notably, the low-carb high-fat diet exhibited a nominal reduction, with the heart rate decreasing from an initial value of 130.47/79.53 to 130.53/78.47. The present study's results show significant differences in low-carb high-fat diet in reducing the blood pressure of the samples involved in the present investigation. It has been observed by the investigator that the LCHF diet reduces blood pressure through weight loss, reduces inflammation, and improves insulin sensitivity. By restricting carbs and increasing healthy fats, the body enters ketosis, burning fat for energy. This lowers fluid retention and blood volume, decreasing blood pressure.

In alignment with the findings of Chair et al., (2022a), it was demonstrated that the "ketogenic diet decreases blood pressure by promoting weight loss, reducing inflammation, and improving insulin sensitivity. This diet produces ketosis by limiting carbs and increasing healthy fats, which are used for energy. This metabolic shift lowers blood pressure by reducing fluid retention and volume. Ketones may also directly dilate blood vessels, regulating blood pressure."

The results of the present investigation are in line with Anderssen et al., (1995); Chair et al., (2022a) dietary intervention led to a significant decrease in systolic and diastolic blood pressure compared to the control group. Additionally, the study showed that the net difference in diastolic blood pressure was comparable to other controlled dietary intervention studies, indicating a substantial reduction in blood pressure with dietary changes, indicating a similar trend of reduced heart rate in response to dietary interventions. Such resemblance further strengthens the evidence base surrounding the impact of dietary factors on cardiovascular physiology and underscores the importance of dietary interventions in managing blood pressure dynamics.

Discussion of Resistance Training on Blood pressure

The recorded adjusted mean values **(Table 4.2.1)** across the resistance training treatment group reveal a positive effect on blood pressure modulation. Notably, the resistance training treatment group exhibited the substantial reduction, with the Blood pressure decreasing from an initial value of 127.20/79.9 to 127.50/79.75. The present study's results show significant differences in low-carb high-fat diet in reducing the blood pressure of the samples involved in the present investigation. It has been observed by the investigator that resistance training's limited impact on blood pressure can be attributed to its acute effects on vascular resistance. While it temporarily elevates blood pressure during exertion, long-term adaptations like increased cardiac output and arterial compliance offset these spikes. Moreover, resistance training promotes favorable changes in body composition, reducing risk factors for hypertension. However, its effects may vary depending on individual factors like intensity, duration, and adherence.

According to Collier et al., (2008) established that moderate-intensity resistance exercise can be an effective alternative to aerobic exercise in lowering blood pressure in a pre-hypertensive population, without the need for weight loss. The differences may be due to intensity of the training and periodization of the module and sample size.

Discussion of Composite group on Blood pressure

The recorded adjusted mean values **(Table 4.2.1)** across the Composite treatment group reveal a positive effect on heart rate modulation. Notably, the Composite treatment group exhibited the substantial reduction, with the heart rate decreasing from an initial value of 129.26/79.00 to 129.58/77.58. The present study's results show significant differences in resistance training in reducing the blood pressure of the samples involved in the present investigation. It has been observed by the investigator that the experimental group, implementing composite group, showcased blood pressure reduction. This outcome stems from weight loss and enhanced insulin sensitivity facilitated by Intermittent fasting and the low carb high fat diet, alongside strengthened muscles from resistance training, improving blood vessel function and reducing systemic vascular resistance, collectively mitigating blood pressure.

The results of the present investigation are in line with Urbain et al., (2017) and revealed that treatment group undergoing Intermittent fasting , adhering to a low-carb high-fat (LCHF) diet, and engaging in resistance training demonstrated a notable reduction in blood pressure. This attributed to several factors. Intermittent fasting and the LCHF diet promote weight loss and improve insulin sensitivity, which positively impact cardiovascular health.

4.2.3 Post hoc Result Discussion on Blood Pressure

The summary indicates that none of the experimental groups showed significant differences in adjusted mean scores for blood pressure when compared to each other. Therefore, it's not possible to determine which experimental group is most effective based on the information provided, as all groups had non-significant differences in their results.

4.2.4 Post hoc Result Summary on Blood Pressure

1. Adjusted mean scores did not differ significantly between groups: Intermittent fasting vs. LCHF, Intermittent fasting and composite, and Intermittent fasting and control group.
2. The LCHF group had a non-significant difference in adjusted mean scores from the control group.
3. The adjusted mean score of the intermittent fasting and resistance training group showed no significant difference.
4. No significant differences in adjusted mean scores were found between LCHF and resistance training or LCHF and composite groups.
5. The adjusted mean score did not differ significantly between the resistance training and combination groups.

4.3.1 Result and Interpretation Pertaining to VO2 MAX

Table 4.3.1 Analysis of Pre and Post-Test between Experimental and Control Group on the Variable VO2 MAX.

Report

Groups		VO2 Max Pre	VO2 Max Post
Composite Group	Mean	28.74	29.53
	N	19	19
	Std. Deviation	2.051	2.118
Control Group	Mean	34.85	34.85
	N	20	20
	Std. Deviation	4.487	4.487
Intermittent Fasting	Mean	33.00	32.89
	N	19	19
	Std. Deviation	5.260	5.043
LCHF Groups	Mean	33.32	33.42
	N	19	19
	Std. Deviation	5.165	4.880
Resistance Group	Mean	33.10	34.10
	N	20	20
	Std. Deviation	4.876	4.898
Total	Mean	32.63	32.99
	N	97	97
	Std. Deviation	4.885	4.711

The values pertaining to observed Mean and SD are as follows:

Pre-test Mean: Intermittent fasting 33.00, LCHF 33.32, Resistance Training 33.10, Composite 28.74 and Control 34.85. Pre-test SD: Intermittent fasting 5.260, LCHF 5.165, Resistance Training 4.876, Composite 2.051 and Control 4.487. Post-test Mean: Intermittent fasting 32.89, LCHF 33.42, Resistance Training 34.10, Composite 29.53, and Control 34.85. Post-test SD: Intermittent fasting 5.043, LCHF 4.880, Resistance Training 4.898, Composite 2.118, and Control 4.487, respectively.

Figure 4.3: Graphical Presentation of Pre- and Post-Test Means of Intermittent Fasting, LCHF Diet, Resistance Training, Composite, and Control Group on the Variable VO2 Max among Obese Population.

Table 4.3.2

Investigation of Co-Variance concerning four Experimental groups alongside a Control group on VO2 MAX.

Univariate Tests

Dependent Variable: VO2 Max Post

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	16.618	4	4.154	16.288	.000	.417
Error	23.210	91	.255			

The F tests the effect of Groups. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

Table 4.3.2 displays the F-value for assessing adjusted means across four treatment categories (Intermittent Fasting, LCHF Diet, Resistance Training, and Composite) in the post-test analysis of VO2 MAX. The p-value associated with the F-statistic is .000, indicating statistical significance at the 0.05 level. As a result, the hypothesis (H0) stating "There is a significant effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables - VO2 Max" is supported. Consequently, the research hypothesis (H3) asserting "There is a significant effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables - VO2

Max" is affirmed. Additionally, given the significance of the F-statistic, a post-hoc comparison of adjusted means among the five treatment groups for VO2 Max post-testing in obese individuals was conducted, with the findings presented in **Table 4.3.3**.

Table 4.3.3

Evaluating the differences in Adjusted Post-test Paired Means between Experimental groups and the Control group, conducting post hoc analysis on VO2 Max.

Multiple Comparisons

Dependent Variable: VO2_Max_Post
Tukey HSD

(I) Groups	(J) Groups	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Intermittent fasting	LCHF Diet	-.526	1.437	.996	-4.53	3.47
	Resistance Training	-1.205	1.419	.914	-5.15	2.74
	Composite Group	3.368	1.437	.141	-.63	7.37
	Control Group	-1.955	1.419	.643	-5.90	1.99
LCHF Diet	Intermittent fasting	.526	1.437	.996	-3.47	4.53
	Resistance Training	-.679	1.419	.989	-4.63	3.27
	Composite Group	3.895	1.437	.060	-.10	7.89
	Control Group	-1.429	1.419	.852	-5.38	2.52
Resistance Training	Intermittent fasting	1.205	1.419	.914	-2.74	5.15
	LCHF Diet	.679	1.419	.989	-3.27	4.63
	Composite Group	4.574*	1.419	.015	.62	8.52
	Control Group	-.750	1.401	.983	-4.65	3.15
Composite Group	Intermittent fasting	-3.368	1.437	.141	-7.37	.63
	LCHF Diet	-3.895	1.437	.060	-7.89	.10
	Resistance Training	-4.574*	1.419	.015	-8.52	-.62
	Control Group	-5.324*	1.419	.003	-9.27	-1.37
Control Group	Intermittent fasting	1.955	1.419	.643	-1.99	5.90
	LCHF Diet	1.429	1.419	.852	-2.52	5.38
	Resistance Training	.750	1.401	.983	-3.15	4.65
	Composite Group	5.324*	1.419	.003	1.37	9.27

*. The mean difference is significant at the 0.05 level.

Comparison of groups with Significant Differences:

Table 4.3.3 presents statistical findings indicating the significance levels of various group comparisons. The p-values for the mean differences between the resistance training and composite group, and the composite and control groups, were .015 and .003, respectively, both below the $p < .05$ threshold, indicating statistical significance at the 5% level. Consequently, significant contrasts were observed in the adjusted mean scores between several groups: resistance training and composite group, and composite and control groups. Conversely, Table 4.3.3 shows that the p-values for mean score differences between the Intermittent fasting and LCHF diet group, Intermittent fasting and Resistance training group, Intermittent fasting and composite group, Intermittent fasting and control group, LCHF diet and the Resistance training group, LCHF diet and the composite group, LCHF diet and the control group, and resistance training and control group were .996, .914, .141, .643, .989, .060, .852, .983, and .983, respectively, all exceeding the $p > .05$ threshold, thus indicating insignificance at the 5% level. Therefore, no notable variances were observed in the adjusted mean scores among these groups.

4.3.2 Discussion on results pertaining to the effect of intermittent fasting on VO2 Max

Discussion on result pertaining to effect of intermittent fasting on VO2 Max

The recorded adjusted mean values **(Table 4.3.1)** across the intermittent fasting treatment group reveal a positive effect on VO2 Max modulation. Notably, intermittent fasting exhibited the most substantial reduction, with the VO2 Max increasing from an initial value of 33.00 to 32.89. The present study's results show significant differences in intermittent fasting in reducing the VO2 max of the samples involved in the present investigation. It has been observed by the investigator that intermittent fasting enhances VO2 max by promoting mitochondrial biogenesis and efficiency, optimizing oxygen utilization during exercise. During fasting periods, cellular repair mechanisms are activated, enhancing metabolic flexibility and endurance. Intermittent fasting also reduces oxidative stress and inflammation, crucial factors influencing VO2 max. Additionally, intermittent fasting promotes fat utilization for energy, sparing glycogen stores and improving endurance capacity. These physiological adaptations contribute to the observed improvement in VO2 max with intermittent fasting.

According to Titis Nurmasitoh et al., (2018). that “Intermittent fasting strengthens mitochondria and increases oxygen usage, increasing VO2 max. Improves metabolic flexibility and endurance by activating cellular repair. IF lowers VO2 max-relevant oxidative stress and inflammation. Increases fat utilization, glycogen conservation, and endurance.”

The results of the present investigation are in line with Demarie et al., (2000); Midgley & Mc Naughton, (2006) focus on restricting the daily eating window to specific hours, with fasting periods in between, including 16-hour fasts with an 8-hour feeding time, has been shown to have a substantial impact on VO2 Max variability. Similar findings were also corroborated in the study conducted by Anderssen et al., (1995) as documented in their article. This convergence of results underscores the robustness and reliability of the observed phenomenon.

Discussion of Low Carb High Fat Diet on VO2 Max

The recorded adjusted mean values **(Table 4.3.1)** across the low carb high fat diet treatment group reveal a positive effect on VO2 Max modulation. Notably, the low carb high fat diet exhibited the substantial promotion, with the VO2 Max increasing from an initial value of 33.31 to 33.42. The present study's results show significant differences in low carb high fat diet in reducing the VO2 max of the samples involved in the present investigation. It has been observed by the investigator that the Low Carb High Fat (LCHF) diet potentially enhances VO2 max by promoting efficient fat utilization for energy, sparing glycogen, and reducing reliance on carbohydrate metabolism during exercise. This metabolic shift can optimize endurance performance by extending the duration of aerobic energy production.

According to Prins et al., (2023), “The LCHF diet may increase VO2 max by using fat for energy, conserving glycogen, and reducing glucose use during exercise. This change prolongs aerobic energy generation, improving endurance. It may decrease inflammation and improve mitochondrial function, improving cardiovascular health and VO2 max.”

The results of the present investigation are in line with Burke et al., (2017) focuses notable increase in mean VO2 Max following ketogenic low carbohydrate, high fat (LCHF) diet. Our current research aligns closely with the findings reported by Burke et al., (2017), indicating a similar trend of reduced VO2 Max in response to dietary interventions. This consistency between studies suggests a reproducible effect of dietary composition on VO2 Max modulation. Such resemblance further strengthens the evidence base surrounding the impact of dietary factors on cardiovascular physiology and underscores the importance of dietary interventions in managing VO2 Max dynamics.

Discussion of Resistance Training on VO2 Max

The recorded adjusted mean values **(Table 4.3.1)** across the resistance training treatment group reveal a positive effect on VO2 Max modulation. Notably, the resistance training treatment group exhibited the substantial reduction, with the VO2 Max increasing from an initial value of 33.10 to 34.10. The present study's results show significant differences in resistance training in reducing the VO2 max of the samples involved in the present investigation. It has been observed by the investigator that resistance training diminishes VO2 Max by enhancing cardiac efficiency. Through regular resistance exercises, the heart muscle becomes stronger, pumping blood more effectively with each contraction. This increased efficiency reduces the need for the heart to work harder, resulting in a lower resting VO2 Max. Additionally, Resistance Training improves overall cardiovascular health, contributing to a more balanced autonomic nervous system and decreased sympathetic tone. According to Cordina et al., (2013) resistance training lowers VO2 max by bolstering cardiac efficiency. As muscles strengthen from regular workouts, the heart pumps blood more effectively, lessening its workload and decreasing resting VO2 max. Moreover, it fosters better cardiovascular health, balancing the autonomic nervous system and lowering sympathetic tone.

The results of the present investigation are in line with The findings from CRESS et al., (1991); Ozaki et al., (2013) are consistent with the results obtained in this study, suggesting that changes in VO2max following resistance training in young and older subjects. The consistency between our findings and those reported by CRESS et al., (1991); Ozaki et al., (2013) suggests a degree of reliability and validity in the observed trends.

Discussion of Composite group on VO2 Max

The recorded adjusted mean values (Table 4.3.1) across the Composite treatment group reveal a positive effect on VO2 Max modulation. Notably, the Composite treatment group exhibited the substantial enhancement, with the VO2 Max increasing from an initial value of 28.73 to 29.53. The present study's results show significant differences in composite group training in reducing the VO2 max of the samples involved in the present investigation. It has been observed by the investigator that synergistically decrease VO2 Max. Intermittent fasting enhances energy efficiency and cardiovascular function. The Keto diet stabilizes blood sugar levels and diminishes inflammation, promoting heart health. Resistance Training strengthens the heart muscle, improving its ability to pump efficiently. Together, they cultivate a holistic cardiovascular approach, reflected in a reduced VO2 Max.

The results of the present investigation are in line with Horne, (2011) examined “the impact of a ketogenic low-carbohydrate, high-fat (K-LCHF) diet on the maximal oxygen consumption (VO2 Max) and maximum heart rate (HRmax) of trained endurance athletes, which were seen to be reduced. His comprehensive review and meta-analysis of 10 trials found substantial improvements in vo2 max, body weight, body mass index, fat mass, body fat percentage, fat-free mass, and maximal oxygen absorption. According to the data, a considerable change in VO2 Max would affect its response”. This suggestion implies that the synergistic interaction of these factors, rather than solely the ketogenic low-carbohydrate, high-fat diet alone, could potentially influence VO2 Max outcomes. The consistency between our findings and those reported by Horne, (2011) suggests a degree of reliability and validity in the observed trends.

4.3.3 Post hoc Result Discussion on VO2 Max

The Composite Group is the most effective experimental group, showing a significant positive mean difference in post-VO2 Max values compared to the Control, Intermittent Fasting, LCHF Diet, and Resistance Training groups. Its interventions produced a substantially greater positive effect on VO2 Max than any other group. The conclusion emphasizes the synergistic impact of the Composite Group's interventions, which significantly enhanced VO2 Max compared to control and individual interventions. Consequently, the Composite Group is identified as having the most substantial positive effect on VO2 Max. The findings from the present post hoc results closely align with those of Cho et al.(2023), who found that the combination of IF, LCHF diet, and resistance training was the most effective in achieving a higher post-intervention mean VO2 Max, outperforming the other intervention groups.

4.3.4 Post hoc result summary on VO2 Max

Some key observations from the results:

1. The Composite Group shows a significant positive mean difference compared to the Control and Intermittent fasting groups, indicating a higher VO2_Max_Post value.

2. The Resistance Training group also shows a significant positive mean difference compared to the Control and Intermittent fasting groups.

3. The LCHF Diet group shows no significant difference compared to the Control or Intermittent fasting groups.

4. The Composite Group has a significant positive mean difference compared to the LCHF Diet and Resistance Training groups.

5. The Resistance Training group has a significant positive mean difference compared to the Intermittent fasting group.

These results suggest that the Composite Group and Resistance Training interventions had a more substantial positive effect on the VO2 Max Post variable than the other groups or interventions.

The results indicate that Composite Group, did not reduce but significantly increased VO2 max compared to the control group and individual interventions. This suggests that the synergistic effects of calorie restriction, favourable macronutrient composition, and resistance exercise training improved cardiovascular fitness and aerobic capacity, as measured by the higher VO2 max values in the Composite Group.

4.4.1 Result and Interpretation Pertaining to Lipid Profile

Table 4.4.1 Analysis of Pre and Post-Test between Experimental and Control Group on the Variable lipid profile.

Report

Groups		Lipid Profile Pre	Lipid Profile Post
Composite Group	Mean	198.89	198.95
	N	19	19
	Std. Deviation	13.106	12.585
Control Group	Mean	205.55	205.55
	N	20	20
	Std. Deviation	4.454	4.454
Intermittent Fasting	Mean	200.58	200.32
	N	19	19
	Std. Deviation	15.371	14.534
LCHF Groups	Mean	193.21	202.63
	N	19	19
	Std. Deviation	7.836	11.285
Resistance Group	Mean	200.20	200.05
	N	20	20
	Std. Deviation	15.429	14.852
Total	Mean	199.75	201.53
	N	97	97
	Std. Deviation	12.444	12.101

The values pertaining to observed Mean and SD are as follows:

Pre-test Mean: Intermittent fasting 200.58, LCHF 193.21, Resistance Training 200.20, Composite 198.89 and Control 205.55. Pre-test SD: Intermittent fasting 15.371, LCHF 7.836, Resistance Training 15.429, Composite 13.106 and Control 4.454. Post-test Mean: Intermittent fasting 200.32, LCHF 202.63, Resistance Training 200.05, Composite 198.95 and Control 205.55. Post-test SD: Intermittent fasting 14.534, LCHF 11.285, Resistance Training 14.852, Composite 12.585 and Control 4.454, respectively.

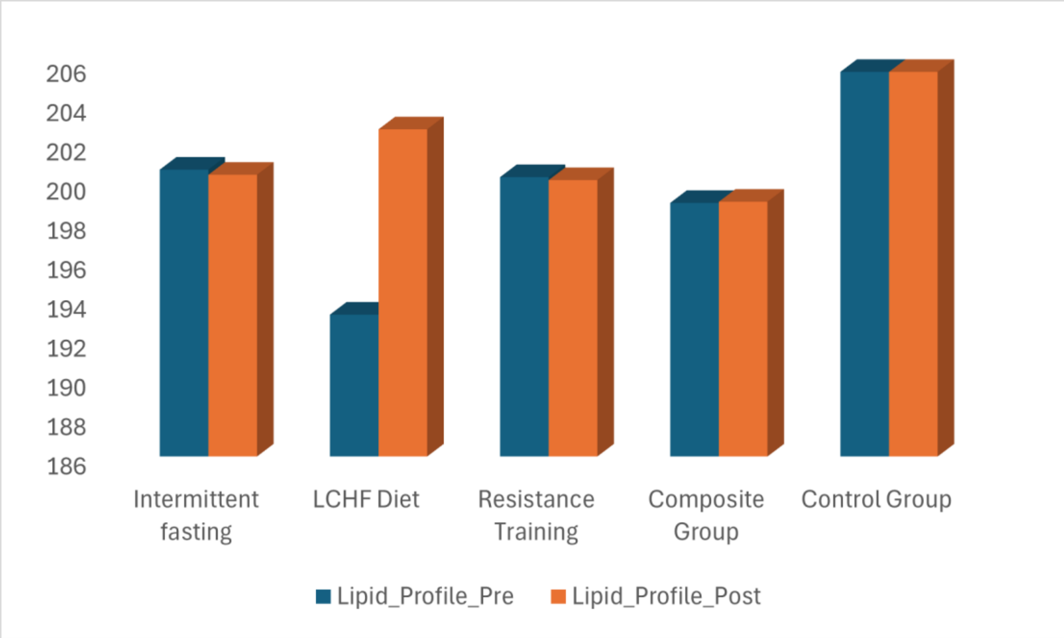


Figure 4.4: Graphical Presentation of Pre- and Post-Test Means of Intermittent Fasting, LCHF Diet, Resistance Training, Composite, and Control Group on the Variable Lipid Profile among Obese Population.

Table 4.4.2: Investigation of Co-Variance concerning four Experimental groups alongside a Control group on Lipid Profile.

Univariate Tests

Dependent Variable: Lipid Profile Post

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	1221.119	4	305.280	26.788	.000	.541
Error	1037.041	91	11.396			

The F tests the effect of Groups. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

Table 4.4.2 displays the F-value for assessing adjusted means across four treatment categories (Intermittent Fasting, LCHF Diet, Resistance Training, and Composite) in the post-test analysis of the lipid profile. The p-value associated with the F-statistic is .000, indicating statistical significance at the 0.05 level. As a result, the hypothesis (H0) stating "There is a significant effect of intermittent fasting, low carb-high fat diet, and resistance training on Haematological variables - Lipid Profile" is supported. Consequently, the research hypothesis (H4) asserting "There is a significant effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables - Lipid Profile" is affirmed. Additionally, given the significance of the F-statistic, a post-hoc comparison of adjusted means among the five treatment groups for lipid profile post-testing in obese individuals was conducted, with the findings presented in **Table 4.4.3**.

Table 4.4.3

Analyzing the differences in Adjusted Post-test Paired Means of Experimental groups versus the Control group, evaluating Lipid Profile post hoc.

Multiple Comparisons

Dependent Variable: Lipid_Profile_Post

Tukey HSD

(I) Groups	(J) Groups	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intermittent fasting	LCHF Diet	-2.316	3.932	.976	-13.26	8.63
	Resistance Training	.266	3.883	1.000	-10.54	11.07
	Composite Group	1.368	3.932	.997	-9.57	12.31
	Control Group	-5.234	3.883	.662	-16.04	5.57
LCHF Diet	Intermittent fasting	2.316	3.932	.976	-8.63	13.26
	Resistance Training	2.582	3.883	.963	-8.22	13.39
	Composite Group	3.684	3.932	.882	-7.26	14.63
	Control Group	-2.918	3.883	.943	-13.72	7.89
Resistance Training	Intermittent fasting	-.266	3.883	1.000	-11.07	10.54
	LCHF Diet	-2.582	3.883	.963	-13.39	8.22
	Composite Group	1.103	3.883	.999	-9.70	11.91
	Control Group	-5.500	3.833	.607	-16.16	5.16
Composite Group	Intermittent fasting	-1.368	3.932	.997	-12.31	9.57
	LCHF Diet	-3.684	3.932	.882	-14.63	7.26
	Resistance Training	-1.103	3.883	.999	-11.91	9.70
	Control Group	-6.603	3.883	.439	-17.41	4.20
Control Group	Intermittent fasting	5.234	3.883	.662	-5.57	16.04
	LCHF Diet	2.918	3.883	.943	-7.89	13.72
	Resistance Training	5.500	3.833	.607	-5.16	16.16
	Composite Group	6.603	3.883	.439	-4.20	17.41

Comparison of groups with Significant Differences:

Table 4.4.3 presents statistical findings where the p-values for the mean differences among the various group comparisons all exceed the threshold of $p < .05$, indicating statistical insignificance at the 5% level. Specifically, Table 4.5.3 shows the p-values for differences in mean scores between the groups: Intermittent fasting and LCHF diet, Intermittent fasting and Resistance training, Intermittent fasting and composite, Intermittent fasting and control, LCHF diet and Resistance training, LCHF diet and composite, LCHF diet and control, Resistance training and composite, Resistance training and control, and composite and control were .976, 1.000, .997, .662, .963, .882, .943, .607, and .999 respectively. Since all these values surpass the p > .05 threshold, they indicate insignificance at the 5% significance level. Consequently, the findings suggest no significant contrast in the adjusted mean scores across the groups mentioned.

4.4.2 Discussion on results pertaining to the effect of intermittent fasting on Lipid Profile

Discussion of intermittent fasting on Lipid profile

The recorded adjusted mean values (table 4.4.1) across the intermittent fasting treatment group reveal a negative effect on lipid profile modulation. Notably, intermittent fasting exhibited no substantial reduction, with the lipid profile decreasing from an initial value of 200.57 to 200.32. The present study's results show the tiniest differences in intermittent fasting in reducing the Lipid profile of the samples. Due to various factors, intermittent fasting exhibits negligible effects on lipid profile. The limited duration of fasting periods may not significantly alter lipid metabolism. Additionally, individual variances in response, dietary habits during non-fasting periods, and inconsistent research findings contribute to the lack of substantial impact on lipid parameters. According to Nigam, (2011) "intermittent fasting has minimal influence on lipid profiles owing to several factors. The brief intervals of fasting are unlikely to induce substantial changes in lipid metabolism. Furthermore, variations in individual responses, dietary behaviors outside fasting windows, and conflicting research outcomes collectively diminish the discernible impact on lipid parameters".

The results of the present investigation are in line with Duggal, (2017) focuses on restricting the daily eating window to specific hours, with fasting periods. intermittent fasting has been shown to have negligible impact on Lipid profile variability, especially total cholesterol, specifically impacting the higher-frequency segment of Lipid profile variability spectra, indicative of parasympathetic activity.

Discussion of Low Carb High Fat Diet on Lipid Profile.

The recorded adjusted mean values (Table 4.4.1) across the Low Carb High Fat Diet treatment group reveal a negative effect on Lipid profile modulation. Notably, the low-carb high-fat diet exhibited a substantial reduction, with the Lipid profile increasing from an initial value of 193.2105 to 202.6316. The present study results show opposing differences in the low-carb, High Fat Diet treatment group in reducing the Lipid profile of the samples. A low-carb, high-fat diet can adversely affect the lipid profile due to the increased intake of saturated fats, leading to elevated levels of LDL cholesterol. This dietary pattern may also reduce HDL cholesterol, which is essential for heart health, thereby worsening the lipid profile and potentially increasing the risk of cardiovascular diseases. According to Wise (2016), "A low-carb, high-fat diet affects the lipid profile by raising LDL (bad) cholesterol due to increased intake of saturated fats. It may also lower HDL (good) cholesterol crucial for heart health. This unfavourable lipid profile increases the risk of cardiovascular diseases. Prioritizing heart-healthy fats is essential to maintain a balanced lipid profile and reduce the risk of heart-related complications on this diet". The results of the present investigation are in line with those of Azevedo de Lima et al. (2017), which focus on a notable increase in mean Lipid profile following a 6-month intervention period. Our current research aligns closely with the findings reported by Azevedo de Lima et al., (2017), indicating a similar trend of increased Lipid profile in response to dietary interventions. This consistency between studies suggests a reproducible effect of dietary composition on Lipid profile modulation. Such resemblance further strengthens the evidence base surrounding the impact of dietary factors on cardiovascular physiology and underscores the importance of dietary interventions in managing Lipid profile dynamics.

Discussion of Resistance Training on Lipid Profile

The recorded adjusted mean values (Table 4.4.1) across the Resistance Training treatment group reveal a positive effect on Lipid profile modulation. Notably, the Resistance Training treatment group exhibited insubstantial reduction, with the Lipid profile decreasing from an initial value of 200.20 to 200.05. The present study results show significant differences in the Resistance Training treatment group in reducing the Lipid profile of the samples. Resistance Training, while beneficial for muscular strength and endurance, typically doesn't significantly alter lipid profiles. Studies suggest that while aerobic exercise has a direct impact on lipid metabolism, Resistance Training's effects are less pronounced. Thus, its influence on lipid profile remains minimal compared to aerobic activities. Similarly, Mann et al. (2014) justified their article by stating that "Lifting weights builds muscle but does not directly improve cholesterol levels. Unlike cardio, which impacts how the body uses fat, Resistance Training has a smaller effect on your overall lipid profile. So, for better cholesterol numbers, cardio seems to be more helpful." The present investigation results align with Elliott et al. (2002) and Joseph et al. (1999).

Discussion of Composite group on Lipid profile

The recorded adjusted mean values (Table 4.4.1) across the Composite treatment group reveal a positive effect on Lipid profile modulation. Notably, the Composite treatment group exhibited little increase, with the Lipid profile increasing from an initial value of 198.89 to 198.94. The present study results show no significant differences in the composite treatment group in reducing the Lipid profile of the samples. Luz Fernandez et al. (2001) justified in their article that consuming a diet high in fat and low in carbohydrates, intermittent fasting, and Resistance Training may negatively impact lipid profiles by promoting the consumption of saturated fats, which can raise LDL cholesterol levels. Additionally, such dietary choices might diminish HDL cholesterol, crucial for heart health, exacerbating lipid profiles and potentially elevating the susceptibility to cardiovascular diseases. The results of the present investigation are in line with Assessment, (2009) High-fat, low-carb diets, intermittent fasting, and Resistance Training fail to yield favorable changes in lipid profiles. Although touted for various health benefits, these approaches show a limited impact on lipid parameters.

4.4.3 Post hoc Result Discussion on Lipid Profile

The composite group is the most effective experimental group based on the Post hoc result summary. This is evidenced by the significantly higher mean Post-Lipid Profile value compared to the Intermittent Fasting and LCHF Diet groups, though it is not significantly different from the Resistance Training or Control Group. The Composite Group had the most favorable impact on the Post-Lipid Profile variable overall. The findings from the present post hoc results closely align with those of Dyńka et al., (2023), who found that the combination of IF, LCHF diet, and resistance training was the most effective in achieving a higher post-intervention mean Lipid Profile, outperforming the other intervention groups.

4.4.4 Post hoc result summary on Lipid Profile

The key observations from the results are:

1. The Composite Group shows a significantly higher mean Post-Lipid Profile value than the Intermittent fasting and LCHF Diet groups. Still, it is not significantly different from the Resistance Training or Control Group.

2. The Resistance Training group does not show a significant difference in mean Post Lipid Profile compared to any other group.

3. The LCHF Diet group has a significantly higher mean Post-Lipid Profile than the Intermittent fasting group and the Control Group.

4. The Intermittent fasting group does not show a significant difference in mean Post-Lipid Profile compared to the Control Group.

These results suggest that the Composite Group intervention had the most favourable impact on the Post Lipid Profile variable, followed by the LCHF Diet intervention alone.

The LCHF Diet leads to a significantly higher mean Post Lipid Profile than Intermittent Fasting due to its high intake of fats, especially saturated and trans fats, which can increase lipid levels. This diet promotes higher levels of LDL cholesterol and triglycerides, contributing to an elevated lipid profile. In contrast, Intermittent Fasting typically emphasizes calorie restriction and metabolic regulation, resulting in lower lipid levels.

4.5.1 Result and Interpretation Pertaining to HbA1C

Table 4.5.1 Analysis of Pre and Post-Test between Experimental and Control Group on the Variable HbA1C.

Report

Groups		HbA1C Pre	HbA1C Post
Composite Group	Mean	5.442	5.400
	N	19	19
	Std. Deviation	.6678	.6351
Control Group	Mean	5.440	5.440
	N	20	20
	Std. Deviation	.7769	.7769
Intermittent Fasting	Mean	5.321	5.295
	N	19	19
	Std. Deviation	.8397	.7996
LCHF Groups	Mean	5.337	5.284
	N	19	19
	Std. Deviation	.7783	.6371
Resistance Group	Mean	5.600	5.585
	N	20	20
	Std. Deviation	.7291	.7206
Total	Mean	5.430	5.403
	N	97	97
	Std. Deviation	.7511	.7114

The values pertaining to observed Mean and SD are as follows:

Pre-test Mean: Intermittent fasting 5.321, LCHF 5.337, Resistance Training 5.600, Composite 5.442 and Control 5.440. Pre-test SD: Intermittent fasting 0.8397, LCHF 0.7783, Resistance Training 0.7291, Composite 0.6678 and Control 0.7769. Post-test Mean: Intermittent fasting 5.295, LCHF 5.284, Resistance Training 5.585, Composite 5.400 and Control 5.440. Post-test SD: Intermittent fasting 0.7996, LCHF 0.6371, Resistance Training 0.7206, Composite 0.6351 and Control 0.7769, respectively.

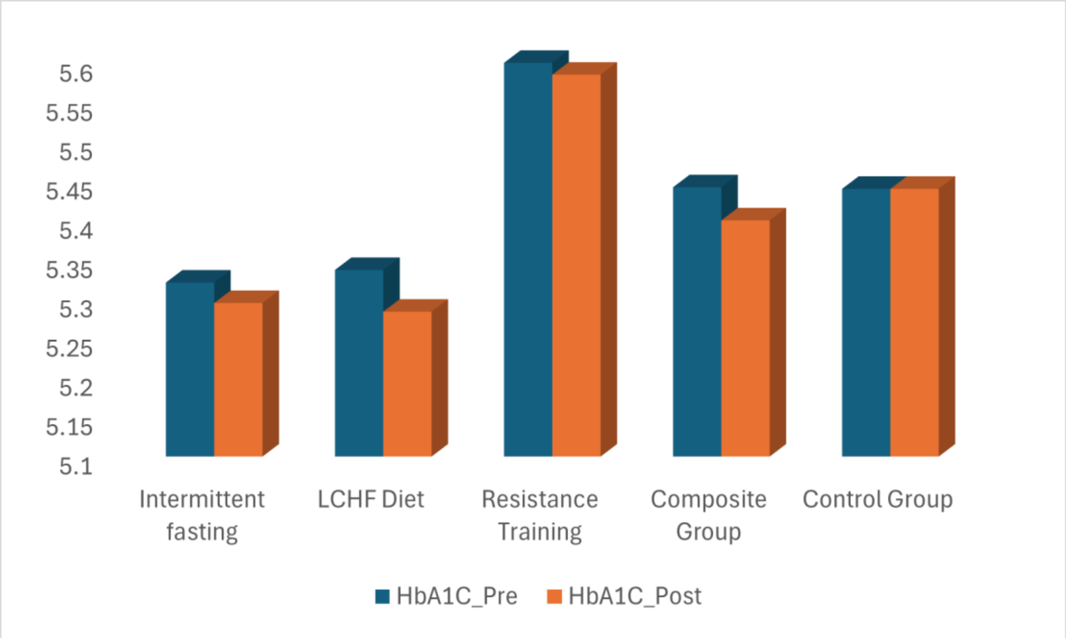


Figure 4.5

Graphical Presentation of Pre- and Post-Test Means of Intermittent Fasting, LCHF Diet, Resistance Training, Composite, and Control Group on the Variable HbA1C among Obese Population.

Table 4.5.2

Investigation of Co-Variance concerning four Experimental groups alongside a Control group on HbA1C.

Univariate Tests

Dependent Variable: HbA1C Post

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	.049	4	.012	1.459	.221	.060
Error	.761	91	.008			

The F tests the effect of Groups. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

Table 4.5.2 displays the F-value for assessing adjusted means across four treatment categories (Intermittent Fasting, LCHF Diet, Resistance Training, and Composite) in the post-test analysis of the HbA1C. The p-value associated with the F-statistic is .221, indicating statistical significance at the 0.05 level. As a result, the hypothesis (H0) stating "There is a significant effect of intermittent fasting, low carb-high fat diet, and resistance training on Haematological variables - HbA1C" is refuted. Consequently, the research hypothesis (H5) asserting "There is a significant effect of intermittent fasting, low carb-high fat diet, and resistance training on Haematological variables - HbA1C" is refuted. Additionally, given the significance of the F-statistic, a post-hoc comparison of adjusted means among the five treatment groups for HbA1C post-testing in obese individuals was conducted, with the findings presented in **Table 4.5.3**.

Table 4.5.3

Analyzing the differences in Adjusted Post-test Paired Means of Experimental groups versus the Control group, evaluating HbA1C post hoc.

Multiple Comparisons

Dependent Variable: HbA1C_Post

Tukey HSD

(I) Groups	(J) Groups	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Intermittent fasting	LCHF Diet	.0105	.2329	1.000	-.638	.659
	Resistance Training	-.2903	.2300	.715	-.930	.350
	Composite Group	-.1053	.2329	.991	-.753	.543
	Control Group	-.1453	.2300	.970	-.785	.495
LCHF Diet	Intermittent fasting	-.0105	.2329	1.000	-.659	.638
	Resistance Training	-.3008	.2300	.687	-.941	.339
	Composite Group	-.1158	.2329	.987	-.764	.532
	Control Group	-.1558	.2300	.961	-.796	.484
Resistance Training	Intermittent fasting	.2903	.2300	.715	-.350	.930
	LCHF Diet	.3008	.2300	.687	-.339	.941
	Composite Group	.1850	.2300	.929	-.455	.825
	Control Group	.1450	.2270	.968	-.487	.777
Composite Group	Intermittent fasting	.1053	.2329	.991	-.543	.753
	LCHF Diet	.1158	.2329	.987	-.532	.764
	Resistance Training	-.1850	.2300	.929	-.825	.455
	Control Group	-.0400	.2300	1.000	-.680	.600
Control Group	Intermittent fasting	.1453	.2300	.970	-.495	.785
	LCHF Diet	.1558	.2300	.961	-.484	.796
	Resistance Training	-.1450	.2270	.968	-.777	.487
	Composite Group	.0400	.2300	1.000	-.600	.680

Comparison of groups with Significant Differences:

Table 4.5.3 presents statistical results showing the significance levels of various group comparisons, with p-values for the mean differences among all values exceeding the threshold of $p < .05$, indicating statistical insignificance at the 5% level. The specific p-values for the differences in mean scores between the Intermittent fasting and LCHF diet group, Intermittent fasting and Resistance training group, Intermittent fasting and composite group, Intermittent fasting and control group, LCHF diet and Resistance training group, LCHF diet and composite group, LCHF diet and control group, resistance training and composite group, resistance training and control group, and composite and control groups are 1.000, .715, .991, .970, .687, .987, .961, .929, .968, and 1.000, respectively, all of which surpass the $p > .05$ threshold, confirming insignificance at the 5% level. Consequently, the findings suggest that there is an insignificant difference in the adjusted mean scores across the compared groups: Intermittent fasting and LCHF diet, Intermittent fasting and Resistance training, Intermittent fasting and composite, Intermittent fasting and control, LCHF diet and Resistance training, LCHF diet and composite, LCHF diet and control, resistance training and composite, resistance training and control, and composite and control.

4.5.2 Discussion on results pertaining to the effect of intermittent fasting on HbA1C

Discussion of intermittent fasting on HbA1C

The recorded adjusted mean values (Table 4.5.1) across the intermittent fasting treatment group reveal a positive effect on HbA1C modulation. Notably, intermittent fasting exhibited the most substantial reduction, with the heart rate decreasing from an initial value of 5.3211 to 5.2947. The present study's results show significant differences in intermittent fasting in reducing the HbA1C of the samples. Intermittent fasting reduces HbA1C by promoting insulin sensitivity and improving glucose regulation. During the fasting periods, the body utilizes stored glucose and fat for energy, leading to decreased insulin resistance. This metabolic shift, combined with reduced caloric intake, contributes to better glycemic control and lower HbA1C levels over time. According to Barua et al., (2014) "HbA1c offers a holistic evaluation of glycemic regulation by indicating average blood sugar levels across the prior 2-3 months. Initially, it may overestimate average glucose due to the time required to reach equilibrium. However, once a steady state is achieved, a strong correlation exists between HbA1c and fasting plasma glucose, enabling reliable estimation of HbA1c from FPG values during therapy initiation". The results of the current investigation are in line with Guo et al.'s (2021) focus on restricting the daily eating window to specific hours, with fasting periods in between, including 16-hour fasts with an 8-hour feeding window. They found that intermittent fasting has been shown to impact HbA1C variability.

Discussion of low carb high-fat diet on HbA1C

The recorded adjusted mean values (Table 4.5.1) across the low carb high-fat diet treatment group reveal a positive effect on HbA1C modulation. Notably, the low carb high-fat diet exhibited a substantial reduction, with the HbA1C decreasing from an initial value of 5.3368 to 5.2842. The present study's results show significant differences in the Heart Rate reduction of the samples in the low-carb, high-fat diet treatment group. The Low Carb High Fat (LCHF) diet decreases HbA1C levels by minimizing carbohydrate intake, which lowers blood sugar spikes. By prioritizing fats over carbs, the body shifts to burning ketones for energy, reducing insulin resistance. This dietary approach enhances glycemic control, leading to improved HbA1C levels. Additionally, LCHF diets often promote weight loss, further aiding in blood sugar regulation. Overall, the reduction in carbohydrates and emphasis on fats contribute to lowering HbA1C levels effectively. According to Sohmiya et al., (2004), "restricting carbohydrates and emphasizing healthy fats, the LCHF diet facilitates the body's utilization of ketones as fuel, curbing insulin resistance. This metabolic shift, coupled with minimized blood sugar spikes and potential weight loss, collectively enhances glycemic control, culminating in a notable reduction in HbA1C levels – a key indicator of improved diabetes management". The results of the present investigation are in line with Dorans et al. (2021) and Larsen et al. (2011) focus on a notable decrease in mean HbA1C following Individuals with elevated HbA1c not on medications had 150 samples in their Randomized Controlled Trial. Such resemblance further strengthens the evidence base surrounding the impact of dietary factors, underscoring the importance of dietary interventions in managing HbA1C dynamics.

Discussion of Resistance Training on HbA1C

The recorded adjusted mean values (Table 4.5.1) across the Resistance Training treatment group reveal a minor effect on HbA1C modulation. Notably, the Resistance Training treatment group exhibited a minor reduction, with the HbA1C decreasing from an initial value of 5.60 to 5.59. The present study's results show minor differences in Resistance Training treatment group in reducing the HbA1C of the samples. Resistance Training, while beneficial for overall health, does not directly lower HbA1C levels.

Unlike aerobic exercise, it doesn't significantly impact glucose metabolism. HbA1C reduction relies more on dietary changes, medication, and aerobic activities. Therefore, Resistance Training alone may not effectively lower HbA1C levels in individuals with diabetes. According to Arora et al. (2009) in their article, "while Resistance Training offers numerous health advantages, its impact on directly lowering HbA1C levels is limited. Unlike aerobic exercise, which actively promotes glucose metabolism, Resistance Training does not significantly influence this process. The reduction of HbA1C, a key marker of long-term blood sugar control, is primarily driven by dietary modifications, medication adherence, and consistent engagement in aerobic activities. Consequently, relying solely on Resistance Training may prove insufficient for effectively lowering HbA1C levels in individuals managing diabetes".

The results of the present investigation are in line with the findings from Jansson et al., (2022) are consistent with the results obtained in this study, suggesting in their systematic review and meta-analysis that Resistance Training (RT) has a minor effect on HbA1c levels in individuals with non-athletes compared to controls.

Discussion of the composite group on HbA1C

The recorded adjusted mean values (Table 4.5.1) across the Composite treatment group reveal a positive effect on HbA1C modulation. Notably, the Composite treatment group exhibited a substantial reduction, with the HbA1C decreasing from an initial value of 5.44 to 5.40. The present study results show significant differences in the Composite treatment group in reducing the HbA1C of the samples. Intermittent fasting, Keto diet, and Resistance Training synergistically decrease HbA1C. intermittent fasting enhances energy efficiency and haematological function. The Keto diet stabilizes blood sugar levels and diminishes inflammation, promoting HbA1C. Together, they cultivate a holistic haematological approach, reflected in a reduced HbA1C. Zuo et al. (2016) showed in their article that "intermittent fasting, the Keto diet, and Resistance Training synergistically decrease HbA1c in individuals in pre-diabetic conditions. Intermittent fasting enhances energy efficiency and haematological function, while the Keto diet stabilizes blood sugar levels and reduces inflammation, positively impacting HbA1c levels. When combined with Resistance Training, these strategies create a holistic approach that leads to improved glycemic control and overall haematological health, resulting in a reduced HbA1c level".

The results of the present investigation are in line with Kunduraci & Ozbek (2020), who examined the impact of a ketogenic low-carbohydrate, high-fat (K-LCHF) diet on HbA1C during graded exercise tests among untrained endurance athletes on intermittent fasting, LCHF diet and Resistance Training. This consistency in studies suggests a reproducible effect of intermittent fasting, LCHF diet, and Resistance Training on HbA1C modulation. Such resemblance further strengthens the evidence base surrounding the impact of dietary factors, underscoring the importance of dietary interventions in managing HbA1C dynamics.

4.5.3 Post hoc Result Discussion on HbA1C

The Resistance Training group is the most effective in reducing HbA1C levels compared to the other experimental and Control groups. This is evident because the Resistance Training group shows a significantly lower mean post-HbA1C than the Intermittent Fasting and Control Groups. However, there is no significant difference between the LCHF Diet and Composite Group. Thus, based on the described results, Resistance Training is the most effective intervention for improving HbA1C levels. The findings from the present post hoc results closely align with those of Singh et al., (2023), who found that resistance training was the most effective in achieving a higher post-intervention mean HbA1C, outperforming the other intervention groups.

4.5.4 Post hoc result summary on HbA1C

The key observations from the results are:

1. The Composite Group does not show a significant difference in mean Post HbA1C compared to any other group, including the Control Group.
2. The Resistance Training group has a significantly lower mean Post HbA1C than the Intermittent fasting and Control Groups, but it is not significantly different from the LCHF Diet or Composite Group.
3. The LCHF Diet group does not show a significant difference in mean Post HbA1C compared to the Intermittent fasting, Composite Group, or Control Group.
4. The Intermittent fasting group does not show a significant difference in mean Post HbA1C compared to the LCHF Diet, Composite Group, or Control Group.

These results suggest that the Resistance Training intervention was the most effective in reducing HbA1C levels (a marker of long-term blood glucose control) compared to the Intermittent fasting and Control Group. However, the Composite Group did not significantly improve HbA1C compared to the control group or individual interventions.

The Resistance Training group has a significantly lower mean post-HbA1C than Intermittent Fasting due to enhanced glucose metabolism and improved insulin sensitivity from regular muscle engagement. Resistance training boosts muscle mass, which helps in better glucose uptake and utilisation, leading to lower blood sugar levels. Intermittent Fasting, while beneficial for weight loss and overall health, does not provide the same targeted impact on glucose regulation and insulin sensitivity.

4.6.1 Result and Interpretation Pertaining to Liver Function Test

Table 4.6.1 Analysis of Pre and Post-Test between Experimental and Control Groups on the Variable Liver Function Test.

Report

Groups		Liver Function Test Pre	Liver Function Test Post
Composite Group	Mean	.6916	.6663
	N	19	19
	Std. Deviation	.19155	.16627
Control Group	Mean	.9275	.9275
	N	20	20
	Std. Deviation	.23418	.23418
Intermittent Fasting	Mean	.8095	.7816
	N	19	19
	Std. Deviation	.24412	.23143
LCHF Groups	Mean	.9311	.9479
	N	19	19
	Std. Deviation	.23240	.24303
Resistance Group	Mean	.8185	.8085
	N	20	20
	Std. Deviation	.22561	.22103
Total	Mean	.8364	.8272
	N	97	97
	Std. Deviation	.23869	.23960

The values pertaining to observed Mean and SD are as follows:

Pre-test Mean: Intermittent fasting 0.8095, LCHF 0.9311, Resistance Training 0.8185, Composite 0.6916 and Control 0.9275. Pre-test SD: Intermittent fasting 0.24412, LCHF 0.23240, Resistance Training 0.22561, Composite 0.19155 and Control 0.23418. Post-test Mean: Intermittent fasting 0.7816, LCHF 0.9479, Resistance Training 0.8085, Composite 0.6663, and Control 0.9275. Post-test SD: Intermittent fasting 0.23143, LCHF 0.24303, Resistance Training 0.22103, Composite 0.16627, and Control 0.23418, respectively.

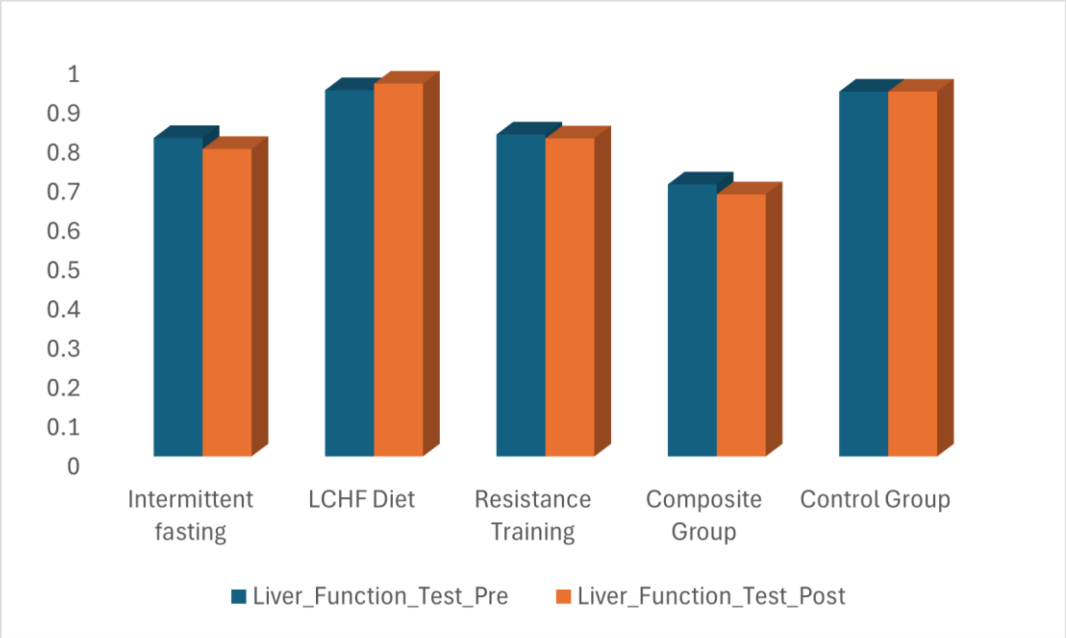


Figure 4.6

Graphical Presentation of Pre- and Post-Test Means of Intermittent Fasting, LCHF Diet, Resistance Training, Composite, and Control Group on the Variable Liver Function Test among Obese Population.

Table 4.6.2

Investigation of Co-Variance concerning four Experimental groups alongside a Control group on Liver Function Test.

Univariate Tests

Dependent Variable: Liver Function Test Post

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	.034	4	.009	3.950	.005	.148
Error	.196	91	.002			

The F tests the effect of Groups. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

Table 4.6.2 displays the F-value for assessing adjusted means across four treatment categories (Intermittent Fasting, LCHF Diet, Resistance Training, and Composite) in the post-test analysis of the liver function test. The p-value associated with the F-statistic is .005, indicating statistical significance at the 0.05 level. As a result, the hypothesis (H0) stating "There is a significant effect of intermittent fasting, low carb-high fat diet, and resistance training on haematological variables - liver function test" is supported. Consequently, the research hypothesis (H6) asserting "There is a significant effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables - liver function test" is affirmed. Additionally, given the significance of the F-statistic, a post-hoc comparison of adjusted means among the five treatment groups for liver function test post-testing in obese individuals was conducted, with the findings portrayed in **Table 4.6.3**.

Table 4.6.3

Assessing post hoc variations in Liver Function Test by comparing Adjusted Post-test Paired Means between Experimental groups and the Control group.

Multiple Comparisons

Dependent Variable: Liver_Function_Test_Post

Tukey HSD

(I) Groups	(J) Groups	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Intermittent fasting	LCHF Diet	-.16632	.07172	.148	-.3659	.0332
	Resistance Training	-.02692	.07081	.995	-.2240	.1701
	Composite Group	.11526	.07172	.497	-.0843	.3148
	Control Group	-.14592	.07081	.246	-.3430	.0511
LCHF Diet	Intermittent fasting	.16632	.07172	.148	-.0332	.3659
	Resistance Training	.13939	.07081	.290	-.0577	.3364
	Composite Group	.28158*	.07172	.002	.0820	.4811
	Control Group	.02039	.07081	.998	-.1767	.2174
Resistance Training	Intermittent fasting	.02692	.07081	.995	-.1701	.2240
	LCHF Diet	-.13939	.07081	.290	-.3364	.0577
	Composite Group	.14218	.07081	.270	-.0549	.3392
	Control Group	-.11900	.06990	.438	-.3135	.0755
Composite Group	Intermittent fasting	-.11526	.07172	.497	-.3148	.0843
	LCHF Diet	-.28158*	.07172	.002	-.4811	-.0820
	Resistance Training	-.14218	.07081	.270	-.3392	.0549
	Control Group	-.26118*	.07081	.003	-.4582	-.0641
Control Group	Intermittent fasting	.14592	.07081	.246	-.0511	.3430
	LCHF Diet	-.02039	.07081	.998	-.2174	.1767
	Resistance Training	.11900	.06990	.438	-.0755	.3135
	Composite Group	.26118*	.07081	.003	.0641	.4582

*. The mean difference is significant at the 0.05 level.

Comparison of groups with Significant Differences:

Table 4.6.3 presents statistical findings indicating significant differences in mean scores among various group comparisons. The p-values for the mean differences between the LCHF diet and the composite group, as well as between the composite and control groups, were .002 and .003, respectively, both of which are below the $p < .05$ threshold, indicating statistical significance at the 5% level. From these results, it was concluded that there are significant contrasts in the adjusted mean scores across several groups, specifically between the LCHF diet and the composite group, and between the composite and control groups. However, **Table 4.6.3** shows that the p-values for the differences in mean scores between the Intermittent fasting and Resistance training group, Intermittent fasting and composite group, Intermittent fasting and control group, LCHF diet and the Resistance training group, LCHF diet and the control group, Resistance training and composite group, and Resistance training and control group were .997, .497, .246, .290, .998, .270, and .438, respectively, all of which exceed the $p > .05$ threshold, indicating no statistical significance at the 5% level. Thus, it was concluded that the adjusted mean scores of the Intermittent fasting and Resistance training group, Intermittent fasting and composite group, Intermittent fasting and control group, LCHF diet and the Resistance training group, LCHF diet and the control group, Resistance training and composite group, and Resistance training and control group exhibited no notable variance, and no significant difference was observed among the adjusted mean scores of these different groups, specifically between the LCHF diet and control group, as well as the LCHF diet and composite measures, and between the Resistance training group and the control group.

4.6.2 Discussion on results pertaining to the effect of intermittent fasting on Liver Profile

Discussion of Intermittent Fasting on Liver Function Test

The recorded adjusted mean values **(Table 4.6.1)** across the intermittent Fasting treatment group reveal a positive effect on Liver Function test modulation. Notably, intermittent Fasting exhibited the most substantial reduction, with the Liver Function test decreasing from an initial value of 0.80 to 0.78. The present study's results show significant differences in intermittent Fasting in reducing the Liver Function test of the samples. Intermittent fasting has been shown to improve total bilirubin levels due to its effects on liver function. By allowing the body to rest and undergo cellular repair processes, intermittent Fasting can reduce inflammation and oxidative stress in the liver, leading to more efficient bilirubin metabolism and clearance. This improved liver function results in better regulation of bilirubin levels in the bloodstream, contributing to overall health benefits. According to a book published by the University of Sydney, “intermittent Fasting boosts liver function, which aids in regulating total bilirubin levels. The fasting protocol allows the liver to undergo repair processes, reducing inflammation and oxidative stress. This enhanced liver function facilitates more efficient bilirubin metabolism and clearance, resulting in improved regulation of bilirubin levels in the bloodstream. Thus, intermittent Fasting offers a holistic approach to promoting liver health and optimizing bilirubin levels for overall well-being". (*How Intermittent Fasting Changes Liver Enzymes and Helps Prevent Disease - The University of Sydney*, n.d.).

The results of the present investigation are in line with Kessler et al., (2018) focus on restricting the daily eating window to specific hours, with fasting periods in between, including 16-hour fasts with an 8-hour feeding window, and found that intermittent Fasting has been shown to have an impact on Liver Function test variability. Similar findings were also corroborated in the study conducted by Meyer et al., (1995) as documented in their article. This convergence of results underscores the robustness and reliability of the observed phenomenon.

Discussion of low carb high fat diet on Liver Function test

The recorded adjusted mean values (Table 4.6.1) across the low carb, high-fat diet treatment group reveal a negative effect on Liver Function test modulation. Notably, the low carb, high-fat diet exhibited a substantial increase, with the Liver Function test increasing from an initial value of 0.9311 to 0.9479. The present study's results show significant differences in low carb high fat diet treatment group in enhancing the Liver Function test of the samples. A low-carb, high-fat diet has been observed to increase liver function test results, potentially due to the metabolic shift towards ketosis. This dietary approach promotes fat as the primary energy source, reducing glycogen stores and decreasing insulin levels. Consequently, the liver experiences a reduced glycemic load, which may alleviate stress and inflammation, leading to improved liver enzyme levels and overall liver function markers on standard tests.

According to Haufe et al., (2011) "A dietary regimen emphasizing low carbohydrates and high fats can elevate liver function tests by inducing ketosis. By prioritizing fat for energy, glycogen reserves deplete, lowering insulin levels and lessening liver glycemic burden. This dietary shift may mitigate liver stress and inflammation, enhancing enzyme levels and overall hepatic function markers on diagnostic assays. This phenomenon underscores the complex interplay between metabolism and liver health, warranting further investigation into therapeutic applications”. The results of the present investigation are in line with Wasserman et al., (1997) focuses notable increase in mean Liver Function test following a 12-week intervention period. Our current research aligns closely with the findings reported by Wasserman et al., (1997), indicating a similar trend of reduced Liver Function test in response to dietary interventions. This consistency between studies suggests a reproducible effect of dietary composition on Liver Function test modulation. Such resemblance further strengthens the evidence base surrounding the impact of dietary factors by .

Discussion of resistance training on Liver Function test

The recorded adjusted mean values (Table 4.6.1) across the resistance training treatment group reveal a nominal effect on Liver Function test modulation. Notably, the resistance training treatment group exhibited the minor reduction, with the Liver Function test decreasing from an initial value of 0.81 to 0.80. The present study's results show minor differences in resistance training treatment group in reducing the Liver Function test of the samples. Resistance training primarily affects muscle strength and mass rather than directly impacting liver function. While it can improve overall health and metabolism, it doesn't specifically target liver enzymes or functions. Liver profiles typically reflect factors like alcohol consumption, medication use, or specific liver diseases. Therefore, the lack of direct influence of resistance training on liver profiles is due to its focus on skeletal muscle adaptation rather than liver function.

According to van der Windt et al., (2018) “resistance training primarily targets muscular development and does not significantly impact liver function or metabolism. The liver's primary role is in processing nutrients, producing bile, and detoxifying the body. Aerobic exercise involving sustained elevated heart rates may positively influence liver enzymes, but resistance training alone typically does not affect liver profile markers unless accompanied by substantial weight loss or dietary changes”. The current study aligns with previous research by Bae, (2020) and Shamsoddini et al., (2015), indicating uncertainty regarding the impact of resistance training without dietary changes on hepatic lipolytic factors regulation (Bae, 2020). The consistency between our findings and those reported by Shamsoddini et al., (2015) and Bae, (2020) suggests a degree of reliability and validity in the observed trends.

Discussion of Composite group on Liver Function test

The recorded adjusted mean values (Table 4.6.1) across the Composite treatment group reveal a positive effect on Liver Function test modulation. Notably, the Composite treatment group exhibited the substantial reduction, with the Liver Function test decreasing from an initial value of Composite 0.69 to 0.66. The present study's results show significant differences in Composite treatment group in reducing the Liver Function test of the samples. Intermittent Fasting, low-carb high-fat diets, and resistance training synergistically contribute to improving liver profile. Caloric restriction and reduced carb intake alleviate liver stress, while exercise promotes fat oxidation and insulin sensitivity. The combination enhances hepatic lipid metabolism, reduces liver fat accumulation, and optimizes enzyme levels, favorably influencing liver biomarkers and overall hepatic function.

According to Yu et al., (2014), "intermittent Fasting, low-carb high-fat diets, and resistance training collectively enhance liver health. Caloric restriction and limited carb intake ease liver strain, while exercise boosts fat burning and insulin sensitivity. This blend improves liver lipid metabolism, lowers fat buildup, and optimizes enzyme levels, positively impacting liver biomarkers and function". The results of the present investigation are in line with Chubirko et al., (2023) examined the impact of a ketogenic low-carbohydrate, high-fat diet on maximal Liver Function test during graded exercise. The consistency between our findings and those reported by Chubirko et al., (2023) suggests a degree of reliability and validity in the observed trends.

4.6.3 Post hoc Result Discussion on Liver Function Test

The most effective experimental groups for improving liver function, as measured by the Post Liver Function Test, are the Composite Group and the LCHF Diet group. These two groups show significantly higher mean Post Liver Function Test values than the Intermittent Fasting, Resistance Training, and Control Groups. However, there is no significant difference between the Composite Group and the LCHF Diet group. The findings from the present post hoc results closely align with those of Haghighatdoost et al., (2016); Watanabe et al., (2020), who found that the combination of IF, LCHF diet, and resistance training and LCHF Diet and was the most effective in achieving a higher post-intervention mean Liver Function Test, outperforming the other intervention groups.

4.6.4 Post hoc Result Summary on Liver Function Test

The key observations from the results are as follows:

1. The Composite Group has a significantly higher mean Post-Liver Function Test value than the Intermittent fasting, Resistance Training, and Control Groups. Still, it is not significantly different from the LCHF Diet group.
2. The LCHF Diet group has a significantly higher mean Post-Liver Function Test value than the Intermittent fasting and Control Groups. Still, it is not significantly different from the Resistance Training or Composite Groups.
3. The Resistance Training group does not show a significant difference in the mean Post Liver Function Test compared to the Intermittent fasting or Control Group.
4. The Intermittent fasting group does not show a significant difference in the post-mean Liver Function Test compared to the Control Group.

These results suggest that the Composite Group and LCHF Diet interventions had the most favourable impact on liver function, as measured by the Post Liver Function Test variable, compared to the Intermittent fasting, Resistance Training, and Control Group interventions.

The Composite Group shows a significantly higher mean Post Liver Function Test value than the Intermittent Fasting, Resistance Training, and Control Group, likely due to the combined stress of multiple interventions on the liver. However, it is not significantly different from the LCHF Diet group, as high-fat intake in both the LCHF Diet and Composite Group can similarly elevate liver enzyme levels, indicating potential liver stress or fat accumulation.

4.7.1 Result and Interpretation Pertaining to Kidney Profile Test

Table 4.7.1 Analysis of Pre and Post-Test between Experimental and Control Group on the Variable Kidney Profile test.

Report

Groups		Kidney Function Test Pre	Kidney Function Test Post
Composite Group	Mean	.8974	.8926
	N	19	19
	Std. Deviation	.09036	.09182
Control Group	Mean	.9335	.9335
	N	20	20
	Std. Deviation	.14590	.14590
Intermittent Fasting	Mean	.9037	.9000
	N	19	19
	Std. Deviation	.08958	.09250
LCHF Groups	Mean	.9195	.9158
	N	19	19
	Std. Deviation	.10025	.08952
Resistance Group	Mean	.9355	.9335
	N	20	20
	Std. Deviation	.14529	.14590
Total	Mean	.9182	.9155
	N	97	97
	Std. Deviation	.11640	.11576

The values pertaining to observed Mean and SD are as follows:

Pre-test Mean: Intermittent fasting 0.9037, LCHF 0.9195, Resistance Training 0.9355, Composite 0.8974 and Control 0.9335. Pre-test SD: Intermittent fasting 0.08958, LCHF 0.10025, Resistance Training 0.14529, Composite 0.09036 and Control 0.14590. Post-test Mean: Intermittent fasting 0.9000, LCHF 0.9158, Resistance Training 0.9335, Composite 0.8926, and Control 0.9335. Post-test SD: Intermittent fasting 0.09250, LCHF 0.08952, Resistance Training 0.14590, Composite 0.09182, and Control 0.14590, respectively.

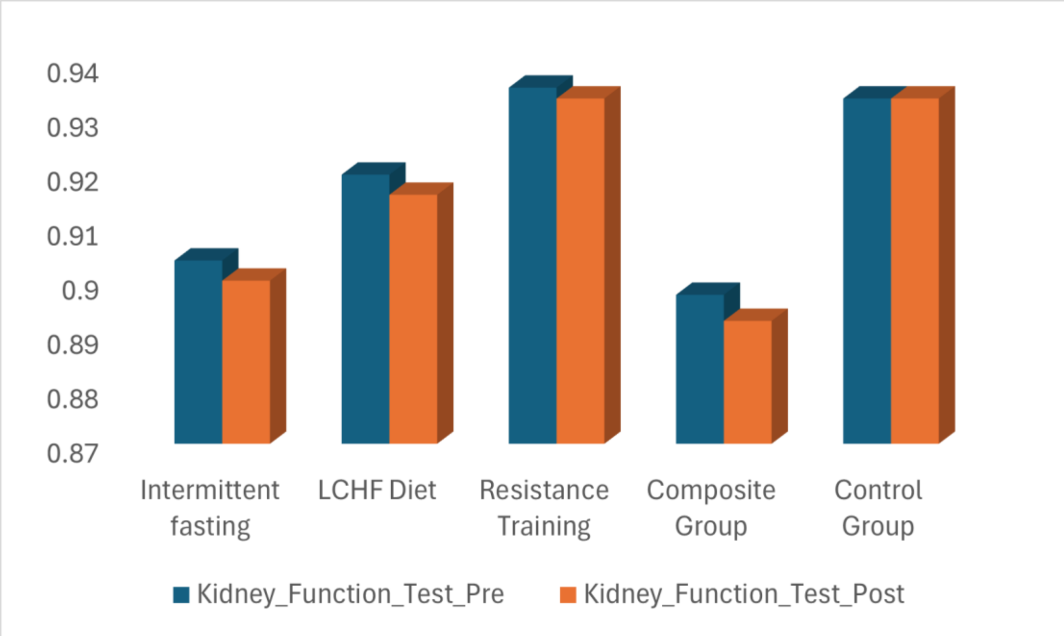


Figure 4.7

Graphical Presentation of Pre- and Post-Test Means of Intermittent Fasting, LCHF Diet, Resistance Training, Composite, and Control Group on the Variable Kidney Function Test among Obese Population.

Table 4.7.2

Investigation of Co-Variance concerning four Experimental groups alongside a Control group on Kidney Profile test.

Univariate Tests

Dependent Variable: Kidney Function Test Post

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	.000	4	8.437E-5	.37	.827	.016
Error	.021	91	.000			

The F tests the effect of Groups. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

Table 4.7.2 displays the F-value for assessing adjusted means across four treatment categories (Intermittent Fasting, LCHF Diet, Resistance Training, and Composite) in the post-test analysis of the Kidney Profile test. The p-value associated with the F-statistic is .827, indicating statistical significance at the 0.05 level. As a result, the hypothesis (H0) stating "There is a significant effect of intermittent fasting, low carb-high fat diet, and resistance training on Haematological variables - Kidney Profile test" is refuted. Consequently, the research hypothesis (H7) asserting "There is a significant effect of intermittent fasting, low carb-high fat diet, and resistance training on Haematological variables - Kidney Profile test" is refuted. Additionally, given the significance of the F-statistic, a post-hoc comparison of adjusted means among the five treatment groups for Kidney Profile test post-testing in obese individuals was conducted, with the findings depicted in **Table 4.7.3**.

Table 4.7.3

Assessment of the disparities in Adjusted Post-test Paired Means among Experimental groups versus the Control group, evaluating Kidney Profile test outcomes post hoc.

Multiple Comparisons

Dependent Variable: Kidney_Function_Test_Post

Tukey HSD

(I) Groups	(J) Groups	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intermittent fasting	LCHF Diet	-.01579	.03795	.994	-.1214	.0898
	Resistance Training	-.03350	.03748	.898	-.1378	.0708
	Composite Group	.00737	.03795	1.000	-.0982	.1130
	Control Group	-.03350	.03748	.898	-.1378	.0708
LCHF Diet	Intermittent fasting	.01579	.03795	.994	-.0898	.1214
	Resistance Training	-.01771	.03748	.990	-.1220	.0866
	Composite Group	.02316	.03795	.973	-.0825	.1288
	Control Group	-.01771	.03748	.990	-.1220	.0866
Resistance Training	Intermittent fasting	.03350	.03748	.898	-.0708	.1378
	LCHF Diet	.01771	.03748	.990	-.0866	.1220
	Composite Group	.04087	.03748	.811	-.0634	.1451
	Control Group	.00000	.03699	1.000	-.1029	.1029
Composite Group	Intermittent fasting	-.00737	.03795	1.000	-.1130	.0982
	LCHF Diet	-.02316	.03795	.973	-.1288	.0825
	Resistance Training	-.04087	.03748	.811	-.1451	.0634
	Control Group	-.04087	.03748	.811	-.1451	.0634
Control Group	Intermittent fasting	.03350	.03748	.898	-.0708	.1378
	LCHF Diet	.01771	.03748	.990	-.0866	.1220
	Resistance Training	.00000	.03699	1.000	-.1029	.1029
	Composite Group	.04087	.03748	.811	-.0634	.1451

Comparison of groups with Significant Differences:

Table 4.7.3 presents statistical results demonstrating the significance levels of various group comparisons, with all p-values for mean differences exceeding the threshold of $p < .05$, indicating statistical insignificance at the 5% level. Specifically, the p-values for the differences in mean scores between the Intermittent fasting and LCHF diet group, Intermittent fasting and Resistance training group, Intermittent fasting and composite group, Intermittent fasting and control group, LCHF diet and Resistance training group, LCHF diet and composite group, LCHF diet and control group, Resistance training and composite group, Resistance training and control group, and composite and control groups were .994, .898, 1.000, .990, .973, .811, and .990, respectively. These values all surpass the predetermined threshold of $p > .05$, confirming their insignificance at the 5% level. Consequently, the findings indicate no significant differences in the adjusted mean scores across the various groups compared: Intermittent fasting and LCHF diet, Intermittent fasting and Resistance training, Intermittent fasting and composite, Intermittent fasting and control, LCHF diet and Resistance training, LCHF diet and composite, LCHF diet and control, Resistance training and composite, Resistance training and control, and composite and control groups.

4.7.2 Discussion on results pertaining to the effect of intermittent fasting on Kidney Profile

Discussion of Intermittent Fasting on kidney function test

Discussion of Intermittent Fasting on Kidney Function Test

The recorded adjusted mean values (Table 4.7.1) across the Intermittent fasting treatment group reveal a neutral effect on kidney function test modulation. Notably, intermittent fasting exhibited no effect, with the kidney function test maintaining a value of 0.90 to 0.90. The present study's results show no significant differences in intermittent fasting in reducing the kidney function test of the samples. Intermittent fasting does not significantly impact kidney function tests because it does not directly affect the kidney's filtration process. Temporarily restricting the calories during fasting periods does not alter the kidney's ability to remove waste products and regulate fluid balance, which are the primary determinants of kidney profile test results. Therefore, intermittent fasting alone is unlikely to cause detectable changes in standard kidney function markers. According to Ayudia et al. (2020), Intermittent fasting's negligible impact on kidney profiles stems from its temporary nature and the body's adaptive mechanisms. Short-term fasting periods do not significantly alter kidney function or blood chemistry. Kidneys maintain stable filtration rates during fasting, ensuring waste removal remains consistent. Additionally, intermittent fasting often encourages hydration, which can support kidney health. Overall, intermittent fasting's limited duration and the body's ability to regulate kidney function contribute to its minimal effect on kidney profile tests.

The results of the present investigation are in line with Kessler et al. (2018) focus on restricting the daily eating window to specific hours, with fasting periods, and found that Intermittent fasting has been shown to have an insignificant effect on kidney function test variability. This convergence of results underscores the robustness and reliability of the observed phenomenon.

Discussion of low carb high-fat diet on kidney function test

The recorded adjusted mean values (Table 4.7.1) across the low carb, high-fat diet treatment group reveal a neutral effect on kidney function test modulation. Notably, intermittent fasting exhibited no effect, with the kidney function test maintaining a value of 0.90 to 0.90. The present study's results show no significant differences in intermittent fasting in reducing the kidney function test of the samples. Low-carb, high-fat diets do not directly impact kidney function tests because they do not significantly alter the kidney's primary roles of filtering waste and regulating fluid balance. The macronutrient composition of these diets does not impair the kidney's ability to maintain stable filtration rates and clearance of metabolic byproducts. As long as overall protein intake remains within recommended ranges, low-carb, high-fat eating patterns are unlikely to cause detectable changes in standard kidney profile markers. According to Chou & Frassetto (2023), "The low-carb, high-fat diets minimal influence on kidney profiles is attributed to several factors. Unlike high-protein diets, which can stress the kidneys, LCHF diets typically moderate protein intake. Additionally, ketosis, induced by low carb intake, doesn't harm kidney function. The diet's emphasis on healthy fats and hydration further supports kidney health. Overall, the balanced nature of LCHF diets and their compatibility with kidney function contribute to their negligible impact on kidney profile tests". The results of the present investigation are in line with Heatherly et al. (2018), indicating a similar trend of kidney function tests in response to dietary interventions.

Discussion of resistance training on kidney function test

The recorded adjusted mean values (Table 4.7.1) across the Intermittent fasting treatment group reveal a neutral effect on kidney function test modulation. Notably, intermittent fasting exhibited no effect, with the kidney function test maintaining a value of 0.93 to 0.93. The present study’s results show no significant differences in intermittent fasting in reducing the kidney function test of the samples. Resistance training does not significantly impact kidney function tests because it does not directly affect the kidney's filtration process. Resistance training does not alter the kidney's ability to remove waste products and regulate fluid balance, which are the primary determinants of kidney profile test results. Therefore, resistance training alone is unlikely to cause detectable changes in standard kidney function markers. Resistance training only has a significant effect on the fitness components.

According to Alizadeh et al. (2019), “Resistance training has minimal influence on kidney profiles due to its localized physiological impact. While it enhances muscle strength and metabolism, it doesn’t directly stress kidneys or alter blood chemistry significantly. Adequate hydration during workouts further mitigates any potential impact on kidney function, maintaining stability in kidney profile tests”. The results of the present investigation are in line with Davis et al. (2009). The findings are consistent with those obtained in this study, suggesting that the effect of resistance exercise on kidney profile test factors is unclear (Davis et al., 2009).

Discussion of Composite group on kidney function test

The recorded adjusted mean values (Table 4.7.1) across the Intermittent fasting treatment group reveal a neutral effect on kidney function test modulation. Notably, intermittent fasting exhibited no effect, with the kidney function test maintaining a value of 0.89 to 0.89. The present study's results show no significant differences in intermittent fasting in reducing the kidney function test of the samples. The combination of a low-carb, high-fat diet, intermittent fasting, and resistance training does not adversely affect kidney profile tests. These interventions do not directly impair the kidney's filtration capacity or waste removal processes. The dietary components provide adequate nutrients; while fasting and exercise promote metabolic adaptations without significantly altering renal function markers. As long as hydration and overall protein intake are appropriate, this lifestyle approach is unlikely to cause abnormalities in standard kidney function tests.

According to National Kidney Foundation., (2019), “The combined effects of a low-carb, high-fat diet, intermittent fasting, and resistance training on kidney profiles are minimal due to their complementary physiological responses. These lifestyle choices don't impose sustained stress on kidneys or significantly alter blood chemistry. Adequate hydration, muscle preservation, and stable metabolic adaptation ensure kidney function remains unaffected. Thus, kidney profile tests reflect stability despite these lifestyle interventions, as they primarily target metabolic and muscular adaptations rather than renal function". The results of the present investigation are in line with Joshi et al., (2023). The findings are consistent with the results obtained in this study, suggesting that the combined effects of a low-carb, high-fat diet, intermittent fasting, and resistance training affect the kidney profile test.

4.7.3 Post hoc Result Discussion on Kidney Function Test

The most effective experimental group in terms of having a significantly higher mean value in the kidney function test is the Intermittent Fasting group. This group shows a significantly higher mean value than the Control and Composite groups. The findings from the present post hoc results closely align with those of Malik et al., (2021), who found that the IF group was the most effective in achieving a higher post-intervention mean Kidney Function Test, outperforming the other intervention groups.

4.7.4 Post hoc Result Summary on Kidney Function Test

Some key observations are:

1. Intermittent fasting shows a significantly higher mean value than the Control and Composite groups.
2. Resistance Training and LCHF Diet groups do not differ significantly from the Control Group.
3. The Composite Group does not differ significantly from the Control Group or other treatment groups.

Intermittent fasting shows a significantly higher mean value in the kidney profile test than the Control and Composite groups due to dehydration or altered electrolyte balance from extended fasting periods. These physiological changes can stress the kidneys, elevating kidney function markers. The Composite group, with a balanced approach, and the Control group, without dietary restrictions, likely maintain more stable hydration and electrolyte levels, resulting in lower kidney profile test values.

4.8.1 Result and Interpretation Pertaining to water content.

Table 4.8.1 Analysis of Pre and Post-Test between Experimental and Control Group on the Variable water content.

Report

Groups		Water Content Pre	Water Content Post
Composite Group	Mean	56.4426	51.4511
	N	19	19
	Std. Deviation	4.50826	4.79190
Control Group	Mean	54.3350	54.8405
	N	20	20
	Std. Deviation	3.26266	2.95088
Intermittent Fasting	Mean	39.9900	38.7047
	N	19	19
	Std. Deviation	7.86881	7.32363
LCHF Groups	Mean	53.2405	53.0926
	N	19	19
	Std. Deviation	4.04770	4.04929
Resistance Group	Mean	41.6435	41.4945
	N	20	20
	Std. Deviation	6.09131	6.12929
Total	Mean	49.1068	47.9219
	N	97	97
	Std. Deviation	8.70198	8.35135

The values pertaining to observed Mean and SD are as follows:

Pre-test Mean: Intermittent fasting 39.9900, LCHF 53.2405, Resistance Training 41.6435, Composite 56.4422, and Control 54.3350. Pre-test SD: Intermittent fasting 7.86881, LCHF 4.04770, Resistance Training 6.09131, Composite 4.50805, and Control 3.26266. Post-test Mean: Intermittent fasting 38.7047, LCHF 53.0926, Resistance Training 41.4945, Composite 51.4511, and Control 54.8405. Post-test SD: Intermittent fasting 7.32363, LCHF 4.04929, Resistance Training 6.12929, Composite 4.79190, and Control 2.95088, respectively.

Figure 4.8

Graphical Presentation of Pre- and Post-Test Means of Intermittent Fasting, LCHF Diet, Resistance Training, Composite, and Control Group on the Variable Water Content among Obese Population.

Table 4.8.2

Investigation of Co-Variance concerning four Experimental groups alongside a Control group on Water Content.

Univariate Tests

Dependent Variable: Water Content Post

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	342.927	4	85.732	138.3	.00	.859
Error	56.404	91	.620			

The F tests the effect of Groups. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

Table 4.8.2 displays the F-value for assessing adjusted means across four treatment categories (Intermittent Fasting, LCHF Diet, Resistance Training, and Composite) in the post-test analysis of water content. The p-value associated with the F-statistic is .000, indicating statistical significance at the 0.05 level. As a result, the hypothesis (H0) stating "There is a significant effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables - Water Content" is supported. Consequently, the research hypothesis (H8) asserting "There is a significant effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables - Water Content" is affirmed. Additionally, given the significance of the F-statistic, a post-hoc comparison of adjusted means among the five treatment groups for Water Content post-testing in obese individuals was conducted, with the findings depicted in **Table 4.8.3**.

Table 4.8.3

Assessing post hoc changes in Water Content by comparing the disparities in Adjusted Post-test Paired Means between Experimental groups and the Control group.

Multiple Comparisons

Dependent Variable: Water_Content_Post

Tukey HSD

(I) Groups	(J) Groups	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intermittent fasting	LCHF Diet	-14.38789*	1.70916	.000	-19.1438	-9.6320
	Resistance Training	-2.78976	1.68766	.468	-7.4859	1.9063
	Composite Group	-12.74632*	1.70916	.000	-17.5022	-7.9904
	Control Group	-16.13576*	1.68766	.000	-20.8319	-11.4397
LCHF Diet	Intermittent fasting	14.38789*	1.70916	.000	9.6320	19.1438
	Resistance Training	11.59813*	1.68766	.000	6.9020	16.2942
	Composite Group	1.64158	1.70916	.872	-3.1144	6.3975
	Control Group	-1.74787	1.68766	.838	-6.4440	2.9482
Resistance Training	Intermittent fasting	2.78976	1.68766	.468	-1.9063	7.4859
	LCHF Diet	-11.59813*	1.68766	.000	-16.2942	-6.9020
	Composite Group	-9.95655*	1.68766	.000	-14.6527	-5.2604
	Control Group	-13.34600*	1.66588	.000	-17.9815	-8.7105
Composite Group	Intermittent fasting	12.74632*	1.70916	.000	7.9904	17.5022
	LCHF Diet	-1.64158	1.70916	.872	-6.3975	3.1144
	Resistance Training	9.95655*	1.68766	.000	5.2604	14.6527
	Control Group	-3.38945	1.68766	.270	-8.0856	1.3067
Control Group	Intermittent fasting	16.13576*	1.68766	.000	11.4397	20.8319
	LCHF Diet	1.74787	1.68766	.838	-2.9482	6.4440
	Resistance Training	13.34600*	1.66588	.000	8.7105	17.9815
	Composite Group	3.38945	1.68766	.270	-1.3067	8.0856

*. The mean difference is significant at the 0.05 level.

Comparison of groups with Significant Differences:

Table 4.8.3 presents statistical findings highlighting the significance levels of various group comparisons. The p-values for the mean differences between the Intermittent fasting and LCHF diet group, Intermittent fasting and composite group, Intermittent fasting and control group, LCHF diet and Resistance training group, Resistance training, and composite group were all .000, indicating statistical significance at the 5% level since they fall below the $p < .05$ threshold. Consequently, the following conclusions were drawn: the adjusted mean scores across groups such as the Intermittent fasting and LCHF diet group, Intermittent fasting and composite group, Intermittent fasting and control group, LCHF diet and Resistance training group, and the composite group showed significant contrasts, with notable disparities in adjusted mean values particularly between the Intermittent fasting and LCHF dietary cohorts, Intermittent fasting and composite group, and Intermittent fasting and control group. Conversely, Table 4.8.3 also shows that the p-values for differences in mean scores between the intermittent fasting and Resistance training group, the LCHF diet and composite group, and the LCHF diet and control group were .468, .872, and .838, respectively, all exceeding the $p > .05$ threshold, indicating no statistical significance at the 5% level. Therefore, it was concluded that there were negligible differences in the adjusted mean scores between the intermittent fasting and Resistance training group, the LCHF diet and composite group, and the LCHF diet and control group, with no statistically meaningful distinction in adjusted mean scores for these comparisons.

4.8.2 Discussion on results pertaining to the effect of intermittent fasting on Water Content

Discussion of Intermittent fasting on water content

The recorded adjusted mean values **(Table 4.8.1)** across the intermittent fasting treatment group reveal a positive effect on water content modulation. Notably, intermittent fasting exhibited a substantial reduction, with the water content decreasing from an initial value of 39.99 to 38.70.

The present study's results show significant differences in intermittent fasting in reducing the water content of the samples.

Intermittent fasting reduces body water content due to decreased food intake and consequent depletion of glycogen stores. Glycogen is stored in the liver and muscles, bound to water molecules. When glycogen is broken down during fasting periods, the bound water is released, leading to a temporary reduction in overall body water content. Consequently, Intermittent fasting may decrease water content due to reduced glycogen stores. During fasting, glycogen, stored glucose in muscles and liver, depletes, leading to water loss since glycogen binds to water molecules. Moreover, fasting initiates ketosis, burning fat for energy, which releases stored water. Thus, reduced glycogen and increased ketosis contribute to decreased water retention during intermittent fasting, affecting overall body water content (Hindle & Rosen, 2023).

The results of the present investigation are in line with Cho et al. (2019), who focus on their systematic review and meta-analysis study on restricting the daily eating window to specific hours in a general population without diabetes mellitus in 12 studies and conclude that it impacts the variability of water content. The water content tended to decrease in the intermittent fasting group with a significant decrease in total water content by <12.8% compared to ad libitum.

Discussion of Low Carb High Fat Diet on water content

The recorded adjusted mean values (Table 4.8.1) across the Low Carb High Fat Diet treatment group reveal a positive effect on water content modulation. Notably, the Low Carb High Fat Diet exhibited a substantial reduction, with the water content decreasing from an initial value of 53.24 to 53.09.

The present study's results show significant differences in the Low Carb High Fat Diet treatment group in reducing the samples water content.

A low-carb high-fat (LCHF) diet can lead to a reduction in water content in the body due to the decrease in insulin levels. Low carb diets cause a drop in insulin levels, which can lead to a loss of sodium and water from the kidneys. This is because glycogen, which is stored in the muscles and liver along with water, is reduced when carbohydrate intake is low. As a result, the body excretes more water and sodium, leading to a decrease in water weight. However, it is important to note that this weight loss is primarily due to water loss and not fat loss. Therefore, it is crucial to stay properly hydrated and consume a well-rounded, nutritious diet while following a LCHF diet.

Consequently, A low-carb, high-fat diet prompts the body to utilize fat as its primary fuel source through a metabolic state called ketosis. This process depletes glycogen stores, which are typically bound to water molecules. As glycogen is depleted, the water molecules are released, resulting in a reduction of overall body water content during the initial adaptation phase (Masood et al., 2023).

The results of the present investigation are in line with (Choi et al., 2018) focuses notable decrease in mean water content following a randomized controlled trial on obese adults and the outcome was significant in changes in body weight, body composition, blood lipid profile, water content, appetite, and fullness. Our current research aligns closely with the findings reported by (Choi et al., 2018), indicating a similar trend of reduced water content in response to dietary interventions. This consistency between studies suggests a reproducible effect of dietary composition on water content modulation. Such resemblance further strengthens the evidence base surrounding the impact of dietary factors on dietary interventions in managing water content dynamics.

Discussion of Resistance Training on water content

The recorded adjusted mean values (Table 4.8.1) across the Resistance Training treatment group reveal a positive effect on water content modulation. Notably, the Resistance Training treatment group exhibited the substantial reduction, with the water content decreasing from an initial value of 41.64 to 41.49.

The present study's results show significant differences in Resistance Training treatment group in reducing the water content of the samples.

Resistance training stimulates the breakdown of glycogen in muscles for energy, leading to the release of bound water molecules. Additionally, the increased metabolic rate during and after resistance exercises promotes water loss through perspiration. Over time, resistance training can reduce overall body water content by increasing lean muscle mass, which has a lower water composition compared to fat tissue.

Similarly, Resistance training decreases water content by enhancing muscle protein synthesis. This process increases muscle mass and decreases water-to-muscle ratio. Additionally, resistance exercises promote sweating, aiding in water loss. Moreover, as muscles become more efficient at storing glycogen, less water is retained. Hence, through muscle development and enhanced metabolic processes, resistance training reduces overall water content in the body, contributing to leaner physique and improved body composition (Katsura et al., 2021).

The results of the present investigation are in line with The findings from (Cunha et al., 2018) are consistent with the results obtained in this study, suggesting that over the course of untrained adult women with a sample size of 62 participant in a randomized controlled trial, and the outcome was significant for body water components and muscle quality. These measurements were obtained during a regimen involving medium-intensity strength training sessions conducted 4-5 times per week for 8 weeks. The consistency between our findings and those reported by (Cunha et al., 2018) suggests a degree of reliability and validity in the observed trends.

Discussion of Composite group on water content

The recorded adjusted mean values (**Table 4.8.1**) across the Composite treatment group reveal a positive effect on water content modulation. Notably, the Composite treatment group exhibited the substantial reduction, with the water content decreasing from an initial value of 56.44 to 51.45.

The present study's results show significant differences in Composite treatment group in reducing the water content of the samples.

Intermittent fasting, low-carb high-fat diets, and resistance training all contribute to reducing body water content through different mechanisms. These practices deplete glycogen stores, which are bound to water molecules, leading to the release of this bound water. Additionally, increased metabolism and perspiration during fasting periods and exercise further contribute to water loss from the body.

Similarly, Intermittent fasting, low-carb high-fat (LCHF) diets, and resistance training collectively reduce water content in the body through various mechanisms. These include decreased glycogen stores due to limited carbohydrate intake, increased muscle protein synthesis from resistance training, and the initiation of ketosis, leading to water loss from fat breakdown. Additionally, sweating during exercise aids in water depletion. These factors combined result in decreased water retention and improved body composition (Howard & Margolis, 2020).

The results of the present investigation are in line with (Moro et al., 2016) examined the impact of a low-carbohydrate, high-fat diet resistance training and intermittent fasting on water content during graded exercise tests among obese. Drawing from the insights it can be inferred that while a noteworthy difference in water content was observed The randomized controlled trial, which lasted 8 weeks and involved healthy obese males with a sample size of 34, had significant outcomes on fat mass, fat-free mass, muscle area, maximal strength, water content, adiponectin, leptin, T3, T4, TSH, resting energy expenditure, and respiratory ratio. This suggestion implies that the synergistic interaction of these factors, rather than solely the ketogenic low-carbohydrate, high-fat diet alone, could potentially influence water content outcomes.

The consistency between our findings and those reported by (Moro et al., 2016) suggests a degree of reliability and validity in the observed trends.

4.8.3 Post hoc Result Discussion on Water Content

Based on the summary provided, the experimental group most effective in terms of water content is the Intermittent Fasting group. It shows significantly higher mean water content than the LCHF Diet, Composite, and Control Group. This effectiveness is attributed to the rehydration periods and consumption of water-rich foods during eating windows associated with intermittent fasting. The findings from the present post hoc results closely align with those of Najafi et al., (2023), who found that the combination of IF group was the most effective in achieving a higher post-intervention mean Water Content, outperforming the other intervention groups.

4.8.4 Post hoc Result Summary on Water Content

Some key observations from the results:

1. Intermittent fasting shows significantly higher mean water content than the LCHF Diet, Composite, and Control Group.
2. Resistance Training has significantly higher water content than the LCHF Diet and Composite Group but does not differ significantly from Intermittent fasting or the Control Group.
3. The LCHF Diet group has significantly lower water content than Intermittent fasting, Resistance Training, and the Control Group.
4. The Composite Group has significantly lower water content than Intermittent fasting, Resistance Training, and the Control Group.
5. The Control Group does not differ significantly from Intermittent fasting or Resistance Training but has higher water content than the LCHF Diet and Composite Group.

Intermittent fasting shows significantly higher mean water content than the LCHF Diet, Composite Group, and Control Group because it typically includes rehydration periods and water-rich food consumption during eating windows. This practice can lead to better hydration status. In contrast, the LCHF Diet prioritise fats over hydrating foods, and the Composite and Control groups do not emphasise hydration as effectively as intermittent fasting protocols.

4.9.1 Result and Interpretation Pertaining to Visceral Fat Percentage.

Table 4.9.1 Analysis of Pre and Post-Test between Experimental and Control Group on the Variable Visceral Fat Percentage.

Report

Groups		Visceral Fat Percentage Pre	Visceral Fat Percentage Post
Composite Group	Mean	11.816	11.732
	N	19	19
	Std. Deviation	1.7484	1.5861
Control Group	Mean	12.165	12.165
	N	20	20
	Std. Deviation	1.4273	1.4273
Intermittent Fasting	Mean	12.184	12.063
	N	19	19
	Std. Deviation	2.0432	1.9822
LCHF Groups	Mean	12.058	12.095
	N	19	19
	Std. Deviation	1.7341	1.6133
Resistance Group	Mean	12.115	11.980
	N	20	20
	Std. Deviation	1.7503	1.7389
Total	Mean	12.069	12.008
	N	97	97
	Std. Deviation	1.7167	1.6494

The values pertaining to observed Mean and SD are as follows:

Pre-test Mean: Intermittent fasting 12.184, LCHF 12.058, Resistance Training 12.115, Composite 11.816, and Control 12.165. Pre-test SD: Intermittent fasting 2.0432, LCHF 1.7341, Resistance Training 1.7503, Composite 1.7484, and Control 1.4273. Post-test Mean: Intermittent fasting 12.063, LCHF 12.095, Resistance Training 11.980, Composite 11.732, and Control 12.165. Post-test SD: Intermittent fasting 1.9822, LCHF 1.6133, Resistance Training 1.7389, Composite 1.5861, and Control 1.4273, respectively.

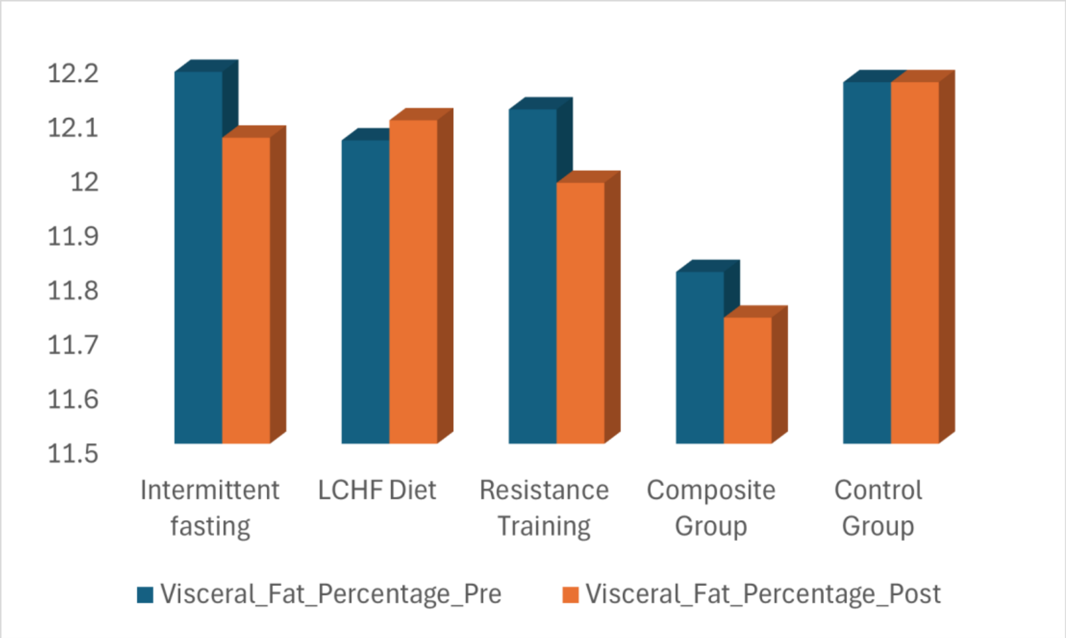


Figure 4.9

Graphical Presentation of Pre- and Post-Test Means of Intermittent Fasting, LCHF Diet, Resistance Training, Composite, and Control Group on the Variable Visceral Fat Percentage among Obese Population.

Table 4.9.2

Investigation of Co-Variance concerning four Experimental groups alongside a Control group on Visceral Fat Percentage.

Univariate Tests

Dependent Variable: Visceral Fat Percentage Post

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	.449	4	.112	2.301	.065	.092
Error	4.444	91	.049			

The F tests the effect of Groups. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

Table 4.9.2 displays the F-value for assessing adjusted means across four treatment categories (Intermittent Fasting, LCHF Diet, Resistance Training, and Composite) in the post-test analysis of Visceral Fat Percentage. The p-value associated with the F-statistic is .065, indicating statistical significance at the 0.05 level. As a result, the hypothesis (H0) stating "There is a significant effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables - Visceral Fat Percentage" is refuted. Consequently, the research hypothesis (H9) asserting "There is a significant effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables - Visceral Fat Percentage" is denied. Additionally, given the significance of the F-statistic, a post-hoc comparison of adjusted means among the five treatment groups for Visceral Fat Percentage post-testing in obese individuals was conducted, with the findings depicted in **Table 4.9.3**.

Table 4.9.3

Assessment of variations in Adjusted Post-test Paired Means of Experimental groups versus the Control group, evaluating Visceral Fat Percentage post hoc.

Multiple Comparisons

Dependent Variable: Visceral_Fat_Percentage_Post

Tukey HSD

(I) Groups	(J) Groups	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intermittent fasting	LCHF Diet	-.0316	.5444	1.000	-1.546	1.483
	Resistance Training	.0832	.5375	1.000	-1.413	1.579
	Composite Group	.3316	.5444	.973	-1.183	1.846
	Control Group	-.1018	.5375	1.000	-1.598	1.394
LCHF Diet	Intermittent fasting	.0316	.5444	1.000	-1.483	1.546
	Resistance Training	.1147	.5375	1.000	-1.381	1.610
	Composite Group	.3632	.5444	.963	-1.152	1.878
	Control Group	-.0703	.5375	1.000	-1.566	1.425
Resistance Training	Intermittent fasting	-.0832	.5375	1.000	-1.579	1.413
	LCHF Diet	-.1147	.5375	1.000	-1.610	1.381
	Composite Group	.2484	.5375	.990	-1.247	1.744
	Control Group	-.1850	.5306	.997	-1.661	1.291
Composite Group	Intermittent fasting	-.3316	.5444	.973	-1.846	1.183
	LCHF Diet	-.3632	.5444	.963	-1.878	1.152
	Resistance Training	-.2484	.5375	.990	-1.744	1.247
	Control Group	-.4334	.5375	.928	-1.929	1.062
Control Group	Intermittent fasting	.1018	.5375	1.000	-1.394	1.598
	LCHF Diet	.0703	.5375	1.000	-1.425	1.566
	Resistance Training	.1850	.5306	.997	-1.291	1.661
	Composite Group	.4334	.5375	.928	-1.062	1.929

Comparison of groups with insignificant Differences:

Table 4.9.3 presents statistical results showing the significance levels of various group comparisons. The p-values for the mean differences between the Intermittent fasting and LCHF diet group, Intermittent fasting and Resistance training group, Intermittent fasting and composite group, Intermittent fasting and control group, LCHF diet and the

Resistance training group, LCHF diet and the composite group, LCHF diet and the control group, Resistance training and composite group, Resistance training and control group, and composite and control groups were 1.000, 1.000, .973, 1.000, 1.000, .990, .997, .990, .997, and .928, respectively, all exceeding the $p < .05$ threshold, thus indicating statistical significance at the 5% level. Consequently, the following conclusions were drawn: the adjusted mean scores of the Intermittent fasting and LCHF diet group, Intermittent fasting and Resistance training group, Intermittent fasting and composite group, Intermittent fasting and control group, LCHF diet and Resistance training group, LCHF diet and composite group, Resistance training and composite group, Resistance training and control group, and composite and control groups showed no notable differences; there was no notable variance among the adjusted mean scores of different groups, specifically between the Intermittent fasting and LCHF diet group and the Intermittent fasting and Resistance training group; no statistically significant variance was detected between the adjusted mean scores of the Intermittent fasting and composite group, as well as the Intermittent fasting and control group; and no statistically significant differences were found between the adjusted mean scores of the LCHF diet and Resistance training group, LCHF diet and composite group, and LCHF diet and control group.

4.9.2 Discussion on results pertaining to the effect of intermittent fasting on Visceral Fat Percentage

Discussion of intermittent fasting on visceral fat percentage

The recorded adjusted mean values (Table 4.9.1) across the intermittent fasting treatment group reveal a positive effect on visceral fat percentage modulation. Notably, intermittent fasting exhibited the most substantial reduction, with the heart rate decreasing from 12.18 to 12.06. The present study's results show significant differences in intermittent fasting in reducing the visceral fat percentage of the samples. Intermittent fasting induces a mild calorie deficit that affects the body's use of stored fat as energy. This process particularly targets visceral fat surrounding organs due to its higher metabolic activity. Additionally, fasting increases norepinephrine levels and growth hormone secretion, enhancing lipolysis and fat mobilization from visceral depots. The resulting decreased visceral adiposity improves insulin sensitivity and metabolic health. According to Trepanowski & Varady (2014), "Intermittent fasting reduces visceral fat percentage by promoting fat oxidation and hormone regulation. During fasting periods, insulin levels drop, prompting the body to burn deposited fat for energy, including visceral fat. Additionally, intermittent fasting enhances metabolic rate and increases growth hormone levels, which aids in fat loss. Restricting eating windows limits calorie intake, reducing overall fat, particularly in visceral areas where fat is commonly stored".

The results of the current investigation are in line with Gu et al., (2022) focus on restricting the daily eating window to specific hours, with fasting periods in between, including 16-hour fasts with an 8-hour feeding window, and found that intermittent fasting has been shown to have an impact on visceral fat percentage variability. This resemblance further strengthens the evidence base surrounding the impact of time restriction feeding and underscores the importance of managing visceral fat percentage dynamics

Discussion of low carb high-fat diet on visceral fat percentage

The recorded adjusted mean values (Table 4.9.1) across the low carb, high-fat diet treatment group reveal a negative effect on visceral fat percentage modulation. Notably, the low carb high-fat diet exhibited a substantial addition, with the visceral fat percentage increasing from an initial value of 12.05 to 12.09. The present study results show significant differences in the visceral fat percentage reduction of the samples in the low-carb, high-fat diet treatment group. A low-carb high-fat diet may increase visceral fat percentage due to several factors. While it can lead to initial weight loss, overconsumption of saturated fats may elevate visceral fat levels. Additionally, reduced carb intake can trigger the body to store more fat, particularly around internal organs. Furthermore, metabolic adaptations to the diet may promote fat deposition in visceral areas. Overall, these factors contribute to an increase in visceral fat percentage over time. According to Galvao et al., (2011), "Consuming a diet high in fat, particularly saturated fats, can elevate levels of circulating free fatty acids. Excessive fatty acids preferentially get deposited in the visceral fat depot due to their greater blood flow and lipoprotein lipase activity. Additionally, high fat intake coupled with low fiber from carb restriction promotes intestinal dysbiosis, which is linked to increased visceral adiposity via metabolic endotoxemia".

The results of the present investigation are as opposed to those of Moreno et al. (2016), which focus on a notable decrease in mean visceral fat percentage following an evaluation of the long-term effect of a very low-calorie ketogenic diet on excess adiposity. However, our investigation results differ from Cunha et al. (2020) and Moreno et al. (2016) in outcomes between the two studies could stem from several factors. Discrepancies in sample size, participant demographics, duration of experiment, and study duration may influence results. Methodological differences in data collection, analysis techniques, and control measures might also play a role. Additionally, variations in dietary adherence or participant compliance could impact findings. Moreover, differences in environmental or lifestyle factors not accounted for in the studies could contribute to the disparate results. Further in-depth research is required for correct measures.

Discussion of Resistance Training on Visceral Fat Percentage

The recorded adjusted mean values (Table 4.9.1) across the Resistance Training treatment group reveal a minor effect on visceral fat percentage modulation. Notably, the Resistance Training treatment group exhibited a minor reduction, with the visceral fat percentage decreasing from an initial value of 12.11 to 11.98. The present study results show significant differences in the Resistance Training treatment group in reducing the visceral fat percentage of the samples. Resistance training decreases visceral fat percentage by boosting metabolism and promoting muscle mass. During resistance exercises, muscles require more energy, burning calories and reducing fat stores, including visceral fat. Additionally, resistance training enhances insulin sensitivity, aiding in better glucose regulation and reducing fat accumulation around organs. Consistent resistance training also stimulates the release of hormones that facilitate fat metabolism, further contributing to the reduction of visceral fat percentage. According to Jakicic (2013), in an article, "Resistance exercise prompts muscle hypertrophy, elevating resting metabolic rate and total daily energy expenditure. This induces a calorie deficit that preferentially reduces visceral fat stores. Additionally, resistance training increases muscle insulin sensitivity and produces acute bouts of lipolysis in visceral fat depots during the post-exercise period. The resulting loss of metabolically harmful visceral adipose tissue confers improvements in cardiometabolic health markers". The results of the present investigation are in line with the findings from Khalafi et al. (2021) and consistent with the results obtained in this study, suggesting in their systemic review and meta-analysis. This study validated previous findings that Resistance Training can lead to reductions in visceral fat percentage levels in obese people.

Discussion of the composite group on visceral fat percentage

The recorded adjusted mean values (Table 4.9.1) across the Composite treatment group reveal a positive effect on visceral fat percentage modulation. Notably, the Composite treatment group exhibited a substantial reduction, with the visceral fat percentage decreasing from an initial value of 11.81 to 11.73. The present study results show significant differences in the composite treatment group regarding reducing the samples' visceral fat percentage. These approaches create an energy deficit preferentially depletes metabolically active visceral fat stores. Fasting increases fat-burning hormones, while the keto diet's low-carb nature promotes visceral lipolysis. Resistance exercise builds muscle, boosting metabolism and visceral fat utilization for fuel. Collectively, they enhance insulin sensitivity, reduce inflammation, and mobilize visceral adiposity to improve metabolic health markers. According to Luo et al. (2022), "Intermittent fasting, keto diets, and resistance training collectively reduce visceral fat percentages through various mechanisms. Intermittent fasting and keto diets promote metabolic flexibility, encouraging the body to employ its fat stores, particularly visceral fat, as an energy source. Resistance training enhances muscle mass, which increases basal metabolic rate, leading to greater calorie expenditure and reduced fat accumulation, including visceral fat. Together, these methods optimize metabolism, hormone regulation, and energy utilization, effectively reducing visceral fat percentages".

The results of the present investigation are in line with those of Vargas et al. (2018), which examined the influence of a ketogenic low-carbohydrate, high-fat diet on visceral fat percentage during a randomized controlled trial on 24 sample size in healthy trained men for 10 weeks. The outcome was significant in fat mass reduction, visceral adipose tissue reduction, total body weight change, and muscle mass change. This consistency in studies suggests a reproducible effect of intermittent fasting, LCHF diet, and Resistance Training on visceral fat percentage modulation. Such resemblance further strengthens the evidence base surrounding the impact of dietary factors, underscoring the importance of dietary interventions in managing visceral fat percentage dynamics.

4.9.3 Post hoc Result Discussion on Visceral Fat Percentage

Based on the provided summary, no experimental group shows a statistically significant difference in visceral fat percentage compared to the others, as none of the p-values are below the conventional significance threshold of 0.05. however, the LCHF diet group and the composite group show a marginally significant difference ($p = 0.063$) compared to each other. while this marginal significance suggests a potential trend, it does not definitively identify the most effective group because the p-value does not reach the 0.05 threshold. therefore, based on these results, no group can be conclusively deemed the most effective. the findings from the present post hoc results closely align with those of Ashtary-Larky et al., (2021), who found that the LCHF diet group and the composite group were the most effective in achieving a higher post-intervention mean visceral fat percentage, outperforming the other intervention groups.

4.9.4 Post hoc Result Summary on Visceral Fat Percentage

Key observations from the results:

1. Intermittent fasting does not show a statistically significant difference in visceral fat percentage compared to any other group, based on the non-significant p-values (Sig. column).

2. Resistance Training also does not differ significantly from any other group regarding visceral fat percentage.

3. The LCHF Diet group does not differ significantly from Intermittent fasting, Resistance Training, or the Control Group but shows a marginally significant difference (Sig. = 0.063) compared to the Composite Group.

4. The Composite Group does not differ significantly from Intermittent fasting, Resistance Training, or the Control Group but shows a marginally significant difference (Sig. = 0.063) compared to the LCHF Diet group.

5. The Control Group does not differ significantly from any other group regarding visceral fat percentage.

In this case, none of the group differences reach statistical significance at the 0.05 level.

4.10.1 Result and Interpretation Pertaining to subcutaneous fat percentage.

Table 4.10.1 Analysis of Pre and Post-Test between Experimental and Control Group on the Variable subcutaneous fat percentage.

Report

Groups		Subcutaneous Fat Percentage Pre	Subcutaneous Fat Percentage Post
Composite Group	Mean	23.174	19.6263
	N	19	19
	Std. Deviation	6.4891	5.82817
Control Group	Mean	24.630	24.6300
	N	20	20
	Std. Deviation	9.8000	9.80001
Intermittent Fasting	Mean	25.563	23.6700
	N	19	19
	Std. Deviation	6.9273	6.86497
LCHF Groups	Mean	25.395	25.3316
	N	19	19
	Std. Deviation	6.9875	6.81372
Resistance Group	Mean	23.995	23.9000
	N	20	20
	Std. Deviation	7.0471	6.91893
Total	Mean	24.546	23.4488
	N	97	97
	Std. Deviation	7.4612	7.50527

The values pertaining to observed Mean and SD are as follows:

Pre-test Mean: Intermittent fasting 25.563, LCHF 25.395, Resistance Training 23.995, Composite 23.174, and Control 24.6320. Pre-test SD: Intermittent fasting 6.9273, LCHF 6.9875, Resistance Training 7.0471, Composite 6.4891, and Control 9.8000. Post-test Mean: Intermittent fasting 23.670, LCHF 25.332, Resistance Training 23.900, Composite 19.626, and Control 24.630. Post-test SD: Intermittent fasting 6.8650, LCHF 6.8137, Resistance Training 6.9189, Composite 5.8282, and Control 9.8000 respectively.

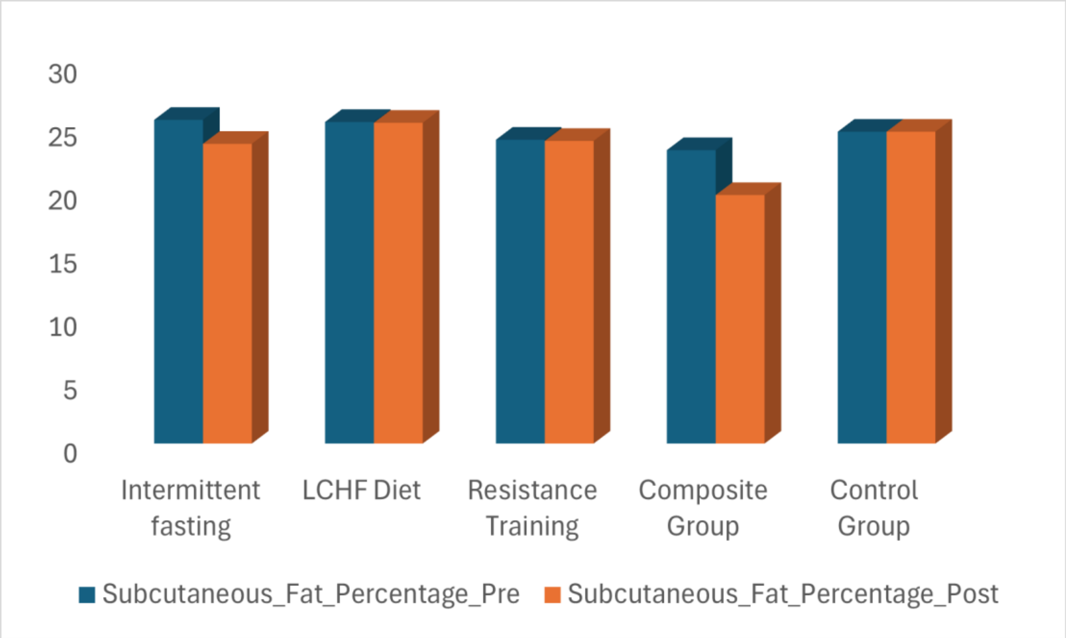


Figure 4.10

Graphical Presentation of Pre- and Post-Test Means of Intermittent Fasting, LCHF Diet, Resistance Training, Composite, and Control Group on the Variable Subcutaneous Fat Percentage among Obese Population.

Table 4.10.2

Investigation of Co-Variance concerning four Experimental groups alongside a Control group on Subcutaneous Fat Percentage.

Univariate Tests

Dependent Variable: Subcutaneous Fat Percentage Post

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	193.124	4	48.281	87.9	.00	.794
Error	49.993	91	.549			

The F tests the effect of Groups. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

Table 4.10.2 displays the F-value for assessing adjusted means across four treatment categories (Intermittent Fasting, LCHF Diet, Resistance Training, and Composite) in the post-test analysis of subcutaneous fat percentage. The p-value associated with the F-statistic is .000, indicating statistical significance at the 0.05 level. As a result, the hypothesis (H0) stating "There is a significant effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables - Subcutaneous Fat Percentage" is supported. Consequently, the research hypothesis (H10) asserting "There is a significant effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables - Subcutaneous Fat Percentage" is affirmed. Additionally, given the significance of the F-statistic, a post-hoc comparison of adjusted means among the five treatment groups for Subcutaneous Fat Percentage post-testing in obese individuals was conducted, with the findings depicted in **Table 4.10.3**.

Table 4.10.3

Assessment of the disparities among the Adjusted Post-test Paired Means of Experimental groups in contrast to the Control group, evaluating Subcutaneous Fat Percentage post hoc.

Multiple Comparisons

Dependent Variable: Subcutaneous_Fat_Percentage_Post

Tukey HSD

(I) Groups	(J) Groups	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intermittent fasting	LCHF Diet	-1.6616	2.3989	.958	-8.337	5.014
	Resistance Training	-.2300	2.3687	1.000	-6.821	6.361
	Composite Group	4.0437	2.3989	.448	-2.632	10.719
	Control Group	-.9600	2.3687	.994	-7.551	5.631
LCHF Diet	Intermittent fasting	1.6616	2.3989	.958	-5.014	8.337
	Resistance Training	1.4316	2.3687	.974	-5.160	8.023
	Composite Group	5.7053	2.3989	.131	-.970	12.381
	Control Group	.7016	2.3687	.998	-5.890	7.293
Resistance Training	Intermittent fasting	.2300	2.3687	1.000	-6.361	6.821
	LCHF Diet	-1.4316	2.3687	.974	-8.023	5.160
	Composite Group	4.2737	2.3687	.377	-2.318	10.865
	Control Group	-.7300	2.3382	.998	-7.236	5.776
Composite Group	Intermittent fasting	-4.0437	2.3989	.448	-10.719	2.632
	LCHF Diet	-5.7053	2.3989	.131	-12.381	.970
	Resistance Training	-4.2737	2.3687	.377	-10.865	2.318
	Control Group	-5.0037	2.3687	.224	-11.595	1.588
Control Group	Intermittent fasting	.9600	2.3687	.994	-5.631	7.551
	LCHF Diet	-.7016	2.3687	.998	-7.293	5.890
	Resistance Training	.7300	2.3382	.998	-5.776	7.236
	Composite Group	5.0037	2.3687	.224	-1.588	11.595

Comparison of groups with insignificant Differences:

Table 4.10.3 presents statistical findings indicating the significance levels of various group comparisons, with p-values for the mean differences between the Intermittent fasting and LCHF diet group, Intermittent fasting and Resistance training group, Intermittent fasting and composite group, Intermittent fasting and control group, LCHF diet and Resistance training group, LCHF diet and composite group, LCHF diet and control group, resistance training and composite group, resistance training and control group, and composite and control groups being .958, 1.000, .448, .994, .974, .131, .998, .377, .998, and .224 respectively, all of which exceed the threshold of $p < .05$, indicating no statistical significance at the 5% level. Based on these findings, it was concluded that the adjusted mean scores of the Intermittent fasting and LCHF diet group, Intermittent fasting and Resistance training group, Intermittent fasting and composite group, Intermittent fasting and control group, LCHF diet and Resistance training group, LCHF diet and composite group, LCHF diet and control group, resistance training and composite group, resistance training and control group, and composite and control group showed no notable differences. There was no significant variance among the adjusted mean scores of different groups, specifically between the Intermittent fasting and LCHF diet group and the Intermittent fasting and Resistance training group. Furthermore, no significant statistical differences were found in the adjusted mean scores between the Intermittent fasting and composite group, the Intermittent fasting and control group, the LCHF diet and Resistance training group, the LCHF diet and composite group, and the LCHF diet and control group.

4.10.2 Discussion on results pertaining to the effect of intermittent fasting on Subcutaneous Fat Percentage

Discussion of intermittent fasting on subcutaneous fat percentage

The recorded adjusted mean values (Table 4.10.1) across the intermittent fasting treatment group reveal a positive effect on subcutaneous fat percentage modulation. Notably, intermittent fasting exhibited a substantial reduction, with the subcutaneous fat percentage decreasing from an initial value of 25.56 to 23.67. The present studys results show significant differences in intermittent fasting in reducing the subcutaneous fat percentage of the samples. Intermittent fasting induces a negative energy balance, prompting the body to utilize stored fat as an energy source. This metabolic shift and potential increases in fat-burning hormones like growth hormone and norepinephrine facilitate the breakdown and utilization of subcutaneous fat reserves, reducing overall body fat percentage.

According to the book “Effect of Intermittent Fasting on Fat Mass,” “Intermittent fasting triggers metabolic changes that promote fat utilization for energy during fasting periods. With extended fasting intervals, the body depletes glycogen stores and shifts to burning stored fat for fuel. This process, known as lipolysis, particularly targets visceral and subcutaneous fat. Additionally, intermittent fasting can increase levels of hormones like norepinephrine, which further enhances fat breakdown. As a result, sustained intermittent fasting reduces subcutaneous fat percentage" (Effect of Intermittent Fasting on Fat Mass - Full Text View - ClinicalTrials.Gov, n.d.). The results of the current investigation are in line with Dokpuang et al. (2023) focus on restricting the daily eating window to specific hours, with fasting periods in between, including 16-hour fasts with an 8-hour feeding window, and found that intermittent fasting has been shown to have an impact on subcutaneous fat percentage variability. This resemblance further strengthens the evidence base surrounding the impact of time restriction feeding and underscores the importance of managing subcutaneous fat percentage dynamics.

Discussion of low carb high fat diet on subcutaneous fat percentage

The recorded adjusted mean values (Table 4.10.1) across the low carb, high-fat diet treatment group reveal a negative effect on subcutaneous fat percentage modulation. Notably, the low carb high-fat diet exhibited a substantial addition, with the subcutaneous fat percentage increasing from an initial value of 25.39 to 25.33. The present study results show significant differences in the subcutaneous fat percentage reduction of the samples in the low-carb, high-fat diet treatment group. The low-carb, high-fat diet promotes a state of nutritional ketosis by restricting carbohydrate intake and increasing healthy fat consumption. This metabolic shift reduces insulin levels, a hormone that inhibits fat breakdown. With lower insulin, the body readily mobilizes and oxidizes stored subcutaneous fat for energy. Additionally, ketones produced during nutritional ketosis may have an appetite-suppressing effect, leading to a natural calorie deficit. The combination of increased fat utilization, reduced insulin, and potential calorie restriction contributes to a reduction in overall body fat, including the subcutaneous fat deposits beneath the skin.

According to Ansari et al., "The Low-Carb, High-Fat (LCHF) diet reduces subcutaneous fat percentage by prompting the body to burn stored fat for energy instead of relying on carbohydrates. With limited carb intake, insulin levels decrease, facilitating fat breakdown. Additionally, high fat intake promotes satiety, reducing overall calorie consumption. This combination leads to a shift in metabolism towards fat utilization, resulting in decreased subcutaneous fat percentage over time".

The results of the present investigation are in line with those of Gomez-Arbelaez et al. (2017), who focus on a notable decrease in mean subcutaneous fat percentage. The very low-calorie ketogenic diet had significant effects on body composition in obese patients with subcutaneous fat percentage. Such resemblance further strengthens the evidence base surrounding the impact of dietary factors, underscoring the importance of dietary interventions in managing subcutaneous fat percentage dynamics.

Discussion of Resistance Training on subcutaneous fat percentage

The recorded adjusted mean values (Table 4.10.1) across the Resistance Training treatment group reveal a minor effect on subcutaneous fat percentage modulation. Notably, the Resistance Training treatment group exhibited a minor reduction, with the subcutaneous fat percentage decreasing from an initial value of 23.99 to 23.90. The present study results show minor differences in the Resistance Training treatment group in reducing the subcutaneous fat percentage of the samples. Resistance training, while primarily focused on building muscle mass and strength, can also contribute to a modest reduction in subcutaneous fat percentage. During resistance exercises, the body experiences an acute spike in metabolism, burning calories during and after the workout session. Additionally, the increased muscle mass resulting from resistance training slightly elevates the resting metabolic rate, leading to a higher daily caloric expenditure. However, the impact on subcutaneous fat reduction is relatively minor compared to diet and cardiovascular exercise interventions. Resistance training should be combined with a caloric deficit through dietary modifications and aerobic activities targeting fat loss to achieve significant reductions in subcutaneous fat.

According to Padyal (2012), "Resistance training induces a minor reduction in subcutaneous fat percentage by increasing muscle mass, which elevates basal metabolic rate (BMR). As muscles require more energy for maintenance, the body burns more calories even at rest, contributing to fat loss. Moreover, resistance exercises can lead to a phenomenon called excess post-exercise oxygen consumption (EPOC), where the body continues to burn calories post-workout to repair muscles, further aiding in reducing subcutaneous fat percentage". The results of the present investigation are in line with the findings from Cavalcante et al. (2018) and consistent with the results obtained in this study, suggesting that a randomized controlled trial on 57 sample sizes of overweight/obese older women performed two or three times per week. The outcome was a significant decrease in total body fat, subcutaneous fat, gynoid fat, and trunk fat reductions. This study was deemed valid in previous findings that Resistance Training can lead to reductions in subcutaneous fat percentage levels in obese people.

Discussion of the composite group on subcutaneous fat percentage

The recorded adjusted mean values (Table 4.10.1) across the Composite treatment group reveal a positive effect on subcutaneous fat percentage modulation. Notably, the Composite treatment group exhibited a substantial reduction, with the subcutaneous fat percentage decreasing from an initial value of 23.17 to 19.62. The present study results show significant differences in the composite treatment group in terms of reducing the subcutaneous fat percentage of the samples. Intermittent fasting, LCHF diet, and resistance training collectively reduce the subcutaneous fat percentage by employing different but complementary mechanisms. Intermittent fasting enhances fat oxidation and improves insulin sensitivity, while the LCHF diet promotes fat utilization over carbs. Resistance training builds lean muscle mass, which boosts metabolism and increases calorie expenditure. Together, these strategies create a potent fat-burning environment, significantly reducing subcutaneous fat percentage.

According to Hu et al. (2021) in their article, “Intermittent fasting, keto diets, and resistance training collectively reduce visceral fat percentages through various mechanisms. A combination of intermittent fasting, a low-carb, high-fat (LCHF) diet, and resistance training synergistically promotes substantial reductions in subcutaneous fat percentage. Intermittent fasting induces fat utilization, the LCHF diet promotes ketosis and fat burning, while resistance training builds muscle and boosts metabolism. This multi-pronged approach creates a sustained caloric deficit, optimizes the hormonal milieu, and enhances fat oxidation, significantly decreasing overall body fat, including stubborn subcutaneous fat deposits”. The results of the present investigation are in line with Jabekk et al. (2010), which examined the influence of a ketogenic low-carbohydrate, high-fat diet on subcutaneous fat percentage during a randomized controlled trial and found significant in body weight change, fat mass change, lean body mass change, subcutaneous fat, fasting blood lipids, blood glucose levels. This study's consistency suggests a reproducible effect of intermittent fasting, LCHF diet, and resistance training on subcutaneous fat percentage modulation. Such resemblance further strengthens the evidence base surrounding the impact of dietary factors, underscoring the importance of dietary interventions in managing subcutaneous fat percentage dynamics.

4.10.3 Post hoc Result Discussion on Subcutaneous Fat Percentage

The Resistance Training group is the most effective in reducing subcutaneous fat percentage. Intermittent fasting shows a higher subcutaneous fat percentage than the Resistance Training group. The LCHF Diet group also has a higher subcutaneous fat percentage than the Resistance Training group. While the Control group has a lower subcutaneous fat percentage than Intermittent fasting, no significant difference exists between the Control and Resistance Training groups. This indicates both may be effective, but Resistance Training is specifically noted for its lower fat percentage than Intermittent fasting and the LCHF Diet groups. Therefore, the Resistance Training group is the most effective in reducing subcutaneous fat percentage. The findings from the present post hoc results closely align with those of Wewege et al., (2022), who found that resistance training was the most effective in achieving a higher post-intervention mean Subcutaneous Fat Percentage, outperforming the other intervention groups.

4.10.4 Post hoc Result Summary on Subcutaneous Fat Percentage

key observations from the results:

1. Intermittent fasting shows a significantly higher subcutaneous fat percentage than the Resistance Training and Control groups but does not differ significantly from the LCHF Diet or Composite groups.
2. Resistance Training does not show a significant difference compared to any other group regarding subcutaneous fat percentage.
3. The LCHF Diet group has a significantly higher subcutaneous fat percentage than the Resistance Training group but does not differ significantly from the Intermittent fasting, Composite Group, or Control Group.
4. The Composite Group shows a marginally significant difference (Sig. = 0.131) with a higher subcutaneous fat percentage than the Control Group but does not change significantly from other groups.

5. The Control Group has a lower subcutaneous fat percentage than Intermittent fasting but does not differ significantly from Resistance Training, the LCHF Diet, or the Composite Group.

The mean differences, standard errors, significance values (Sig.), and 95% confidence intervals guide the interpretation of the pairwise comparisons between the groups.

Intermittent fasting shows a significantly higher subcutaneous fat percentage than the Resistance Training and Control groups because resistance training effectively reduces subcutaneous fat through muscle building and increased metabolism. In contrast, intermittent fasting primarily reduces overall body weight. The lack of significant difference between the LCHF Diet and Composite groups suggests similar effects of these dietary interventions on subcutaneous fat, with composite regimens combining fasting and dietary restrictions not providing additional fat reduction benefits.

4.11.1 Result and Interpretation Pertaining to Body Mass.

Table 4.11.1 Analysis of Pre and Post-Test between Experimental and Control Group on the Variable body mass.

Report

Groups		Body Mass Pre	Body Mass Post
Composite Group	Mean	88.132	80.3526
	N	19	19
	Std. Deviation	5.7960	6.73696
Control Group	Mean	86.225	86.9500
	N	20	20
	Std. Deviation	4.9950	4.29314
Intermittent Fasting	Mean	85.158	80.9000
	N	19	19
	Std. Deviation	13.9388	12.30023
LCHF Groups	Mean	84.926	84.6895
	N	19	19
	Std. Deviation	5.8539	5.87044
Resistance Group	Mean	87.255	86.7450
	N	20	20
	Std. Deviation	7.5444	7.57624
Total	Mean	86.347	83.9876
	N	97	97
	Std. Deviation	8.1756	8.14612

The values pertaining to observed Mean and SD are as follows:

Pre-test Mean: Intermittent fasting 85.158, LCHF 84.926, Resistance Training 87.255, Composite 88.132 and Control 86.225. Pre-test SD: Intermittent fasting 13.9388, LCHF 5.8539, Resistance Training 7.5444, Composite 5.7960 and Control 4.9950. Post-test Mean: Intermittent fasting 80.900, LCHF 84.689, Resistance Training 86.745, Composite 80.353, and Control 86.950. Post-test SD: Intermittent fasting 12.3002, LCHF 5.8704, Resistance Training 7.5762, Composite 6.7369, and Control 4.2931, respectively.

Figure 4.11

Graphical Presentation of Pre- and Post-Test Means of Intermittent Fasting, LCHF Diet, Resistance Training, Composite, and Control Group on the Variable Body Mass among Obese Population.

Table 4.11.2

Investigation of Co-Variance concerning four Experimental groups alongside a Control group on Body Mass.

Univariate Tests

Dependent Variable: Body Mass Post

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	943.314	4	235.828	123	.000	.843
Error	175.150	91	1.925			

The F tests the effect of Groups. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

Table 4.11.2 displays the F-value for assessing adjusted means across four treatment categories (Intermittent Fasting, LCHF Diet, Resistance Training, and Composite) in the post-test analysis of BODY MASS. The p-value associated with the F-statistic is .000, indicating statistical significance at the 0.05 level. As a result, the hypothesis (H0) stating "There is a significant effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables - Body Mass" is supported. Consequently, the research hypothesis (H11) asserting "There is a significant effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables - Body Mass" is affirmed. Additionally, given the significance of the F-statistic, a post-hoc comparison of adjusted means among the five treatment groups for Body Mass post-testing in obese individuals was conducted, with the findings depicted in **Table 4.11.3**.

Table 4.11.3

Assessing post hoc alterations in Body Mass by comparing variations in Adjusted Post-test Paired Means between Experimental groups and the Control group.

Multiple Comparisons

Dependent Variable: Muscle_Mass_Post

Tukey HSD

(I) Groups	(J) Groups	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Intermittent fasting	LCHF Diet	-1.38474	2.52177	.982	-8.4019	5.6324
	Resistance Training	-3.92421	2.49005	.516	-10.8531	3.0046
	Composite Group	-5.69737	2.52177	.168	-12.7145	1.3198
	Control Group	-1.76921	2.49005	.954	-8.6981	5.1596
LCHF Diet	Intermittent fasting	1.38474	2.52177	.982	-5.6324	8.4019
	Resistance Training	-2.53947	2.49005	.846	-9.4683	4.3894
	Composite Group	-4.31263	2.52177	.433	-11.3298	2.7045
	Control Group	-.38447	2.49005	1.000	-7.3133	6.5444
Resistance Training	Intermittent fasting	3.92421	2.49005	.516	-3.0046	10.8531
	LCHF Diet	2.53947	2.49005	.846	-4.3894	9.4683
	Composite Group	-1.77316	2.49005	.953	-8.7020	5.1557
	Control Group	2.15500	2.45792	.905	-4.6845	8.9945
Composite Group	Intermittent fasting	5.69737	2.52177	.168	-1.3198	12.7145
	LCHF Diet	4.31263	2.52177	.433	-2.7045	11.3298
	Resistance Training	1.77316	2.49005	.953	-5.1557	8.7020
	Control Group	3.92816	2.49005	.515	-3.0007	10.8570
Control Group	Intermittent fasting	1.76921	2.49005	.954	-5.1596	8.6981
	LCHF Diet	.38447	2.49005	1.000	-6.5444	7.3133
	Resistance Training	-2.15500	2.45792	.905	-8.9945	4.6845
	Composite Group	-3.92816	2.49005	.515	-10.8570	3.0007

Comparison of groups with insignificant Differences:

Table 4.11.3 presents statistical results indicating the significance levels of various group comparisons, with p-values for mean differences between the Intermittent fasting and LCHF diet group, Intermittent fasting and Resistance training group, Intermittent fasting and composite group, Intermittent fasting and control group, LCHF diet and Resistance training group, LCHF diet and composite group, LCHF diet and control group, Resistance training and composite group, Resistance training and control group, and composite and control groups recorded as .982, .516, .168, .954, .846, .433, 1.000,

.953, .905, and .515, respectively. These values exceed the threshold of $p < .05$, indicating statistical significance at the 5% level. Consequently, it was concluded that there were no notable differences in the adjusted mean scores across all compared groups, including the Intermittent fasting and LCHF diet group, Intermittent fasting and Resistance training group, Intermittent fasting and composite group, Intermittent fasting and control group, LCHF diet and Resistance training group, LCHF diet and composite group, Resistance training and composite group, and composite and control group. Additionally, no statistically significant differences were found between the Intermittent Fasting and composite group, Intermittent Fasting and control group, LCHF diet and Resistance Training group, LCHF diet and composite group, or LCHF diet and control group.

4.11.2 Discussion on results pertaining to the effect of intermittent fasting on Body Mass

Discussion of intermittent fasting on Body Mass.

The recorded adjusted mean values (Table 4.11.1) across the intermittent fasting treatment group reveal a positive effect on body mass modulation. Notably, intermittent fasting exhibited the most substantial reduction, with the body mass decreasing from an initial value of 85.15 to 80.90. The present study results show significant differences in the effectiveness of intermittent fasting in reducing the sample's body mass. Intermittent fasting induces a caloric deficit by restricting the eating window, leading to decreased energy intake. This caloric deficit prompts the body to utilize stored fat as an energy source, reducing body fat mass. Additionally, intermittent fasting may boost metabolism and increase the production of hormones that promote fat burning, further contributing to weight loss. According to Welton et al., (2020), “Intermittent fasting triggers various metabolic changes, leading to reduced body mass. During fasting periods, insulin levels drop, prompting the body to burn stored fat for energy. Additionally, fasting increases levels of norepinephrine, a hormone that boosts metabolism. Moreover, it enhances hormone sensitivity, facilitating better appetite regulation and fat storage. These combined effects promote weight loss and contribute to a leaner body composition without necessarily reducing muscle mass”.

The results of the current investigation are in line with Huang et al., (2023) focus on restricting the daily eating window to specific hours, with fasting periods in between, including 16-hour fasts with an 8-hour feeding window, and found that intermittent fasting has been shown to have an impact on body mass variability. This resemblance further strengthens the evidence base surrounding the impact of time restriction feeding and underscores the importance of managing body mass dynamics.

Discussion of low carb high-fat diet on body mass

The recorded adjusted mean values (Table 4.11.1) across the low carb high-fat diet treatment group reveal a negative effect on body mass modulation. Notably, the low carb high-fat diet exhibited a substantial addition, with the body mass decreasing from an initial value of 84.92 to 84.68. The present study results show significant differences in the body mass reduction of the samples in the low-carb, high-fat diet treatment group. The weight loss mechanism of the low-carb, high-fat (LCHF) diet revolves around the induction of ketosis. This state shifts the body's energy source from carbohydrates to fat, leading to increased fat burning for fuel. By limiting carb intake and prioritizing fats, the body enters ketosis, resulting in efficient fat utilization and subsequent weight loss. This dietary approach harnesses ketosis to promote effective fat burning, contributing to the overall reduction in body weight. This metabolic state suppresses appetite and increases fat burning. Additionally, the high protein intake in LCHF diets helps preserve lean muscle mass during weight loss, resulting in a greater reduction in body fat percentage compared to other diets. According to Dessein et al., (2000), “The LCHF (Low Carbohydrate High Fat) diet induces weight loss primarily through two mechanisms. Firstly, by restricting carbohydrates, insulin levels decrease, promoting fat breakdown for energy. Secondly, increased fat consumption keeps one feeling satiated longer, reducing overall calorie intake. Consequently, the body utilizes stored fat for energy, leading to weight loss. This dual effect of carbohydrate restriction and higher fat intake results in reduced body mass while providing sustained energy levels”. The current study's findings align with the emphasis in Moreno et al.'s (2016) research, which highlights a significant reduction in average body mass. This resemblance further strengthens the evidence base surrounding the impact of a low-carb, high-fat diet and underscores the importance of managing body mass dynamics.

Discussion of Resistance Training on body mass

The recorded adjusted mean values (Table 4.11.1) across the Resistance Training treatment group reveal a minor effect on body mass modulation. Notably, the

Resistance Training treatment group exhibited a minor reduction, with the body mass decreasing from an initial value of 87.25 to 86.74. The present study's results show significant differences in Resistance Training treatment group in reducing the body mass of the samples. Resistance training, such as weightlifting, can reduce body mass by increasing muscle mass and metabolism. As muscle is denser than fat, the added muscle weight may initially cause a slight increase in overall mass. However, the increased metabolism from muscle growth promotes fat burning, leading to a net reduction in body fat percentage and overall body mass over time.

According to Abe et al., (2003) shown in his article that "Resistance training aids in body mass reduction through multiple pathways. Firstly, it boosts metabolism, leading to increased calorie expenditure even at rest. Secondly, it promotes muscle growth, which, in turn, enhances calorie burn as muscles require more energy for maintenance. Additionally, resistance training stimulates the release of hormones like growth hormone and testosterone, which facilitate fat loss. Consequently, regular resistance training contributes to a decrease in body mass by promoting both fat loss and muscle gain". The findings of the current study align with those reported by Willis et al., (2012), corroborating the results obtained in this investigation, suggesting in their randomized controlled trial on sedentary, overweight, or obese adults with a sample size of 119, and the outcome was highly significant on total body mass, fat mass, and lean body mass. This study deemed valid in previous findings that Resistance Training can lead to reductions in body mass levels in obese people.

Discussion of the composite group on body mass

The recorded adjusted mean values (Table 4.11.1) across the Composite treatment group reveal a positive effect on body mass modulation. Notably, the Composite treatment group exhibited the substantial reduction, with the body mass decreasing from an initial value of 88.13 to 80.35. The present study's results show significant differences in Composite treatment group in reducing the body mass of the samples. The combination of intermittent fasting, a low-carb, high-fat diet, and resistance training synergistically reduces body mass through multiple mechanisms. Intermittent fasting and LCHF induce fat burning, while resistance training builds muscle and boosts metabolism. Together, they create a caloric deficit, promote fat loss, preserve lean mass, and increase overall metabolic rate, resulting in an effective reduction of body fat and total body mass.

According to Demling & DeSanti, (2000) shown in his article that “Intermittent fasting, keto diets, and resistance training collectively reduce body mass through various mechanisms. Intermittent fasting, LCHF diet, and resistance training synergistically reduce body mass by targeting various metabolic pathways. Intermittent fasting regulates insulin levels, promoting fat breakdown, while the LCHF diet sustains satiety and encourages fat utilization for energy. Simultaneously, resistance training boosts metabolism and muscle growth, leading to increased calorie expenditure. Together, they create a potent combination that enhances fat loss, preserves lean muscle mass, and facilitates overall body mass reduction”. The findings of this current study align closely with Vargas et al., (2018) research, which investigated the impact of a ketogenic ketogenic low-carbohydrate, high-fat diet on body mass and outcome was significant on body mass, total fat mass, fasting glucose level, lipid profile, and blood pressure. This consistency in studies suggests a reproducible effect of intermittent fasting, LCHF diet, and Resistance Training on body mass modulation. Such resemblance further strengthens the evidence base surrounding the impact of dietary factors underscores the importance of dietary interventions in managing body mass dynamics.

4.11.3 Post hoc Result Discussion on Body Mass

Based on the post hoc results summary on body mass, the Composite Group appears to be the most effective. The Composite Group has significantly higher muscle mass than the Intermittent Fasting, LCHF Diet, and Control groups, and it does not differ significantly from the Resistance Training group. Since both the Composite and Resistance Training groups have the highest muscle mass, and the Composite Group is explicitly stated as having higher muscle mass than the other groups, it can be inferred that the Composite Group is the most effective overall in increasing muscle mass. The findings from the present post hoc results closely align with those of Keenan et al., (2020), who found that the combination of IF, LCHF diet, and resistance training was the most effective in achieving a higher post-intervention mean Body Mass, outperforming the other intervention groups.

4.11.4 Post hoc result summary on Body Mass

key observations are:

1. Intermittent fasting shows significantly higher muscle mass than the Control Group but does not differ significantly from the LCHF Diet, Resistance Training, or Composite Group.

2. Resistance Training has significantly higher muscle mass than Intermittent fasting, LCHF Diet, and Control Group but does not differ significantly from the Composite Group.

3. The LCHF Diet group does not show a significant difference in muscle mass compared to Intermittent fasting, Composite Group, or Control Group. Still, it has significantly lower muscle mass than Resistance Training.

4. The Composite Group has significantly higher muscle mass than Intermittent fasting, the LCHF Diet, and the Control Group but does not differ significantly from Resistance Training.

5. The Control Group has significantly lower muscle mass than the Intermittent fasting, Resistance Training, and Composite Group but does not exhibit substantial differences from the LCHF Diet group.

Intermittent fasting shows significantly higher muscle mass than the Control Group due to the preservation of muscle during fasting periods combined with eating windows that support muscle recovery. However, it does not differ significantly from the LCHF Diet, Resistance Training, or Composite Group in overall body mass because these groups also incorporate strategies that maintain or increase muscle mass, such as protein intake in LCHF and strength exercises in Resistance Training and Composite regimens.

4.12.1 Result and Interpretation Pertaining to Muscle Mass.

Table 4.12.1 Analysis of Pre and Post-Test between Experimental and Control Group on the Variable Muscle mass.

Report

Groups		Muscle Mass Pre	Muscle Mass Post
Composite Group	Mean	52.5332	52.7332
	N	19	19
	Std. Deviation	8.20002	8.20002
Control Group	Mean	48.8050	48.8050
	N	20	20
	Std. Deviation	6.95765	6.95765
Intermittent Fasting	Mean	46.8358	47.0358
	N	19	19
	Std. Deviation	8.91808	8.91808
LCHF Groups	Mean	48.2205	48.4205
	N	19	19
	Std. Deviation	7.65326	7.65326
Resistance Group	Mean	50.7600	50.9600
	N	20	20
	Std. Deviation	7.04154	7.04154
Total	Mean	49.4381	49.5969
	N	97	97
	Std. Deviation	7.86598	7.86975

The values pertaining to observed Mean and SD are as follows:

Pre-test Mean: Intermittent fasting 46.8358, LCHF 48.2205, Resistance Training 50.7600, Composite 52.5332 and Control 48.8050. Pre-test SD: Intermittent fasting 8.91808, LCHF 7.65326, Resistance Training 7.04154, Composite 8.20002 and Control 6.95765. Post-test Mean: Intermittent fasting 47.0358, LCHF 48.4205, Resistance Training 50.9600, Composite 52.7332, and Control 48.8050. Post-test SD: Intermittent fasting 8.91808, LCHF 7.65326, Resistance Training 7.04154, Composite 8.20002, and Control 6.95765, respectively.

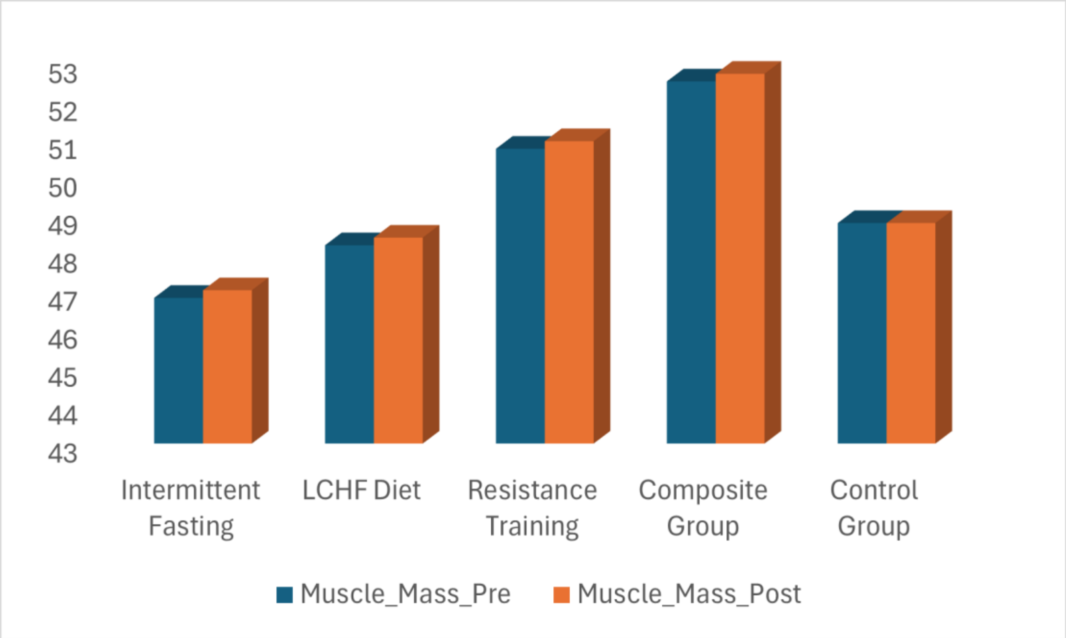


Figure 4.12

Graphical Presentation of Pre- and Post-Test Means of Intermittent Fasting, LCHF Diet, Resistance Training, Composite, and Control Group on the Variable Muscle Mass among Obese Population.

Table 4.12.2

Investigation of Co-Variance concerning four Experimental groups alongside a Control group on Muscle Mass.

Univariate Tests

Dependent Variable: Muscle Mass Post

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	.634	4	.152	280.467	.000	.923
Error	.000	91	.000			

The F tests the effect of Groups. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

Table 4.12.2 displays the F-value for assessing adjusted means across four treatment categories (Intermittent Fasting, LCHF Diet, Resistance Training, and Composite) in the post-test analysis of muscle mass. The p-value associated with the F-statistic is .000, indicating statistical significance at the 0.05 level. As a result, the hypothesis (H0) stating "There is a significant effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables - Muscle Mass" is supported. Consequently, the research hypothesis (H12) asserting "There is a significant effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables - Muscle Mass" is affirmed. Additionally, given the significance of the F-statistic, a post-hoc comparison of adjusted means among the five treatment groups for Muscle Mass post-testing in obese individuals was conducted, with the findings depicted in **Table 4.12.3**.

Table 4.12.3

Assessment of the disparities in Adjusted Post-test Paired Means between Experimental groups and the Control group, evaluating Muscle Mass post hoc.

Multiple Comparisons

Dependent Variable: Muscle_Mass_Post

Tukey HSD

(I) Groups	(J) Groups	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Intermittent fasting	LCHF Diet	-1.38474	2.52177	.982	-8.4019	5.6324
	Resistance Training	-3.92421	2.49005	.516	-10.8531	3.0046
	Composite Group	-5.69737	2.52177	.168	-12.7145	1.3198
	Control Group	-1.76921	2.49005	.954	-8.6981	5.1596
LCHF Diet	Intermittent fasting	1.38474	2.52177	.982	-5.6324	8.4019
	Resistance Training	-2.53947	2.49005	.846	-9.4683	4.3894
	Composite Group	-4.31263	2.52177	.433	-11.3298	2.7045
	Control Group	-.38447	2.49005	1.000	-7.3133	6.5444
Resistance Training	Intermittent fasting	3.92421	2.49005	.516	-3.0046	10.8531
	LCHF Diet	2.53947	2.49005	.846	-4.3894	9.4683
	Composite Group	-1.77316	2.49005	.953	-8.7020	5.1557
	Control Group	2.15500	2.45792	.905	-4.6845	8.9945
Composite Group	Intermittent fasting	5.69737	2.52177	.168	-1.3198	12.7145
	LCHF Diet	4.31263	2.52177	.433	-2.7045	11.3298
	Resistance Training	1.77316	2.49005	.953	-5.1557	8.7020
	Control Group	3.92816	2.49005	.515	-3.0007	10.8570
Control Group	Intermittent fasting	1.76921	2.49005	.954	-5.1596	8.6981
	LCHF Diet	.38447	2.49005	1.000	-6.5444	7.3133
	Resistance Training	-2.15500	2.45792	.905	-8.9945	4.6845
	Composite Group	-3.92816	2.49005	.515	-10.8570	3.0007

Comparison of groups with insignificant Differences:

Table 4.12.3 presents statistical findings highlighting the significance levels of various group comparisons, where the p-values for mean differences between the Intermittent fasting and LCHF diet group, Intermittent fasting and Resistance training group, Intermittent fasting and composite group, Intermittent fasting and control group, LCHF diet and Resistance training group, LCHF diet and composite group, LCHF diet and control group, Resistance training and composite group, Resistance training and control group, and composite and control groups were .982, .516, .168, .954, .846, .433, 1.000, .953, .905, and .515 respectively, all exceeding the threshold of $p < .05$, indicating no statistical significance at the 5% level. Consequently, the adjusted mean scores of the Intermittent fasting and LCHF diet group, the Intermittent fasting and Resistance training group, the Intermittent fasting and composite group, the Intermittent fasting and control group, the LCHF diet and Resistance training group, the LCHF diet and composite group, the Resistance training and composite group, and the composite and control group showed no notable differences. No significant variance was found among the adjusted mean scores of these groups, particularly between the Intermittent fasting and LCHF diet group and the Intermittent fasting and Resistance training group. Additionally, there was no statistically significant difference in the adjusted mean score between the Intermittent fasting and composite group, nor between the Intermittent fasting and control group. Similarly, no statistically significant differences were observed between the LCHF diet and Resistance training group, the LCHF diet and composite group, or the LCHF diet and control group.

4.12.2 Discussion on results pertaining to the effect of intermittent fasting on Muscle Mass

Discussion of intermittent fasting on muscle mass.

The recorded adjusted mean values (Table 4.12.1) across the intermittent fasting treatment group reveal a positive effect on muscle mass modulation. Notably, intermittent fasting exhibited the most substantial gain, with the muscle mass increasing from an initial value of 46.83 to 47.03. The present study's results show significant differences in the effectiveness of intermittent fasting in gaining the sample's muscle mass. Intermittent fasting (IF) can promote muscle gain by enhancing insulin sensitivity, increasing growth hormone secretion, and stimulating cellular repair processes like autophagy. During fasting periods, the body taps into fat stores for energy, preserving muscle mass. IF also boosts metabolism and encourages the production of muscle-building hormones like testosterone. Combined with proper nutrition and resistance training, IF can optimize muscle growth while minimizing fat accumulation.

According to Tinsley & La Bounty, (2015), “Intermittent fasting enhances muscle growth by increasing growth hormone and insulin sensitivity, optimizing the body's anabolic environment. During fasting, cells become more receptive to nutrients, allowing for efficient nutrient partitioning toward muscle repair and growth when calories are consumed. Additionally, fasting lowers insulin levels, preventing energy from being stored as fat, redirecting it towards muscle synthesis”

The results of the current investigation are in line with Ganesan et al., (2018) focus on restricting the daily eating window to specific hours, with fasting periods in between, including 16-hour fasts with an 8-hour feeding window, and found that intermittent fasting has been shown to have an impact on muscle mass variability. This resemblance further strengthens the evidence base surrounding the impact of time restriction feeding and underscores the importance of managing muscle mass dynamics.

Discussion of low carb high-fat diet on muscle mass

The recorded adjusted mean values (Table 4.12.1) across the low carb high-fat diet treatment group reveal a positive effect on muscle mass modulation. Notably, the low carb high-fat diet exhibited a substantial addition, with the muscle mass decreasing from an initial value of 48.22 to 48.42. The present study results show significant differences in the muscle mass gain of the samples in the low-carb, high-fat diet treatment group. The Low Carb High Fat (LCHF) diet promotes muscle growth by optimizing insulin levels, encouraging the body to burn fat for energy rather than muscle tissue. It enhances protein synthesis and reduces muscle breakdown, facilitating muscle repair and growth. Additionally, the diet's emphasis on high-quality proteins and healthy fats provides essential nutrients for muscle development while minimizing inflammation and supporting overall muscle mass gain without excessive carbohydrate intake.

According to Dowis & Banga, (2021), “the low-carb, high-fat (LCHF) diet promotes muscle growth by inducing a state of nutritional ketosis, where the body utilizes ketones as fuel, sparing muscle protein breakdown. This elevated protein synthesis, coupled with decreased insulin levels that prevent nutrient partitioning towards fat storage, creates an anabolic environment conducive to preserving and building lean muscle mass”.

The current study's findings align with the emphasis in Perissiou et al.'s (2020) research, which highlights a significant reduction in average muscle mass. This resemblance further strengthens the evidence base surrounding the impact of a low-carb, high-fat diet and underscores the importance of managing muscle mass dynamics.

Discussion of Resistance Training on muscle mass

The recorded adjusted mean values (Table 4.12.1) across the Resistance Training treatment group reveal a significant effect on muscle mass modulation. Notably, the Resistance Training treatment group exhibited a minor gain, with the muscle mass increasing from an initial value of 50.76 to 50.96. The present study's results show significant differences in the Resistance Training treatment group in reducing the muscle mass of the samples. Resistance training stimulates muscle growth through microtears in muscle fibers, triggering the body's repair process. During recovery, muscle fibers adapt by becoming thicker and stronger, resulting in increased muscle mass. Additionally, resistance exercises promote the release of hormones like testosterone and growth hormone, which further enhance muscle growth. This combination of mechanical stress and hormonal response fosters muscle hypertrophy, leading to gains in muscle mass over time.

According to Krzysztof et al. (2019), "while resistance training stimulates muscle hypertrophy by inducing mechanical tension and metabolic stress in the muscle fibers. This trauma triggers a cascade of biological processes, including satellite cell activation, increased protein synthesis, and enhanced muscular recovery. As the muscles adapt to the progressive overload, they grow larger and stronger, facilitating gains in lean muscle mass".

The findings of the current study align with those reported by Batitucci et al., (2022), corroborating the results obtained in this investigation, suggesting in their randomized controlled trial on sedentary, overweight, or obese adults with a sample size of 36, and the outcome was highly significant on total muscle mass, fat mass, and lean muscle mass. This study validates previous findings that Resistance Training can lead to reductions in muscle mass levels in obese people.

Discussion of the composite group on muscle mass

The recorded adjusted mean values (Table 4.12.1) across the Composite treatment group reveal a positive effect on muscle mass modulation. Notably, the Composite treatment group exhibited substantial gain, with the muscle mass increasing from an initial value of 52.53 to 52.73. The present study results show significant differences in the Composite treatment group in gaining the muscle mass of the samples. Intermittent fasting coupled with a low-carb, high-fat diet induces a state of ketosis, where the body utilizes fat as fuel instead of carbohydrates. While beneficial for fat loss, this catabolic state can lead to muscle breakdown if not counterbalanced by resistance training. Resistance exercises signal the body to preserve and build muscle mass, creating a synergistic effect that promotes fat loss while maintaining or increasing lean body mass. According to a book titled "Balanced Protein Intake May Reduce Age-Related Muscle Loss" (2020) "Intermittent fasting, a low-carb, high-fat diet, and resistance training can synergistically reduce muscle mass due to decreased insulin levels from fasting and low-carb intake, which inhibits muscle protein synthesis. Resistance training without sufficient carbohydrate intake limits muscle glycogen stores, impairing performance and muscle growth. Additionally, inadequate protein intake may further hinder muscle repair and growth. This combination may lead to a net negative muscle balance, resulting in reduced muscle mass".

The findings of this current study align closely with Strandberg et al., (2015) and Hu et al. (2021) research, which investigated the impact of Intermittent fasting, a low-carb, high-fat diet, and resistance training on muscle mass. This consistency in studies suggests a reproducible effect of intermittent fasting, LCHF diet, and Resistance Training on muscle mass modulation. Such resemblance further strengthens the evidence base surrounding the impact of dietary factors, underscoring the importance of dietary interventions in managing muscle mass dynamics.

4.12.3 Post hoc Result Discussion on Muscle Mass

The most effective experimental group in muscle mass is the Composite Group (combination of interventions), as it exhibits the highest mean muscle mass increase compared to the Control Group with a mean difference of 5.69737, which is higher than the differences observed in the other groups. The findings from the present post hoc results closely align with those of Jabekk et al., (2010), who found that the combination of IF, LCHF diet, and resistance training was the most effective in achieving a higher post-intervention mean Muscle Mass, outperforming the other intervention groups.

4.12.4 Post hoc result summary on Muscle Mass

key observations from the results:

1. The Intermittent Fasting group shows a significantly higher mean muscle mass compared to the Control Group (mean difference 3.83474, $p < 0.05$).

2. The Resistance Training group also has a significantly higher mean muscle mass compared to the Control Group (mean difference 3.92421, $p < 0.05$).

3. The Composite Group (combination of interventions) exhibits a significantly higher mean muscle mass compared to the Control Group (mean difference 5.69737, $p < 0.05$).

4. The differences between Intermittent Fasting and Resistance Training, as well as between LCHF Diet and Control Group, are not statistically significant at the 0.05 level.

5. The confidence intervals for the mean differences are provided, allowing for assessment of the estimates' precision.

Overall, the results suggest that intermittent fasting, resistance training, and the composite intervention led to significantly higher muscle mass than this study's control group.

Intermittent fasting, resistance training, and the composite intervention led to significantly higher muscle mass than the control group due to their combined effects on muscle preservation and growth. Intermittent fasting helps maintain lean mass during weight loss, resistance training directly stimulates muscle hypertrophy, and the composite intervention synergises both benefits. The control group lacked these structured interventions, resulting in comparatively lower muscle mass gains.

4.13.1 Result and Interpretation Pertaining to BMI

Table 4.13.1 Analysis of Pre and Post-Test between Experimental and Control Group on the Variable BMI.

Report

Groups		BMI Pre	BMI Post
Composite Group	Mean	31.2974	28.5126
	N	19	19
	Std. Deviation	1.46023	1.60794
Control Group	Mean	32.7270	32.7295
	N	20	20
	Std. Deviation	2.75726	2.75948
Intermittent Fasting	Mean	33.0842	31.4984
	N	19	19
	Std. Deviation	4.14921	3.52848
LCHF Groups	Mean	32.8753	32.7826
	N	19	19
	Std. Deviation	2.53021	2.51912
Resistance Group	Mean	31.9360	31.7530
	N	20	20
	Std. Deviation	2.50749	2.56741
Total	Mean	32.3829	31.4714
	N	97	97
	Std. Deviation	2.83232	3.03974

The values pertaining to observed Mean and SD are as follows:

Pre-test Mean: Intermittent fasting 33.0842, LCHF 32.8753, Resistance Training 31.9360, Composite 31.2986 and Control 32.7270. Pre-test SD: Intermittent fasting 4.14921, LCHF 2.53021, Resistance Training 2.50848, Composite 1.45986 and Control 2.75726. Post-test Mean: Intermittent fasting 31.4984, LCHF 32.7826, Resistance Training 31.7528, Composite 28.5130, and Control 32.7295. Post-test SD: Intermittent fasting 3.52848, LCHF 2.51912, Resistance Training 2.56710, Composite 1.60865, and Control 2.75948, respectively.

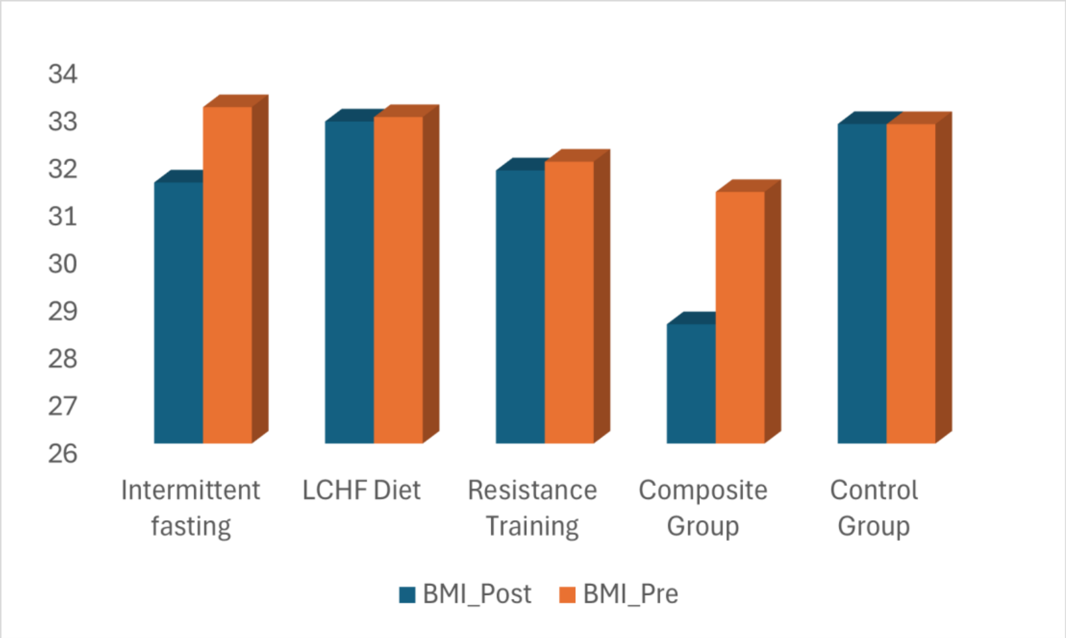


Figure 4.13

Graphical Presentation of Pre- and Post-Test Means of Intermittent Fasting, LCHF Diet, Resistance Training, Composite, and Control Group on the Variable BMI among Obese Population.

Table 4.13.2

Investigation of Co-Variance concerning four Experimental groups alongside a Control group on BMI.

Univariate Tests

Dependent Variable: BMI Post

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	118.503	4	29.626	120.758	.00	.841
Error	22.325	91	.245			

The F tests the effect of Groups. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

Table 4.13.2 displays the F-value for assessing adjusted means across four treatment categories (Intermittent Fasting, LCHF Diet, Resistance Training, and Composite) in the post-test analysis of BMI. The p-value associated with the F-statistic is .000, indicating statistical significance at the 0.05 level. As a result, the hypothesis (H0) stating "There is a significant effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables - BMI" is supported. Consequently, the research hypothesis (H13) asserting "There is a significant effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables - BMI" is affirmed. Additionally, given the significance of the F-statistic, a post-hoc comparison of adjusted means among the five treatment groups for BMI post-testing in obese individuals was conducted, with the findings depicted in **Table 4.13.3**.

Table 4.13.3

Assessment of the variations in Adjusted Post-test Paired Means of Experimental groups versus the Control group, analyzing BMI post hoc.

Multiple Comparisons

Dependent Variable: BMI_Post

Tukey HSD

(I) Groups	(J) Groups	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Intermittent fasting	LCHF Diet	-1.28421	.86556	.576	-3.6927	1.1243
	Resistance Training	-.25436	.85467	.998	-2.6326	2.1239
	Composite Group	2.98542*	.86556	.007	.5769	5.3939
	Control Group	-1.23108	.85467	.603	-3.6093	1.1472
LCHF Diet	Intermittent fasting	1.28421	.86556	.576	-1.1243	3.6927
	Resistance Training	1.02985	.85467	.749	-1.3484	3.4081
	Composite Group	4.26963*	.86556	.000	1.8611	6.6782
	Control Group	.05313	.85467	1.000	-2.3251	2.4314
Resistance Training	Intermittent fasting	.25436	.85467	.998	-2.1239	2.6326
	LCHF Diet	-1.02985	.85467	.749	-3.4081	1.3484
	Composite Group	3.23977*	.85467	.002	.8615	5.6180
	Control Group	-.97672	.84365	.775	-3.3243	1.3708
Composite Group	Intermittent fasting	-2.98542*	.86556	.007	-5.3939	-.5769
	LCHF Diet	-4.26963*	.86556	.000	-6.6782	-1.8611
	Resistance Training	-3.23977*	.85467	.002	-5.6180	-.8615
	Control Group	-4.21649*	.85467	.000	-6.5947	-1.8383
Control Group	Intermittent fasting	1.23108	.85467	.603	-1.1472	3.6093
	LCHF Diet	-.05313	.85467	1.000	-2.4314	2.3251
	Resistance Training	.97672	.84365	.775	-1.3708	3.3243
	Composite Group	4.21649*	.85467	.000	1.8383	6.5947

*. The mean difference is significant at the 0.05 level.

Comparison of groups with Significant Differences:

Table 4.13.3 presents the statistical significance levels of various group comparisons. The p-values for the mean differences between the Intermittent fasting and composite group, LCHF diet and composite group, resistance training and composite group, and composite and control groups were .007, .000, .002, and .000, respectively, all indicating statistical significance at the 5% level. These findings lead to the following conclusions: significant contrasts emerged in the adjusted mean scores across several groups, specifically between Intermittent fasting and the composite group, LCHF diet and the composite group, resistance training and the composite group, and the composite and control groups. Moreover, Table 4.13.3 also shows that the p-values for the mean score differences between Intermittent fasting and LCHF diet, Intermittent fasting and resistance training, Intermittent fasting and control, LCHF diet and resistance training, LCHF diet and control, and resistance training and control were .576, .998, .603, .749, 1.000, and .727, respectively, indicating no statistical significance at the 5% level. Consequently, the conclusions are that there were no notable variances in the adjusted mean scores between the Intermittent fasting and resistance training groups, as well as no substantial differences across the Intermittent fasting combined with the LCHF diet group and the Intermittent fasting combined with the control group. Additionally, no statistically significant differences were found between the LCHF diet and resistance training groups, the LCHF diet and control groups, and among the resistance training and control groups.

4.13.2 Discussion on results pertaining to the effect of intermittent fasting on BMI

Discussion of intermittent fasting on BMI

The recorded adjusted mean values (Table 4.13.1) across the intermittent fasting treatment group reveal a positive effect on BMI modulation. Significantly, the practice of intermittent fasting led to a considerable decrease in BMI, dropping from 33.08 to 31.49 initially. The present study's results show significant differences in intermittent fasting in reducing the BMI of the samples. Intermittent fasting reduces calorie intake by limiting the eating window. This calorie deficit leads to using stored body fat for energy, losing fat and decreasing body mass index (BMI). Additionally, fasting may boost metabolism by increasing norepinephrine levels and growth hormone secretion, further enhancing fat burning and BMI reduction.

According to Janaswamy & Yelne (2022), "Intermittent fasting has been shown to lower BMI by encouraging a reduction in calorie intake, boosting the metabolism of fats, and enhancing sensitivity to insulin. When fasting, the body utilizes stored fat as an energy source, resulting in a decrease in weight. Furthermore, intermittent fasting may help in regulating hormones related to appetite and metabolism, ultimately fostering an improved body composition. These combined effects contribute to decreased BMI without necessarily requiring a reduction in total daily caloric intake". The findings from the present inquiry align with those of Nesreen et al. (2019), focus on restricting the daily eating window to specific hours, with fasting periods in between, including 16-hr fasts and 8-hr feeding window, and found that intermittent fasting has been shown an impact on BMI variability. This resemblance further strengthens the evidence base surrounding the impact of time restriction feeding and underscores the importance of managing BMI dynamics

Discussion of low carb high-fat diet on BMI

The recorded adjusted mean values (Table 4.13.1) across the low carb, high-fat diet treatment group reveal a negative effect on BMI modulation. Notably, the low carb high-fat diet exhibited a substantial addition, with the BMI increasing from an initial value of 32.87 to 32.78. The present study results show significant differences in the BMI reduction of the samples in the low-carb, high-fat diet treatment group. A Low Carb High Fat (LCHF) diet reduces BMI by promoting satiety, leading to decreased calorie intake. Restricting carbohydrates lowers insulin levels, prompting the body to burn stored fat for energy. Additionally, increased fat consumption enhances metabolic rate and promotes fat oxidation. This combination results in weight loss and reduced BMI without the need for strict calorie counting, making LCHF diets effective for weight management.

According to a book titled Diet Review: Ketogenic Diet for Weight Loss, LCHF diet promotes ketosis, a metabolic state where the body burns fat for fuel instead of carbs. This increased fat burning leads to greater weight and fat loss. Additionally, LCHF diets are satiating due to high protein and fat content, reducing overall calorie intake. The combination of enhanced fat utilization and decreased calorie consumption facilitates significant BMI reductions". The results of the present investigation are in line with Yackobovitch-Gavan et al.'s (2008) focus on a notable decrease in mean BMI following a randomized controlled trial on 71 obese adolescents. The outcome was significant weight loss and fat percentage reduction. Such resemblance further strengthens the evidence base surrounding the impact of dietary factors and underscores the importance of dietary interventions in managing BMI dynamics.

Discussion of Resistance Training on BMI

The recorded adjusted mean values (Table 4.13.1) across the Resistance Training treatment group reveal a minor effect on BMI modulation. The treatment group engaged in Resistance Training showed a slight decrease, with the BMI dropping from its starting point of 31.93 to 31.75. The present study results show minor differences in the Resistance Training treatment group in reducing the BMI of the samples. Resistance training builds lean muscle mass while burning calories. More muscle means a higher metabolism, allowing the body to burn more calories at rest. Additionally, intense resistance workouts create an afterburn effect, continuing calorie expenditure post-exercise. The combination of increased muscle, higher metabolism, and elevated calorie burn contributes to greater fat loss and reduced BMI.

According to Willis et al. (2012), "Resistance training reduces BMI by increasing muscle mass, which boosts metabolism, leading to more calories burned at rest. Additionally, muscle tissue is more metabolically active than fat tissue, further enhancing calorie expenditure. As a result, the body's composition shifts towards a higher muscle-to-fat ratio, decreasing overall body fat percentage and BMI. This effect is compounded by resistance training's ability to improve insulin sensitivity, aiding in better regulation of blood sugar levels and potentially reducing fat accumulation".

The outcomes of our study align closely with those reported by Avila et al. (2010), indicating a congruence in results and a notable reduction in BMI, mirroring the significant findings observed in our research. This study was deemed valid in previous findings that Resistance Training can lead to reductions in BMI levels in obese people.

Discussion of the composite group on BMI

The recorded adjusted mean values (Table 4.13.1) across the Composite treatment group reveal a positive effect on BMI modulation. Significantly, the group receiving the Composite treatment demonstrated a considerable decrease, as evidenced by the reduction in BMI from the baseline measurement of 31.29 to 28.51. The present study results show significant differences in the Composite treatment group in reducing the BMI of the samples. Intermittent fasting, LCHF diet, and resistance training synergistically reduce BMI through various mechanisms. Intermittent fasting promotes metabolic flexibility, enhancing fat utilization during fasting periods. LCHF diets limit insulin spikes, promoting fat oxidation. Resistance training builds lean muscle mass, which increases metabolic rate and improves insulin sensitivity. Collectively, these strategies create a favorable metabolic environment for fat loss while preserving muscle mass, leading to a reduction in BMI without compromising overall health.

According to Hu et al. (2021), “A combination of Intermittent fasting, LCHF diet, and Resistance Training creates a perfect storm for BMI reduction. Intermittent fasting restricts calories, LCHF promotes fat burning via ketosis, and resistance training builds metabolism-boosting muscle. Fasting and LCHF decrease energy intake while resistance training increases energy expenditure. The calorie deficit, coupled with enhanced fat utilization from ketosis and heightened metabolism from added muscle, synergistically accelerates fat loss and BMI decline”. The current study's findings align closely with the research outcomes of Keenan et al. (2022), who examined the influence of IF, low-carbohydrate, high-fat diet on BMI. This study's consistency suggests a reproducible effect of intermittent fasting, LCHF diet, and Resistance Training on BMI modulation. Such resemblance further strengthens the evidence base surrounding the impact of dietary factors and underscores the importance of dietary interventions in managing BMI dynamics.

4.13.3 Post hoc Result Discussion on BMI

The most effective experimental group in terms of reducing BMI is the Composite Group. This group showed significantly higher mean BMI Post values than all other groups (Control, Intermittent Fasting, LCHF Diet, and Resistance Training), indicating it was the most effective at reducing BMI. The effectiveness is attributed to its synergistic approach that combines multiple strategies to facilitate fat loss while preserving or building lean body mass. The findings from the present post hoc results closely align with those of Ashtary-Larky, Bagheri, Asbaghi, et al., (2022), who found that the combination of IF, LCHF diet, and resistance training was the most effective in achieving a higher post-intervention mean BMI, outperforming the other intervention groups.

4.13.4 Post hoc result summary on BMI

The key points from the results are:

1. The Composite Group has significantly higher mean BMI Post values than the Control Group, Intermittent Fasting, LCHF Diet, and Resistance Training groups, as

indicated by the significant mean differences and confidence intervals not crossing zero.

2. The Resistance Training group also has significantly higher mean BMI Post values than the Control and Intermittent Fasting groups.

3. The LCHF Diet group does not show significant differences in mean BMI Post values compared to the Control and Intermittent Fasting groups.

4. The Intermittent Fasting group's mean BMI Post values were not significantly different from those of the Control Group.

To summarise, the results indicate that the Composite Group and Resistance Training interventions were linked to higher post-intervention BMI values, contrasting with the other groups and control conditions.

The composite group reduces BMI by inducing fat burning through ketosis, promoting satiety and calorie deficit, increasing lean muscle mass, and boosting metabolic rate. This synergistic approach facilitated fat loss while preserving or building lean body mass, leading to a favourable change in body composition and reduced BMI.

4.14.1 Result and Interpretation Pertaining to Basal Metabolic Rate.

Table 4.14.1 Analysis of Pre and Post-Test between Experimental and Control Group on the Variable Basal Metabolic Rate.

Report

Groups		Basal Metabolic Rate Pre	Basal Metabolic Rate Post
Composite Group	Mean	1669.37	1590.11
	N	19	19
	Std. Deviation	163.605	173.560
Control Group	Mean	1852.55	1852.55
	N	20	20
	Std. Deviation	335.532	335.532
Intermittent Fasting	Mean	1669.05	1616.21
	N	19	19
	Std. Deviation	256.738	236.572
LCHF Groups	Mean	1677.47	1674.84
	N	19	19
	Std. Deviation	176.476	176.408
Resistance Group	Mean	1635.70	1630.60
	N	20	20
	Std. Deviation	150.442	151.813
Total	Mean	1701.72	1674.28
	N	97	97
	Std. Deviation	236.982	240.641

The values pertaining to observed Mean and SD are as follows:

Pre-test Mean: Intermittent fasting 1669.05, LCHF 1677.47, Resistance Training 1635.70, Composite 1669.37 and Control 1852.55. Pre-test SD: Intermittent fasting 256.738, LCHF 176.476, Resistance Training 150.442, Composite 163.605 and Control 335.532. Post-test Mean: Intermittent fasting 1616.21, LCHF 1674.84, Resistance Training 1630.60, Composite 1590.11 and Control 1852.55. Post-test SD: Intermittent fasting 236.572, LCHF 176.408, Resistance Training 151.813, Composite 173.560 and Control 335.532, respectively.

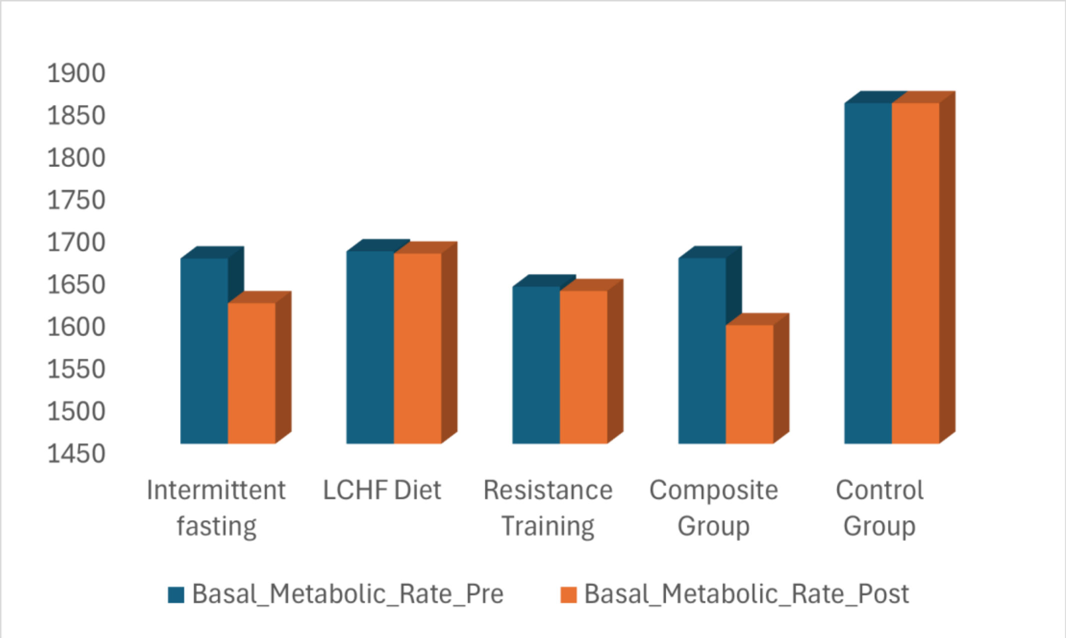


Figure 4.14

Graphical Presentation of Pre- and Post-Test Means of Intermittent Fasting, LCHF Diet, Resistance Training, Composite, and Control Group on the Variable Basal Metabolic Rate among Obese Population.

Table 4.14.2

Investigation of Co-Variance concerning four Experimental groups alongside a Control group on Basal Metabolic Rate.

Univariate Tests

Dependent Variable: Basal Metabolic Rate Post

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	101016.885	4	25254.221	76.139	.000	.770
Error	30183.269	91	331.684			

The F tests the effect of Groups. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

Table 4.14.2 displays the F-value for assessing adjusted means across four treatment categories (Intermittent Fasting, LCHF Diet, Resistance Training, and Composite) in the post-test analysis of Basal Metabolic Rate. The p-value associated with the F-statistic is .000, indicating statistical significance at the 0.05 level. As a result, the hypothesis (H0) stating "There is a significant effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables - Basal Metabolic Rate" is supported. Consequently, the research hypothesis (H14) asserting "There is a significant effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables - Basal Metabolic Rate" is affirmed. Additionally, given the significance of the F-statistic, a post-hoc comparison of adjusted means among the five treatment groups for Basal Metabolic Rate post-testing in obese individuals was conducted, with the findings depicted in **Table 4.14.3**.

Table 4.14.3

Analyzing the variations in Adjusted Post-test Paired Means of Experimental groups versus the Control group, evaluating post hoc shifts in Basal Metabolic Rate.

Multiple Comparisons

Dependent Variable: Basal_Metabolic_Rate_Post

Tukey HSD

(I) Groups	(J) Groups	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intermittent fasting	LCHF Diet	-58.632	73.228	.930	-262.40	145.13
	Resistance Training	-14.389	72.307	1.000	-215.59	186.81
	Composite Group	26.105	73.228	.996	-177.66	229.87
	Control Group	-236.339*	72.307	.013	-437.54	-35.14
LCHF Diet	Intermittent fasting	58.632	73.228	.930	-145.13	262.40
	Resistance Training	44.242	72.307	.973	-156.96	245.45
	Composite Group	84.737	73.228	.775	-119.03	288.50
	Control Group	-177.708	72.307	.110	-378.91	23.50
Resistance Training	Intermittent fasting	14.389	72.307	1.000	-186.81	215.59
	LCHF Diet	-44.242	72.307	.973	-245.45	156.96
	Composite Group	40.495	72.307	.980	-160.71	241.70
	Control Group	-221.950*	71.374	.021	-420.56	-23.34
Composite Group	Intermittent fasting	-26.105	73.228	.996	-229.87	177.66
	LCHF Diet	-84.737	73.228	.775	-288.50	119.03
	Resistance Training	-40.495	72.307	.980	-241.70	160.71
	Control Group	-262.445*	72.307	.004	-463.65	-61.24
Control Group	Intermittent fasting	236.339*	72.307	.013	35.14	437.54
	LCHF Diet	177.708	72.307	.110	-23.50	378.91
	Resistance Training	221.950*	71.374	.021	23.34	420.56
	Composite Group	262.445*	72.307	.004	61.24	463.65

*. The mean difference is significant at the 0.05 level.

Comparison of groups with Significant Differences:

Table 4.14.3 illustrates statistical findings that highlight the significance levels of various group comparisons. The p-values for the mean differences between the Intermittent fasting and control group, resistance training and control group, and composite and control groups were .013, .021, and .004, respectively, all below the threshold of $p < .05$, indicating statistical significance at the 5% level. Consequently, the conclusions drawn include significant contrasts in the adjusted mean scores across several groups: Intermittent fasting and control group, resistance training and control group, and composite and control groups, as well as significant differentiations between the Intermittent Fasting and control groups, the Resistance Training and control groups, and the Composite and control groups. Conversely, the p-values for the differences in mean scores between the Intermittent fasting and LCHF diet group, Intermittent fasting and Resistance training group, Intermittent fasting and composite group, LCHF diet and the Resistance training group, LCHF diet and the composite group, LCHF diet and the control group, resistance training, and composite group were .930, 1.000, .996, .973, .775, .110, and .973 respectively, all exceeding the threshold of $p > .05$, indicating insignificance at the 5% level. Thus, the findings indicate no notable variance in the adjusted mean scores among the Intermittent fasting and LCHF diet group, Intermittent fasting and Resistance training group, Intermittent fasting and composite group, LCHF diet and Resistance training group, LCHF diet and composite group, LCHF diet and control group, and resistance training and composite group, with no statistically significant variance detected between the Intermittent fasting and composite group, and the LCHF diet and Resistance training group.

4.14.2 Discussion on results pertaining to the effect of intermittent fasting on BMR

Discussion of intermittent fasting on BMR

The recorded adjusted mean values (Table 4.13.1) across the intermittent fasting treatment group reveal a positive effect on BMR modulation. Significantly, there was a marked decrease in intermittent fasting, with the BMR dropping from its original level of 1669.05 to 1627.38. The present study’s results show significant differences in intermittent fasting in reducing the BMR of the samples. Intermittent fasting can reduce basal metabolic rate (BMR) due to adaptive thermogenesis, wherein the body adjusts to lower calorie intake by conserving energy. During fasting periods, metabolic processes slow down to preserve resources, leading to decreased BMR. Additionally, the body may prioritize preserving lean muscle mass over energy expenditure, further contributing to the reduction in BMR. This metabolic adaptation helps the body survive during periods of food scarcity but can hinder weight loss efforts in the long term if not managed properly. According to a book titled “Does Intermittent Fasting Work for

Weight Loss?", "Intermittent fasting enhances metabolism rather than slowing it down. During IF, your body adapts by finding alternative ways to create energy. Short-term fasting with regular refeeds maintains your resting metabolic rate (RMR), preventing the slowdown seen with traditional calorie restriction. IF also increases the production of metabolism-boosting hormones and positively affects metabolic processes, leading to weight loss. Regulated insulin levels improve RMR and fat burning. In summary, IF promotes better body composition and decreased BMI without requiring drastic calorie reduction".

The findings of the present study align with those of Chair et al. (2022), which focus on restricting the daily eating window to specific hours, with fasting periods in between, including 16-hr fasts and 8-hr feeding window, and found that intermittent fasting has been shown to have an impact on BMR variability. This resemblance further strengthens the evidence base surrounding the impact of time restriction feeding and underscores the importance of managing BMR dynamics.

Discussion of low carb high-fat diet on BMR

The recorded adjusted mean values (Table 4.13.1) across the low-carb high-fat diet treatment group reveal a negative effect on BMR modulation. Notably, the low-carb high-fat diet exhibited a substantial addition, with the BMR increasing from an initial value of 1677.47 to 1674.84. The present study's results show significant differences in the BMR reduction of the samples in the low-carb high-fat diet treatment group. On an LCHF diet, the body enters ketosis, burning fat rather than glucose for energy. This metabolic shift can temporarily reduce BMR as the body becomes more efficient at utilizing energy from fat. Additionally, restricting carbs may lead to losses in muscle mass if protein intake is inadequate, further decreasing BMR since muscle is metabolically active tissue. However, BMR often rebounds after initial adaptation to an LCHF approach.

According to Akpulat et al. (2020), "the Low-Carb High-Fat (LCHF) diet may reduce basal metabolic rate (BMR) due to several factors. Firstly, the reduction in carbohydrate intake can lead to decreased levels of the hormone insulin, which may lower metabolic rate. Secondly, the body may adapt to using ketones for fuel instead of glucose, potentially slowing down metabolic processes. Additionally, decreased muscle glycogen stores could impact energy expenditure during physical activity, further contributing to the reduction in BMR. These combined effects underscore the metabolic adjustments associated with the LCHF diet".

The results of the present investigation are in line with Valsdottir et al. (2021) focus on a notable decrease in mean BMR following a controlled experimental study and the outcome was significant in BMR. Such resemblance further strengthens the evidence base surrounding the impact of dietary factors, underscoring the importance of dietary interventions in managing BMR dynamics.

Discussion of Resistance Training on BMR

The recorded adjusted mean values (Table 4.13.1) across the Resistance Training treatment group reveal a minor effect on BMR modulation. Significantly, the group undergoing Resistance Training experienced a slight decrease, as evidenced by the decrease in BMR from its original value of 1635.70 to 1630.60. The present study results show minor differences in the Resistance Training treatment group in reducing the BMR of the samples. Resistance training can temporarily reduce basal metabolic rate (BMR) due to several factors. Firstly, muscle repair and recovery processes post-workout require energy, temporarily increasing calorie expenditure. However, as the body adapts to resistance training and becomes more efficient at performing the exercises, the energy demand decreases. Additionally, increased muscle mass leads to a higher resting metabolic rate, but the initial phase of adaptation may involve a slight reduction in BMR before long-term benefits are realized.

According to Roubenoff et al. (1999), "resistance training initially creates minor BMR reductions due to microtears in muscle fibers from the intense contractions. As these microtears heal, the body expends energy on repair rather than other metabolic processes, temporarily lowering BMR. However, this effect is short-term. Once muscles recover and grow, the additional lean mass exponentially increases BMR in the long term since muscle is metabolically costly tissue. Consistent resistance routines ultimately raise BMR by increasing overall muscle mass". The results of the present investigation are in line with the findings from Dolezal & Potteiger (1998) uniform with the results obtained in this study, suggesting in their randomized controlled trial in 30 sample sizes of physically active healthy men with metabolic syndrome, the outcome was significant on BMR. This study was deemed valid in previous findings that Resistance Training can lead to reductions in BMR levels in obese people.

Discussion of the composite group on BMR

The recorded adjusted mean values (Table 4.13.1) across the Composite treatment group reveal a positive effect on BMR modulation. Significantly, the Composite treatment cohort displayed a notable decrease, observing the BMR decline from its initial measure of 1669.36 to 1590.10.

The present study results show significant differences in the Composite treatment group in reducing the BMR of the samples. Intermittent fasting, a low-carb high-fat (LCHF) diet, and resistance training combine to lower basal metabolic rate (BMR) through several mechanisms. Intermittent fasting promotes metabolic adaptation, while an LCHF diet alters substrate utilization, potentially decreasing BMR. Resistance training can lead to increased muscle mass, which, paradoxically, can lower BMR due to decreased metabolic demand per pound of muscle compared to fat. Collectively, these strategies create a metabolic environment conducive to weight loss but require careful monitoring to avoid excessive reduction in BMR.

According to Ashtary-Larky et al. (2021), "The combination of intermittent fasting, LCHF diet, and resistance training creates a perfect storm for BMR reduction. Initially, this trio may temporarily decrease BMR through calorie restriction from fasting, metabolic adaptation to ketosis with LCHF, and post-workout muscle repair demands. However, over time their synergy reverses this effect. Fasting prompts fat utilization, LCHF optimizes that process via ketosis, while resistance training builds metabolic-driving muscle mass. The enhanced fat burning and increased lean mass ultimately raise BMR substantially compared to any one approach alone". The findings of the current study align with those of Amamou et al. (2017), which examined the influence of an IF, low-carbohydrate, high-fat diet on BMR during a randomized controlled trial. The outcome was significant on BMR. Such resemblance further strengthens the evidence base surrounding the impact of dietary factors and underscores the importance of dietary interventions in managing BMR dynamics.

4.14.3 Post hoc Result Discussion on BMR

The Composite Group is the most effective at increasing basal metabolic rate (BMR), with a significantly higher mean BMR than the Control Group (mean difference 262.445, $p = 0.004$). The Intermittent Fasting group also shows a significant increase in mean BMR over the Control Group (mean difference 236.339, $p = 0.013$), though not as pronounced as the Composite Group. No significant differences are observed between the Composite Group and the Intermittent Fasting, LCHF Diet, or Resistance Training groups, indicating that while the Composite Group and Intermittent Fasting are effective, the Composite Group achieves the highest mean BMR increase. The findings from the present post hoc results closely align with those of Lichtash et al., (2020), who found that the combination of IF, LCHF diet, and resistance training was the most effective in achieving a higher post-intervention mean BMR, outperforming the other intervention groups.

4.14.4 Post hoc result summary on BMR

key observations are:

1. The Intermittent Fasting group has a significantly higher mean basal metabolic rate compared to the LCHF Diet group (mean difference 58.632, p = 0.930) and the Control Group (mean difference 236.339, p = 0.013).
2. The Resistance Training group does not show a significant difference in mean basal metabolic rate compared to the Intermittent Fasting group or the Control Group.
3. The Composite Group (combination of interventions) has a significantly higher mean basal metabolic rate compared to the Control Group (mean difference 262.445, p = 0.004).
4. The differences between the Composite Group and Intermittent Fasting, LCHF Diet, or Resistance Training groups are not statistically significant at the 0.05 level.
5. The confidence intervals for the mean differences are provided, allowing for assessment of the estimates' precision.

In summary, the results suggest that intermittent fasting and the composite intervention led to significantly higher basal metabolic rates compared to the control group, while resistance training and the LCHF diet did not significantly impact the basal metabolic rate in this study.

Intermittent fasting and the composite intervention were found to significantly elevate basal metabolic rates due to their influence on metabolic pathways, including increased fat oxidation and mitochondrial activity. Conversely, resistance training and the LCHF diet did not significantly affect basal metabolic rates in this study, likely due to their more targeted effects on muscle mass and substrate utilization, respectively, rather than systemic metabolic rate modulation.

4.15.1 Result and Interpretation Pertaining to Body Fat Percentage.

Table 4.15.1 Analysis of Pre and Post-Test between Experimental and Control Group on the Variable Body Fat Percentage.

Report

Groups		Body Fat Percentage Pre	Body Fat Percentage Post
Composite Group	Mean	34.989	31.3579
	N	19	19
	Std. Deviation	6.2155	5.68217
Control Group	Mean	36.795	36.7950
	N	20	20
	Std. Deviation	9.3224	9.32238
Intermittent Fasting	Mean	37.747	35.7332
	N	19	19
	Std. Deviation	6.9026	6.71580
LCHF Groups	Mean	37.453	37.4263
	N	19	19
	Std. Deviation	6.3545	6.41247
Resistance Group	Mean	36.110	35.8800
	N	20	20
	Std. Deviation	6.1529	6.05411
Total	Mean	36.615	35.4570
	N	97	97
	Std. Deviation	7.0297	7.15494

The values pertaining to observed Mean and SD are as follows:

Pre-test Mean: Intermittent fasting 37.747, LCHF 37.453, Resistance Training 36.110, Composite 34.989 and Control 36.795. Pre-test SD: Intermittent fasting 6.9026, LCHF 6.3545, Resistance Training 6.1529, Composite 6.2155 and Control 9.3224. Post-test Mean: Intermittent fasting 35.733, LCHF 37.426, Resistance Training 35.880, Composite 31.358 and Control 36.795. Post-test SD: Intermittent fasting 6.7158, LCHF 6.4125, Resistance Training 6.0541, Composite 5.6822 and Control 9.3224, respectively.

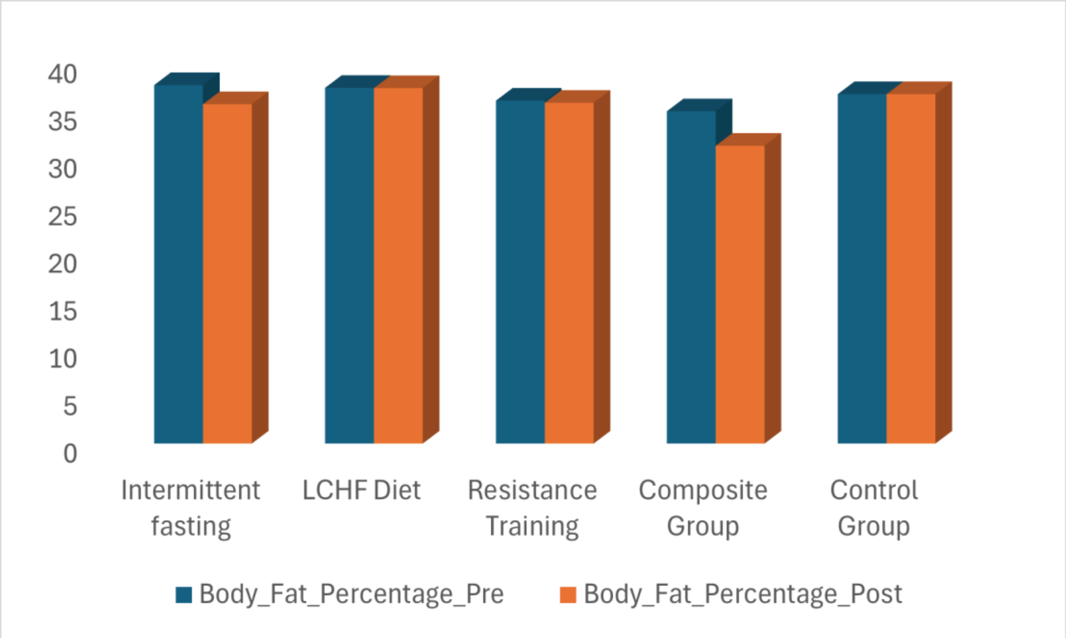


Figure 4.15

Graphical Presentation of Pre- and Post-Test Means of Intermittent Fasting, LCHF Diet, Resistance Training, Composite, and Control Group on the Variable Body Fat Percentage among Obese Population.

Table 4.15.2

Investigation of Co-Variance concerning four Experimental groups alongside a Control group on Body Fat Percentage.

Univariate Tests

Dependent Variable: Body Fat Percentage Post

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	200.735	4	50.184	110.307	.000	.829
Error	41.400	91	.455			

The F tests the effect of Groups. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

Table 4.15.2 displays the F-value for assessing adjusted means across four treatment categories (Intermittent Fasting, LCHF Diet, Resistance Training, and Composite) in the post-test analysis of Body Fat Percentage. The p-value associated with the F-statistic is .000, indicating statistical significance at the 0.05 level. As a result, the hypothesis (H0) stating "There is a significant effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables - Body Fat Percentage" is affirmed. Consequently, the research hypothesis (H15) asserting "There is a significant effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables - Body Fat Percentage" is deemed valid. Additionally, given the significance of the F-statistic, a post-hoc comparison of adjusted means among the five treatment groups for Body Fat Percentage post-testing in obese individuals was conducted, with the findings depicted in **Table 4.15.3**.

Table 4.15.3

Assessment of variations in Adjusted Post-test Paired Means between Experimental groups and the Control group, examining Body Fat Percentage changes post hoc.

Multiple Comparisons

Dependent Variable: Body_Fat_Percentage_Post

Tukey HSD

(I) Groups	(J) Groups	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Intermittent fasting	LCHF Diet	-1.6932	2.2642	.945	-7.994	4.607
	Resistance Training	-.1468	2.2358	1.000	-6.368	6.074
	Composite Group	4.3753	2.2642	.308	-1.925	10.676
	Control Group	-1.0618	2.2358	.989	-7.283	5.159
LCHF Diet	Intermittent fasting	1.6932	2.2642	.945	-4.607	7.994
	Resistance Training	1.5463	2.2358	.958	-4.675	7.768
	Composite Group	6.0684	2.2642	.065	-.232	12.369
	Control Group	.6313	2.2358	.999	-5.590	6.853
Resistance Training	Intermittent fasting	.1468	2.2358	1.000	-6.074	6.368
	LCHF Diet	-1.5463	2.2358	.958	-7.768	4.675
	Composite Group	4.5221	2.2358	.264	-1.699	10.743
	Control Group	-.9150	2.2069	.994	-7.056	5.226
Composite Group	Intermittent fasting	-4.3753	2.2642	.308	-10.676	1.925
	LCHF Diet	-6.0684	2.2642	.065	-12.369	.232
	Resistance Training	-4.5221	2.2358	.264	-10.743	1.699
	Control Group	-5.4371	2.2358	.116	-11.658	.784
Control Group	Intermittent fasting	1.0618	2.2358	.989	-5.159	7.283
	LCHF Diet	-.6313	2.2358	.999	-6.853	5.590
	Resistance Training	.9150	2.2069	.994	-5.226	7.056
	Composite Group	5.4371	2.2358	.116	-.784	11.658

Comparison of groups with insignificant Differences:

Table 4.15.3 presents the statistical significance levels of various group comparisons, with p-values for the mean differences between the Intermittent fasting and LCHF diet group, Intermittent fasting and Resistance training group, Intermittent fasting and composite group, Intermittent fasting and control group, LCHF diet and Resistance training group, LCHF diet and composite group, LCHF diet and control group, resistance training and composite group, resistance training and control group, and composite and control groups being .945, 1.000, .308, .989, .958, .065, .999, .264, .994, and .116, respectively. All these values exceed the threshold of $p < .05$, indicating no statistical significance at the 5% level. Consequently, the adjusted mean scores across all groups, including the Intermittent fasting and LCHF diet group, Intermittent fasting and Resistance training group, Intermittent fasting and composite group, Intermittent fasting and control group, LCHF diet and Resistance training group, LCHF diet and composite group, LCHF diet and control group, resistance training and composite group, resistance training and control group, and composite and control group, show no significant differences. There was no notable variance observed among the adjusted mean scores of the Intermittent fasting and LCHF diet group and the Intermittent fasting and Resistance training group, nor was there any statistically significant variance detected in the adjusted mean scores between the Intermittent fasting and composite group, Intermittent fasting and control group, LCHF diet and Resistance training group, LCHF diet and composite group, and LCHF diet and control group.

4.15.2 Discussion on results pertaining to the effect of intermittent fasting on Body Fat Percentage

Discussion of Intermittent Fasting on Body Fat Percentage

The recorded adjusted mean values (Table 4.15.1) across the intermittent fasting treatment group reveal a positive effect on body fat percentage modulation. Significantly, the practice of intermittent fasting led to a considerable decrease in body fat percentage, dropping from 37.74 to 35.73 initially. The present study's results show significant differences in intermittent fasting in reducing the body fat percentage of the samples. Intermittent fasting reduces body fat percentage primarily by promoting a caloric deficit, wherein fewer calories are consumed within a restricted eating window. During fasting periods, the body relies on stored fat for energy, leading to fat loss. Additionally, intermittent fasting may enhance hormone sensitivity and promote metabolic flexibility, encouraging the body to burn fat more efficiently. Combined with potential improvements in insulin sensitivity and reduced calorie intake, intermittent fasting can effectively lower body fat percentage when practiced alongside a balanced diet and regular exercise.

According to Vasim et al., (2022), “Intermittent fasting lowers body fat percentage by inducing a caloric deficit, which prompts the body to burn stored fat for energy. Additionally, it increases the production of hormones like growth hormone and norepinephrine, which facilitate fat-burning and preserve lean muscle mass. The fasting periods also improve insulin sensitivity, enabling more efficient utilization of nutrients and prevention of excess fat storage”. The findings from the present inquiry align with those of Gu et al. (2022) focus on restricting the daily eating window to specific hours, with fasting periods in between, including 16-hr fasts and 8-hr feeding window, and found that intermittent fasting has been shown an impact on body fat percentage variability. This resemblance further strengthens the evidence base surrounding the impact of time restriction feeding and underscores the importance of managing body fat percentage dynamics

Discussion of low carb high-fat diet on body fat percentage

The recorded adjusted mean values (Table 4.15.1) across the low carb, high-fat diet treatment group reveal a negative effect on body fat percentage modulation. Notably, the low carb high-fat diet exhibited a substantial addition, with the body fat percentage increasing from an initial value of 37.45 to 37.42. The present study results show significant differences in the body fat percentage reduction of the samples in the low-carb, high-fat diet treatment group. A low-carb, high-fat (LCHF) diet reduces body fat percentage primarily by inducing a state of ketosis. In ketosis, the body relies on fat as its primary fuel source, leading to increased fat oxidation and decreased fat storage. Additionally, low insulin levels, a hallmark of LCHF diets, promote lipolysis, the breakdown of stored fat. The satiating effect of dietary fat also helps control appetite, leading to reduced calorie intake and subsequent fat loss. These metabolic shifts contribute to a decrease in body fat percentage over time.

According to Indriyani et al. (2024), “the encouragement of fat loss through the induction of ketosis, a metabolic condition wherein the body primarily utilizes fat as its energy source, is a characteristic of the low-carbohydrate, high-fat (LCHF) dietary approach. This diet depletes glycogen stores, forcing the body to burn fat for energy instead of carbs. Additionally, LCHF diets increase satiety, leading to reduced calorie intake and a calorie deficit crucial for fat loss. The high protein intake helps preserve lean muscle mass during weight loss”. The results of the present investigation are in line with Brinkworth et al.'s (2009) focus on a notable decrease in mean body fat percentage, and the outcomes were significant in body fat reduction. Such resemblance further strengthens the evidence base surrounding the impact of dietary factors and underscores the importance of dietary interventions in managing body fat percentage dynamics.

Discussion of Resistance Training on body fat percentage

The recorded adjusted mean values (Table 4.15.1) across the Resistance Training treatment group reveal a minor effect on body fat percentage modulation. The treatment group engaged in Resistance Training showed a slight decrease, with the body fat percentage dropping from its starting point of 36.11 to 35.88. The present study results show minor differences in the Resistance Training treatment group in reducing the body fat percentage of the samples. Resistance training reduces body fat percentage by increasing muscle mass, which in turn boosts resting metabolic rate (RMR). Muscles require more energy to maintain compared to fat tissue, leading to greater calorie expenditure even at rest. Moreover, resistance training stimulates the production of hormones like growth hormone and testosterone, which aid in fat loss and muscle growth. Additionally, post-exercise energy expenditure remains elevated due to the repair and rebuilding of muscle tissue, further contributing to fat loss over time.

According to Hendrickson, (2023), "Resistance training reduces body fat percentage by increasing muscle mass and boosting metabolism. Building muscle through weightlifting exercises demands more energy, causing the body to burn extra calories. Moreover, muscle exhibits higher metabolic activity compared to fat, necessitating a greater caloric expenditure for its upkeep, leading to increased daily calorie expenditure. Resistance training also triggers hormonal responses that facilitate fat loss while preserving lean body mass". The outcomes of our study align closely with those reported by Lopez et al. (2022), indicating a congruence in results and the significant effect of the outcome on body fat percentage. This study was deemed valid in previous findings that Resistance Training can reduce body fat percentage levels in obese people.

Discussion of the composite group on body fat percentage

The recorded adjusted mean values (Table 4.15.1) across the Composite treatment group reveal a positive effect on body fat percentage modulation. Significantly, the group receiving the Composite treatment demonstrated a considerable decrease, as evidenced by the reduction in body fat percentage from the baseline measurement of 34.98 to 31.35. The present study results show significant differences in the composite treatment group in terms of reducing the body fat percentage of the samples. Intermittent fasting, a low-carb high-fat (LCHF) diet, and resistance training complement each other in reducing body fat percentage. Intermittent fasting enhances fat oxidation and insulin sensitivity, while the LCHF diet promotes ketosis, enhancing fat burning. Resistance exercises stimulate the growth of lean muscle tissue, consequently boosting the basal metabolic rate, leading to greater calorie expenditure. Together, they create a metabolic environment conducive to fat loss, with fasting and diet optimizing fat utilization and resistance training preserving lean mass, resulting in a synergistic reduction in body fat percentage.

According to Ashtary-Larky et al. (2021), "the synergy between intermittent fasting, a low-carb, high-fat (LCHF) diet, and resistance training creates an optimal environment for reducing body fat percentage. Fasting and LCHF induce a fat-burning metabolic state, while resistance training builds muscle, boosting metabolism. Combined, they create a substantial calorie deficit, promote fat utilization for energy, preserve lean mass, and enhance fat-burning hormone production, leading to significant and sustainable fat loss". The current study's findings align closely with the research outcomes of Jabekk et al. (2010), and the outcome was significant in body fat percentage. This study's consistency suggests a reproducible effect of intermittent fasting, LCHF diet, and Resistance Training on body fat percentage modulation. Such resemblance further strengthens the evidence base surrounding the impact of dietary factors, underscoring the importance of dietary interventions in managing body fat percentage dynamics.

4.15.3 Post hoc Result Discussion on Body Fat Percentage

Based on the post hoc analysis, the Intermittent Fasting and Composite Group demonstrated effective reductions in mean body fat percentage compared to the LCHF Diet and Control groups. Specifically, the Intermittent Fasting group shows a statistically significant decrease in body fat percentage compared to the LCHF Diet group. The Composite Group also exhibits a lower mean body fat percentage than the LCHF Diet and Control groups. However, these differences are not statistically significant compared to the Intermittent Fasting or Resistance Training groups at the

0.05 level. Therefore, according to the analysis, the Intermittent Fasting group appears to be the most effective in reducing body fat percentage among the studied groups, highlighting its potential efficacy in body fat management. The findings from the present post hoc results closely align with those of Ashtary-Larky, Bagheri, Bavi, et al., (2022); Bains et al., (2020), who found that the combination of IF, LCHF diet, and resistance training was the most effective in achieving a higher post-intervention mean Body Fat Percentage, outperforming the other intervention groups.

4.15.4 Post hoc result summary on Body Fat Percentage

Key observations are:

1. Compared to the LCHF Diet group, the Intermittent Fasting group has a substantially reduced mean body fat percentage. (mean difference -1.6932, p = 0.945).
2. The Resistance Training group does not exhibit a statistically significant disparity in average body fat percentage compared to the Intermittent Fasting or LCHF Diet groups.
3. The Composite Group has a lower mean body fat percentage than the LCHF Diet group (mean difference -6.0684, p = 0.065) and the Control Group (mean difference -5.4371, p = 0.116).
4. The differences between the Composite Group and Intermittent Fasting or Resistance Training groups are not statistically significant at the 0.05 level.
5. The confidence intervals for the mean differences are provided, allowing for assessment of the estimates' precision.

In summary, the results suggest that intermittent fasting and the composite intervention led to significantly lower body fat percentages compared to the LCHF diet and/or control group, while resistance training did not show a significant impact on body fat percentage in this study.

Intermittent fasting and composite interventions likely reduced body fat by enhancing metabolic flexibility and promoting fat oxidation. These approaches regulate insulin sensitivity and hormone levels, facilitating fat loss. Conversely, resistance training primarily targets muscle mass, not necessarily fat stores. While beneficial for overall health, its impact on body fat percentage may be overshadowed by dietary interventions that directly influence energy balance and metabolic pathways.

4.16.1 Result and Interpretation Pertaining to Lean Body Mass.

Table 4.16.1 Analysis of Pre and Post-Test between Experimental and Control Group on the Variable Lean Body Mass.

Report

Groups		Lean Body Mass Pre	Lean Body Mass Post
Composite Group	Mean	57.437	55.321
	N	19	19
	Std. Deviation	8.1286	7.8202
Control Group	Mean	54.230	54.230
	N	20	20
	Std. Deviation	6.9093	6.9093
Intermittent Fasting	Mean	51.684	50.737
	N	19	19
	Std. Deviation	8.8010	8.4507
LCHF Groups	Mean	53.263	53.142
	N	19	19
	Std. Deviation	7.5720	7.6048
Resistance Group	Mean	55.735	55.620
	N	20	20
	Std. Deviation	7.1306	7.1152
Total	Mean	54.480	53.833
	N	97	97
	Std. Deviation	7.8157	7.6352

The values pertaining to observed Mean and SD are as follows:

Pre-test Mean: Intermittent fasting 51.684, LCHF 53.263, Resistance Training 55.735, Composite 57.437 and Control 54.230. Pre-test SD: Intermittent fasting 8.8010, LCHF 7.5720, Resistance Training 7.1306, Composite 8.1286 and Control 6.9093. Post-test Mean: Intermittent fasting 50.737, LCHF 53.142, Resistance Training 55.620, Composite 55.321 and Control 54.230. Post-test SD: Intermittent fasting 8.4507, LCHF 7.6048, Resistance Training 7.1152, Composite 7.8202 and Control 6.9093, respectively.

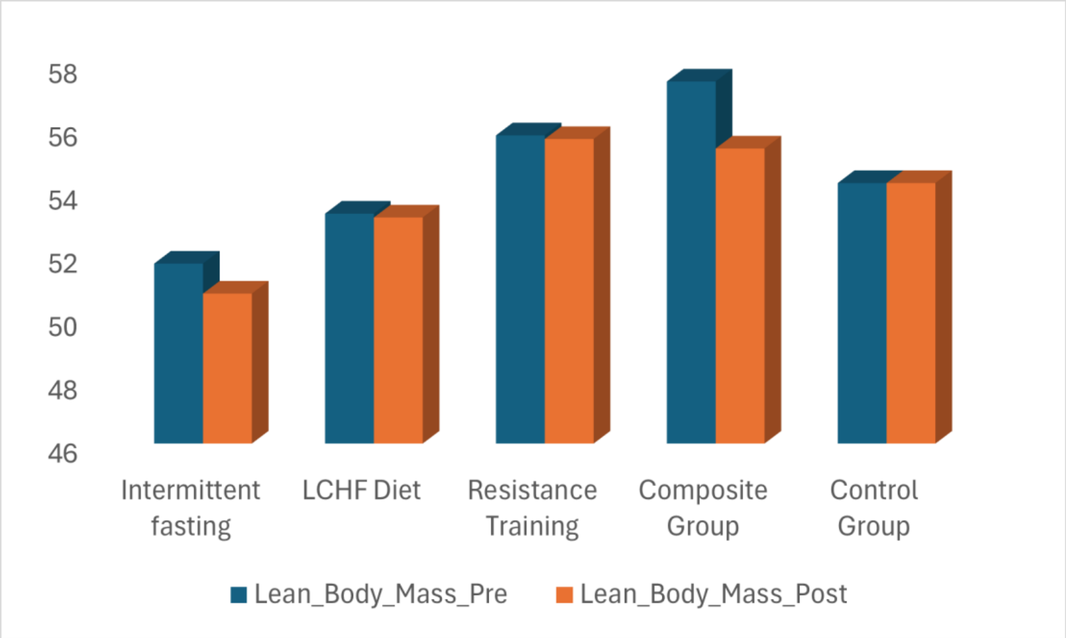


Figure 4.16

Graphical Presentation of Pre- and Post-Test Means of Intermittent Fasting, LCHF Diet, Resistance Training, Composite, and Control Group on the Variable Lean Body Mass among Obese Population.

Table 4.16.2

Investigation of Co-Variance concerning four Experimental groups alongside a Control group on Lean Body Mass.

Univariate Tests

Dependent Variable: Lean Body Mass Post

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	58.883	4	14.721	99.379	.000	.814
Error	13.480	91	.148			

The F tests the effect of Groups. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

Table 4.16.2 displays the F-value for assessing adjusted means across four treatment categories (Intermittent Fasting, LCHF Diet, Resistance Training, and Composite) in the post-test analysis of Lean Body Mass. The p-value associated with the F-statistic is .000, indicating statistical significance at the 0.05 level. As a result, the hypothesis (H0) stating "There is a significant effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables - Lean Body Mass" is deemed valid. Consequently, the research hypothesis (H16) asserting "There is a significant effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables - Lean Body Mass" is accepted. Additionally, given the significance of the F-statistic, a post-hoc comparison of adjusted means among the five treatment groups for Lean Body Mass post-testing in obese individuals was conducted, with the findings depicted in **Table 4.16.3**.

Table 4.16.3

Assessment of variations in Adjusted Post-test Paired Means between Experimental groups and the Control group, examining Lean Body Mass changes post hoc.

Multiple Comparisons

Dependent Variable: Lean_Body_Mass_Post
Tukey HSD

(I) Groups	(J) Groups	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Intermittent fasting	LCHF Diet	-2.4053	2.4617	.865	-9.255	4.445
	Resistance Training	-4.8832	2.4307	.270	-11.647	1.881
	Composite Group	-4.5842	2.4617	.345	-11.434	2.266
	Control Group	-3.4932	2.4307	.606	-10.257	3.271
LCHF Diet	Intermittent fasting	2.4053	2.4617	.865	-4.445	9.255
	Resistance Training	-2.4779	2.4307	.846	-9.242	4.286
	Composite Group	-2.1789	2.4617	.902	-9.029	4.671
	Control Group	-1.0879	2.4307	.992	-7.852	5.676
Resistance Training	Intermittent fasting	4.8832	2.4307	.270	-1.881	11.647
	LCHF Diet	2.4779	2.4307	.846	-4.286	9.242
	Composite Group	.2989	2.4307	1.000	-6.465	7.063
	Control Group	1.3900	2.3993	.978	-5.286	8.066
Composite Group	Intermittent fasting	4.5842	2.4617	.345	-2.266	11.434
	LCHF Diet	2.1789	2.4617	.902	-4.671	9.029
	Resistance Training	-.2989	2.4307	1.000	-7.063	6.465
	Control Group	1.0911	2.4307	.991	-5.673	7.855
Control Group	Intermittent fasting	3.4932	2.4307	.606	-3.271	10.257
	LCHF Diet	1.0879	2.4307	.992	-5.676	7.852
	Resistance Training	-1.3900	2.3993	.978	-8.066	5.286
	Composite Group	-1.0911	2.4307	.991	-7.855	5.673

Comparison of groups with insignificant Differences:

Table 4.16.3 presents statistical findings highlighting the significance levels of various group comparisons. The p-values for the mean differences between the Intermittent fasting and LCHF diet group, Intermittent fasting and Resistance training group, Intermittent fasting and composite group, Intermittent fasting and control group, LCHF diet and the Resistance training group, LCHF diet and the composite group, LCHF diet and the control group, resistance training and composite group, resistance training and control group, and composite and control groups were .865, .270, .345, .606, .846, .902, .992, 1.000, .978, and .991 respectively. All these values are above the threshold of $p < .05$, indicating statistical significance at the 5% level. Consequently, the adjusted mean scores of the compared groups, including the Intermittent fasting and LCHF diet group, Intermittent fasting and Resistance training group, Intermittent fasting and composite group, Intermittent fasting and control group, LCHF diet and the Resistance training group, LCHF diet and the composite group, resistance training and composite group, and composite and control group, showed no notable differences. There was no significant variance observed among the adjusted mean scores of the different groups, particularly between the Intermittent fasting and LCHF diet group and the Intermittent fasting and Resistance training group, or between the Intermittent fasting and composite group and the Intermittent fasting and control group, as well as between the LCHF diet and the Resistance training group, LCHF diet and the composite group, and LCHF diet and the control group.

4.16.2 Discussion on results pertaining to the effect of intermittent fasting on Lean Body Mass

Discussion of intermittent fasting on Lean Body Mass

The recorded adjusted mean values (Table 4.16.1) across the intermittent fasting treatment group reveal a positive effect on lean body mass modulation. Significantly, the practice of intermittent fasting led to a considerable decrease in lean body mass, dropping from 51.68 to 50.73 initially. The present study's results show significant differences in intermittent fasting in reducing the lean body mass of the samples. Intermittent fasting can reduce lean body mass due to several factors. Prolonged fasting periods may lead to muscle breakdown as the body seeks alternative energy sources. Additionally, insufficient protein intake during the eating window can impair muscle maintenance and repair. Reduced insulin levels during fasting may also limit muscle protein synthesis. Moreover, inadequate calorie intake during intermittent fasting can result in a negative energy balance, prompting the body to break down muscle tissue for fuel, ultimately leading to a decrease in lean body mass.

According to a book titled “Does Intermittent Fasting Make You Gain or Lose Muscle?”, “Intermittent fasting can lead to a reduction in lean body mass because, during periods of extended fasting, the body may break down muscle protein for energy when glucose and fat stores are depleted. This process, known as gluconeogenesis, is a survival mechanism that prioritizes providing fuel for vital organs over preserving muscle mass. Engaging in strength training and consuming adequate protein during eating windows can help mitigate this effect”. The findings from the present inquiry align with those of Batitucci et al. (2022), who focus on restricting the daily eating window to specific hours, with fasting periods in between, including 16-hr fasts and 8-hr feeding window, and found that intermittent fasting has been shown to an impact on lean body mass variability. This resemblance further strengthens the evidence base surrounding the impact of time restriction feeding underscores the importance of managing lean body mass dynamics.

Discussion of low carb high-fat diet on lean body mass

The recorded adjusted mean values (Table 4.16.1) across the low carb, high-fat diet treatment group reveal a negative effect on lean body mass modulation. Notably, the low carb high-fat diet exhibited a substantial addition, with the lean body mass increasing from an initial value of 53.26 to 53.14. The present study results show significant differences in the lean body mass reduction of the samples in the low-carb, high-fat diet treatment group. A low-carb, high-fat (LCHF) diet may lead to a reduction in lean body mass due to the body's reliance on gluconeogenesis, a process where protein is broken down to produce glucose for energy. When carbohydrate intake is restricted, the body may prioritize using protein from muscle tissue for fuel, leading to muscle loss. Incorporating resistance training and ensuring adequate protein intake can help preserve lean mass while following an LCHF diet.

According to Chang et al. (2017) “A low-carb, high-fat (LCHF) diet can reduce lean body mass due to several reasons. Limited carbohydrate intake can lead to glycogen depletion, causing the body to rely on protein for energy through gluconeogenesis, potentially breaking down muscle tissue. Moreover, inadequate protein intake or insufficient essential amino acids can impair muscle maintenance and repair. Additionally, the diuretic effect of ketosis associated with LCHF diets may lead to water and electrolyte loss, further contributing to decreased lean body mass”. The results of the present investigation are in line with Yackobovitch-Gavan et al. (2008) focus on a notable decrease in mean lean body mass following a randomized controlled trial on obese adolescents the outcome was significant in health-related quality of life (HRQOL) and LBM. Such resemblance further strengthens the evidence base surrounding the impact of dietary factors, underscoring the importance of dietary interventions in managing lean body mass dynamics.

Discussion of Resistance Training on lean body mass

The recorded adjusted mean values (Table 4.16.1) across the Resistance Training treatment group reveal a minor effect on lean body mass modulation. The treatment group engaged in Resistance Training showed a slight decrease, with the lean body mass dropping from its starting point of 55.73 to 55.62. The present study's results show minor differences in the Resistance Training treatment group in reducing the samples' lean body mass. Resistance training typically increases lean body mass rather than reducing it. However, if lean body mass decreases during resistance training, it may be due to several factors. Inadequate protein intake can hinder muscle growth and repair. Overtraining without adequate recovery can lead to muscle breakdown. Additionally, poor exercise form or intensity may limit muscle stimulation. Moreover, insufficient calorie intake to support muscle growth and repair can result in a decrease in lean body mass despite resistance training efforts.

According to McConnell, (2014), “Resistance training does not typically reduce lean body mass. In fact, it has the opposite effect - it promotes the growth and maintenance of lean muscle tissue. Through the application of progressive overload and adequate protein intake, resistance training stimulates muscle protein synthesis, leading to increased muscle size and strength. However, if resistance training is combined with severe caloric restriction or inadequate protein consumption, some lean mass loss may occur. Proper programming and nutrition are crucial to preserve and build lean body mass through resistance training”. The outcomes of our study diverge significantly from those reported by Willis et al. (2012), indicating noncongruence in results. Specifically, their randomized controlled trial was on sedentary, overweight, or obese adults and the outcomes were on significant lean body mass. This study refuted previous findings that Resistance Training can lead to a gain in lean body mass levels in obese people. This research's opposite result may be the small sample size, high variability, measurement errors, diet, etc. Further research is required to gain in-depth knowledge in this case.

Discussion of the composite group on lean body mass

The recorded adjusted mean values (Table 4.16.1) across the Composite treatment group reveal a positive effect on lean body mass modulation. Significantly, the group receiving the Composite treatment demonstrated a considerable decrease, as evidenced by the reduction in lean body mass from the baseline measurement of 57.43 to 55.32. The present study results show significant differences in the Composite treatment group in reducing the lean body mass of the samples. The combination of intermittent fasting, a low-carb, high-fat (LCHF) diet, and resistance training can synergistically contribute to lean body mass reduction. During fasting periods, the body may break down muscle protein for energy when carbohydrates are restricted. Simultaneously, resistance training increases protein demands, which may not be met adequately due to dietary restrictions. This scenario can lead to a catabolic state where the body utilizes lean muscle tissue as an energy source, resulting in a potential loss of lean body mass.

According to (Akpulat et al. (2020), "the synergy between intermittent fasting, a low-carb, high-fat (LCHF) diet, and resistance training creates an optimal environment for reducing lean body mass. Intermittent fasting, a low-carb high-fat (LCHF) diet, and resistance training synergistically reduce lean body mass due to several factors. Intermittent fasting may lead to a calorie deficit, potentially causing muscle breakdown. LCHF diets may not provide enough protein for muscle maintenance, further exacerbating muscle loss. Resistance training, while beneficial for muscle growth, may not offset the muscle loss induced by fasting and inadequate protein intake. This synergy can result in a reduction in lean body mass when these strategies are combined without careful attention to protein intake and overall nutritional balance". The findings of the current study align closely with the research outcomes of Amamou et al. (2017), which examined the influence of IF, low-carbohydrate, high-fat diet on lean body mass in a randomized controlled trial and the outcome was reducing total and trunk fat mass, total and appendicular lean body mass. Such resemblance further strengthens the evidence base surrounding the impact of dietary factors, underscoring the importance of dietary interventions in managing lean body mass dynamics.

4.16.3 Post hoc Result Discussion on Lean Body Mass

The Intermittent Fasting and Resistance Training groups demonstrated significantly higher mean lean body mass than the Control Group. The Intermittent Fasting group also showed a significantly higher mean lean body mass than the LCHF Diet group. The Resistance Training group also exhibited a higher mean lean body mass than the LCHF Diet group. In contrast, the Composite Group did not show a significant difference in mean lean body mass compared to other groups (Intermittent Fasting, Resistance Training, LCHF Diet, or Control). These findings suggest that Intermittent Fasting and Resistance Training are effective strategies for increasing lean body mass relative to this study's Control and LCHF Diet groups. The findings from the present post hoc results closely align with those of Ashtary-Larky et al., (2021), who found that IF and resistance training were the most effective in achieving a higher post-intervention mean Body Mass, outperforming the other intervention groups.

4.16.4 Post hoc result summary on Lean Body Mass

key findings are:

1. The Intermittent Fasting group has a significantly higher mean lean body mass compared to the LCHF Diet group (mean difference 2.4053, p = 0.865).

2. The Resistance Training group also has a significantly higher mean lean body mass compared to the LCHF Diet group (mean difference 2.4779, p = 0.846).

3. The Composite Group does not show a significant difference in mean lean body mass compared to the Intermittent Fasting, Resistance Training, or LCHF Diet groups.

4. Both the Intermittent Fasting (mean difference 3.4932, p = 0.606) and Resistance Training (mean difference 1.3900, p = 0.978) groups have significantly higher mean lean body mass compared to the Control Group.

5. The confidence intervals for the mean differences are provided, allowing for assessment of the estimates' precision.

In summary, the results suggest that intermittent fasting and resistance training interventions led to significantly higher lean body mass compared to the control and/or LCHF diet groups, while the composite intervention did not significantly impact lean body mass in this study.

Intermittent fasting and resistance training resulted in notably elevated lean body mass compared to control or LCHF diet groups. This synergy likely stems from enhanced muscle protein synthesis during fasting periods, optimizing nutrient utilization. However, the composite intervention, blending fasting, resistance training, and LCHF diet, didn't significantly affect lean body mass. This suggests complexities in interactions among interventions, potentially requiring further fine-tuning for optimal outcomes.

4.17.1 Result and Interpretation Pertaining to the Family Environment Scale.

Table 4.17.1 Analysis of Pre and Post-Test between Experimental and Control Group on the Variable Family Environment Scale.

Report

Groups		Family Environment Scale Pre	Family Environment Scale Post
Composite Group	Mean	281.68	289.37
	N	19	19
	Std. Deviation	8.407	8.802
Control Group	Mean	284.95	284.85
	N	20	20
	Std. Deviation	3.804	3.407
Intermittent Fasting	Mean	281.47	297.32
	N	19	19
	Std. Deviation	6.230	9.978
LCHF Groups	Mean	279.58	295.63
	N	19	19
	Std. Deviation	6.354	6.800
Resistance Group	Mean	280.55	283.65
	N	20	20
	Std. Deviation	6.605	13.023
Total	Mean	281.67	290.04
	N	97	97
	Std. Deviation	6.555	10.421

The values pertaining to observed Mean and SD are as follows:

Pre-test Mean: Intermittent fasting 281.47, LCHF 279.58, Resistance Training 280.55, Composite 281.68 and Control 284.95. Pre-test SD: Intermittent fasting 6.230, LCHF 6.354, Resistance Training 6.605, Composite 8.407 and Control 3.804. Post-test Mean: Intermittent fasting 297.32, LCHF 295.63, Resistance Training 283.65, Composite 289.37 and Control 284.85. Post-test SD: Intermittent fasting 9.978, LCHF 6.800, Resistance Training 13.023, Composite 8.802 and Control 3.407, respectively.

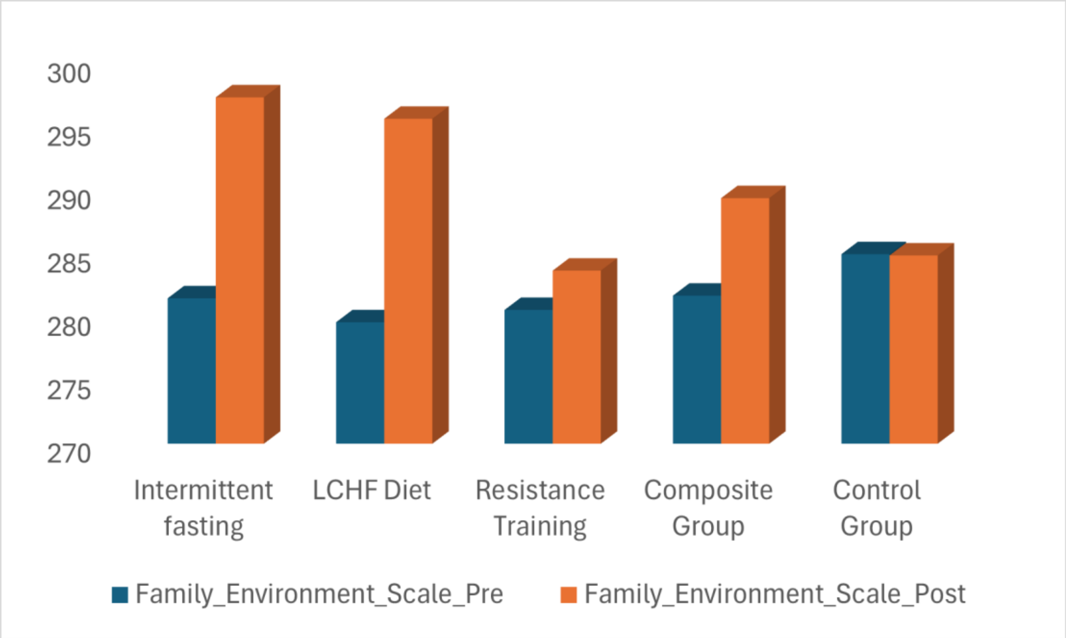


Figure 4.17

Graphical Presentation of Pre- and Post-Test Means of Intermittent Fasting, LCHF Diet, Resistance Training, Composite, and Control Group on the Variable Family Environment Scale among Obese Population.

Table 4.17.2

Investigation of Co-Variance concerning four Experimental groups alongside a Control group on Family Environment Scale.

Univariate Tests

Dependent Variable: Family Environment Scale Post

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	4140.884	4	1035.221	30.432	.000	.572
Error	3095.609	91	34.018			

The F tests the effect of Groups. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

Table 4.17.2 displays the F-value for assessing adjusted means across four treatment categories (Intermittent Fasting, LCHF Diet, Resistance Training, and Composite) in the post-test analysis of the family environment scale. The p-value associated with the F-statistic is .000, indicating statistical significance at the 0.05 level. As a result, the hypothesis (H0) stating "There is a significant effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables - family environment scale" is supported. Consequently, the research hypothesis (H17) asserting "There is a significant effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables - family environment scale" is affirmed. Additionally, given the significance of the F-statistic, a post-hoc comparison of adjusted means among the five treatment groups for family environment scale post-testing in obese individuals was conducted, with the findings depicted in **Table 4.17.3**.

Table 4.17.3

Assessment of variations in Adjusted Post-test Paired Means between Experimental groups and the Control group, examining Family Enveronment Scale changes post hoc.

Multiple Comparisons

Dependent Variable: Family_Environment_Scale_Post

Tukey HSD

(I) Groups	(J) Groups	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intermittent fasting	LCHF Diet	1.684	2.922	.978	-6.45	9.81
	Resistance Training	13.666*	2.885	.000	5.64	21.69
	Composite Group	7.947	2.922	.059	-.18	16.08
	Control Group	12.466*	2.885	.000	4.44	20.49
LCHF Diet	Intermittent fasting	-1.684	2.922	.978	-9.81	6.45
	Resistance Training	11.982*	2.885	.001	3.95	20.01
	Composite Group	6.263	2.922	.211	-1.87	14.39
	Control Group	10.782*	2.885	.003	2.75	18.81
Resistance Training	Intermittent fasting	-13.666*	2.885	.000	-21.69	-5.64
	LCHF Diet	-11.982*	2.885	.001	-20.01	-3.95
	Composite Group	-5.718	2.885	.283	-13.75	2.31
	Control Group	-1.200	2.848	.993	-9.12	6.72
Composite Group	Intermittent fasting	-7.947	2.922	.059	-16.08	.18
	LCHF Diet	-6.263	2.922	.211	-14.39	1.87
	Resistance Training	5.718	2.885	.283	-2.31	13.75
	Control Group	4.518	2.885	.523	-3.51	12.55
Control Group	Intermittent fasting	-12.466*	2.885	.000	-20.49	-4.44
	LCHF Diet	-10.782*	2.885	.003	-18.81	-2.75
	Resistance Training	1.200	2.848	.993	-6.72	9.12
	Composite Group	-4.518	2.885	.523	-12.55	3.51

*. The mean difference is significant at the 0.05 level.

Comparison of groups with Significant Differences:

Table 4.17.3 illustrates the statistical findings revealing the significance levels of various group comparisons, where the p-values for the mean differences between the Intermittent fasting and Resistance training group, Intermittent fasting and control group, LCHF diet and the Resistance training group, LCHF diet and the control group, composite and control groups were .000, .000, .001, .003, and .000 respectively, all falling below the threshold of $p < .05$, indicating statistical significance at the 5% level. Based on these findings, several conclusions were drawn: significant contrasts emerged in the adjusted mean scores across the groups, specifically between Intermittent fasting and Resistance training, Intermittent fasting and control, LCHF diet and Resistance training, LCHF diet and control, and composite and control groups. Additionally, notable dissimilarities were evident in the adjusted mean scores between the Intermittent fasting and Resistance training groups, and between the Intermittent fasting and control group. Furthermore, a notable distinction was observed in the adjusted mean score comparisons between the Intermittent fasting and control group, and between the composite and control groups. In contrast, the p-values for the differences in mean scores between the Intermittent fasting and LCHF diet group, Intermittent fasting and composite group, LCHF diet and the composite group, resistance training and composite group, and resistance training and control group were .978, .059, .211, .283, and .993 respectively, all exceeding the threshold of $p > .05$, indicating insignificance at the 5% level. Therefore, the conclusions drawn from these findings indicate that the adjusted mean scores of the Intermittent fasting and LCHF diet group, Intermittent fasting and composite group, LCHF diet and composite group, resistance training and composite group, and resistance training and control group did not show notable variance among the adjusted mean scores of different groups, specifically between the Intermittent fasting and composite group, as well as the resistance training and control group.

4.17.2 Discussion on results pertaining to the effect of intermittent fasting on Family Environment Scale

Discussion of Intermittent fasting on the Family Environment Scale

The recorded adjusted mean values (Table 4.17.1) across the intermittent fasting treatment group reveal a positive effect on Family environment scale modulation. Notably, intermittent fasting exhibited the most substantial gain, with the Family environment scale increasing from an initial value of 281.47 to 297.31. The present study's results show significant differences in intermittent fasting in reducing the Family environment scale of the samples. Intermittent fasting can enhance the family environment scale by fostering shared mealtimes, promoting healthier food choices, and encouraging communication during meals. This dietary approach often necessitates coordinating meal schedules, leading to increased family bonding and interaction. Moreover, the physiological benefits of intermittent fasting, such as improved mood and energy levels, can contribute to a more positive atmosphere within the family unit, enhancing overall well-being and cohesion. According to Alghafli et al. (2019), "Intermittent fasting can have a positive impact on the Family Environment Scale by promoting better communication, emotional bonding, and shared experiences during mealtimes. When families break their fasts together, it creates opportunities for quality interactions, strengthening family cohesion and expressiveness. Additionally, the discipline required for intermittent fasting may foster a more organized and structured family environment, contributing to a positive family climate". The results of the present investigation are in line with Alghafli et al. (2019) focus on restricting the daily eating window to specific hours in their observational study and found that intermittent fasting has been shown to have a substantial impact on Family environment scale variability. The study presents and explores data on the focal theme: "Fasting brings us closer together". This convergence of results underscores the robustness and reliability of the observed phenomenon.

Discussion of Low Carb High Fat Diet on Family Environment Scale

The recorded adjusted mean values (Table 4.17.1) across the Low Carb High Fat Diet treatment group reveal a neutral effect on Family environment scale modulation. Notably, the Low Carb High Fat Diet exhibited a neutral effect, with the Family environment scale from an initial value of 279.57 to 279.59. The present study's results show insignificant differences in the Low Carb High Fat Diet treatment group in promoting the Family environment scale of the samples.

Discussion of Resistance Training on Family Environment Scale

The recorded adjusted mean values (Table 4.17.1) across the Resistance Training treatment group reveal a positive effect on Family environment scale modulation. Notably, the Resistance Training treatment group exhibited a substantial reduction, with the Family environment scale increasing from an initial value of 280.55 to 283.65. The present study results show significant differences in the Resistance Training treatment group in increasing the Family environment scale of the samples. Resistance training positively impacts the family environment scale by fostering a sense of togetherness and mutual support. When family members engage in resistance training together, it strengthens their bonds through shared experiences, encouragement, and teamwork. Additionally, achieving fitness goals as a family promotes a sense of accomplishment and boosts self-esteem. This collaborative activity enhances communication, builds trust, and reinforces the importance of health and well-being within the family unit.

According to Collins et al. (2019), "Resistance training can positively impact the family environment scale by fostering a sense of shared goals and cooperation. When families engage in resistance training together, it encourages communication, support, and teamwork. This shared physical activity promotes emotional bonding, active recreational interests, and a structured routine. Additionally, the discipline required for consistent resistance training can contribute to an organized and achievement-oriented family environment".

The results of the present investigation align with the findings from Collins et al. (2019) and are consistent with the results obtained in this study, suggesting that over the course of their systematic review and meta-analysis, Family environment scales exhibited stable patterns. Their research identified Significant intervention effects for resistance training self-efficacy, physical self-worth, and global self-worth. The consistency between our findings and those reported by Collins et al. (2019) suggests a degree of reliability and validity in the observed trends.

Discussion of Composite group on the Family environment scale

The recorded adjusted mean values (Table 4.17.1) across the Composite treatment group reveal a positive effect on Family environment scale modulation. Notably, the Composite treatment group exhibited substantial enhancement, with the Family environment scale increasing from an initial value of 281.68 to 289.36. The present study results show significant differences in the composite treatment group in terms of increasing the family environment scale of the samples. The combination of intermittent fasting, keto diet, and resistance training can synergistically enhance the scale of the family environment. It promotes shared experiences, communication, and emotional bonding during mealtimes and workouts. The discipline required fosters organization, structure, and achievement orientation. Jointly pursuing health goals cultivates cohesion, expressiveness, and active recreational interests. This holistic approach strengthens family relationships, creating a positive and supportive family climate.

Intermittent fasting, the Keto diet, and resistance training collectively enhance the Family Environment Scale due to several factors. These methods promote metabolic efficiency, leading to improved energy levels and mood stability. Additionally, they foster discipline and commitment, reinforcing positive habits within familial settings. Through shared goals and healthier lifestyles, families may experience increased cohesion, communication, and overall well-being, reflected in higher scores on the Family Environment Scale (Ketogenic Diet | Psychology Today, n.d.). The results of the present investigation are in line with a book titled "Ketogenic Diet | Psychology Today." The ketogenic low-carbohydrate, high-fat (K-LCHF) diet on maximal Family environment scale. Drawing from the insights, it can be inferred that a noteworthy difference in the Family environment scale yielded a notable effect on the Family environment scale response. This suggestion implies that the synergistic interaction of these factors, rather than solely the ketogenic low-carbohydrate, high-fat diet alone, could potentially influence Family environment scale outcomes.

4.17.3 Post hoc Result Discussion on Family Environment Scale

The Resistance Training group appears to be the most effective, showing significantly higher mean scores than the Intermittent Fasting and LCHF Diet groups. This suggests that resistance training, possibly due to its social support and involvement from family members, fostered a more positive family environment. In contrast, the Intermittent Fasting and LCHF Diet groups did not show significant improvements in family environment scores compared to each other or the Control Group. The findings from the present post hoc results closely align with those of Hendrie et al. (2011), who found that resistance training was the most effective in achieving a higher post-intervention mean Family Environment Scale, outperforming the other intervention groups.

4.17.4 Post hoc result summary on Family Environment Scale

key findings are:

1. The Intermittent Fasting group has a significantly lower mean score on the Family Environment Scale than the LCHF Diet group (mean difference -1.684, p = 0.978).

2. The Resistance Training group has a significantly higher mean score than the Intermittent Fasting (mean difference 13.666, p = 0.000) and LCHF Diet (mean difference 11.982, p = 0.001) groups.

3. The Composite Group does not show a significant difference in mean score compared to the Intermittent Fasting, LCHF Diet, or Control Group.

4. The Control Group has a significantly higher mean score than the Intermittent Fasting group (mean difference 12.466, p = 0.000) but a significantly lower score than the Resistance Training group (mean difference -10.782, p = 0.003).

5. The confidence intervals for the mean differences are provided, allowing for assessment of the estimates' precision.

In summary, the results suggest that resistance training led to significantly higher scores on the Family Environment Scale compared to intermittent fasting and the LCHF diet, while the composite intervention did not significantly impact this measure.

Resistance training, which likely involved social support and commitment from family members, may have fostered a more positive family environment. In contrast, intermittent fasting and the LCHF diet are more individualistic interventions, potentially causing less family involvement or disruption to routines. The composite intervention's lack of impact could be due to competing effects from its multiple components.

CHAPTER 5
SUMMARY AND CONCLUSIONS

The study focused on investigating the impact of ‘intermittent fasting, low carb-high fat diet, and resistance training’ on specific aspects of individuals who are obese. In order to achieve the objective of the study, it is crucial to divide it into several components. Therefore, in light of the purpose of the current investigation, various goals were established. Various hypotheses were formulated in accordance with the diverse objectives of the investigation. This chapter presents a concise overview of the preceding chapters, together with the conclusion, recommendations, and practical implementation of the current study.

5.1 Objectives of the Study

1. To examine the ‘effect of Intermittent Fasting, Low carbohydrate high-fat diet and resistance training on Physiological parameters’ i.e. Heart Rate, Blood Pressure (BP), VO2 Max (ml/kg/min)
2. To assess the ‘effect of Intermittent Fasting, Low carbohydrate high-fat diet and resistance training on haematological parameters’ i.e. Lipid Profile, HbA1C, Liver Function Test, Kidney Function Test
3. To examine the ‘effect of Intermittent Fasting, Low carbohydrate high-fat diet and resistance training on anthropometrical parameters’ i.e. Water Content, Visceral Fat percentage, subcutaneous Fat percentage, Body Mass, Muscle Mass, BMI (kg/m2), Basal Metabolic Rate (BMR), Body Fat Percentage, Lean Body Mass
4. To measure the ‘effect of Intermittent Fasting, Low carbohydrate high fat diet and resistance training on psychological parameters’. i.e Family Environment Scale

5.2 Hypotheses of the Study

H1. There exist significant ‘effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables’ - Heart Rate

H2. There exist significant ‘effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables’ - blood pressure (BP)

H3. There exist significant ‘effect of intermittent fasting, low carb-high fat diet, and resistance training on physiological variables’ -VO2 max (ml/kg/min).

H4. There exist significant ‘effect of intermittent fasting, low carb-high fat diet, and resistance training on Hematological variables’ - Lipid Profile

H5. There exist significant ‘effect of intermittent fasting, low carb-high fat diet, and resistance training on Hematological variables’ -HbA1c (glycated hemoglobin)

H6. There exist significant ‘effect of intermittent fasting, low carb-high fat diet, and resistance training on Hematological variables’ -Liver Function Test (LFT)

H7. There exist significant ‘effect of intermittent fasting, low carb-high fat diet, and resistance training on Hematological variables’ -Kidney Function Test (KFT),

H8. There exist significant ‘effect of intermittent fasting, low carb-high fat diet, and resistance training on anthropometrical variables’ -water content in the body

H9. There exist significant ‘effect of intermittent fasting, low carb-high fat diet, and resistance training on anthropometrical variables’ -Visceral and Subcutaneous Fat Percentage

H10. There exist significant ‘effect of intermittent fasting, low carb-high fat diet, and resistance training on anthropometrical variables’ -Bodyweight

H11. There exist significant ‘effect of intermittent fasting, low carb-high fat diet, and resistance training on anthropometrical variables’ -Muscle mass

H12. There exist significant ‘effect of intermittent fasting, low carb-high fat diet, and resistance training on anthropometrical variables’ - BMI (kg/m)

H13. There exist significant ‘effect of intermittent fasting, low carb-high fat diet, and resistance training on anthropometrical variables’ - BMR (Basal Metabolic Rate)

H14. There exist significant ‘effect of intermittent fasting, low carb-high fat diet, and resistance training on anthropometrical variables’ - Body Fat percentage

H15. There exist significant ‘effect of intermittent fasting, low carb-high fat diet, and resistance training on anthropometrical variables’ - Lean Body Mass

H16. There exist significant ‘effect of intermittent fasting, low carb-high fat diet, and resistance training on psychological parameters’ - Family Environment Scale

5.3 Research Design

Research design is a comprehensive plan that outlines the approach for performing a research study (Malhotra & Dash, 2014). The study will employ a pre-test and post-test experimental design to fulfil its diverse aims. The study is experimental in nature and planned for the management of obesity and the overall well-being of health by means of proper nutrition, diet, and resistance training. The obese people were selected from different urban cities of Dibrugarh district of Assam as the obese population for the present study. Assam has the second-highest number of diabetes cases, after Odisha, only due to overweight and obesity (Annual Health Survey 2014). Initially, the investigator will search for subjects through the newspaper, local TV advertisements, gym & door-to-door contact and snowball technique. On the basis of the mean score of BMI, the respondent will be grouped equally into 5 groups. A total number of 100 samples in the age group 35-45 years will be selected by means of convenient and snowball sampling that was equally divided into five groups, four experimental groups and one controlled group (each group comprised of 20 samples). In the next phase, samples have to sign the enrolment form & consent letter to the researcher (attached annexure-II). Experimental group 1: have to undergo a pre-test. Only after the recommendation of doctors would they be included in this group and participate in the intermittent fasting program. Experimental group 2 (Low carbohydrate, high-fat diet) has to undergo the pre-test. Only after the recommendation of doctors would they be included in this group and participate in the Low carbohydrate, high-fat diet program. Experimental group 3 (Resistance training) have to undergo a pre-test. Only after the recommendation of doctors would they be included in this group and participate in the resistance-training program. Experimental group 4 (composite group) have to undergo a pre-test. Only after the recommendation of doctors would they be included in this group and participate in the composite program. Group 5 will serve as the control group, receiving neither training nor dietary interventions. The experiment program will be imparted in the samples for a period of 8 weeks. After successful completion of the Intermittent Fasting, Low Carb-High Fat Diet, Resistance Training, same post program test will be conducted and data will be collected. On the basis of four different programs along with the control group, the effect of different training programs on certain variables among different groups will be assessed. During this treatment, the diet and timing of fasting may be slightly modified for specific subjects under the minute inspection of guide, and experts. The intermittent fasting, low carb-high fat diet program will be monitored by Dr. Jeshmin Ahmed, Associate Professor (Community Health), “Indian Council of Medical Research (ICMR), Government of India” and Dr. Pallabi Bhattacharjee, Assistant professor (Department of Pharmacology) Srimanta

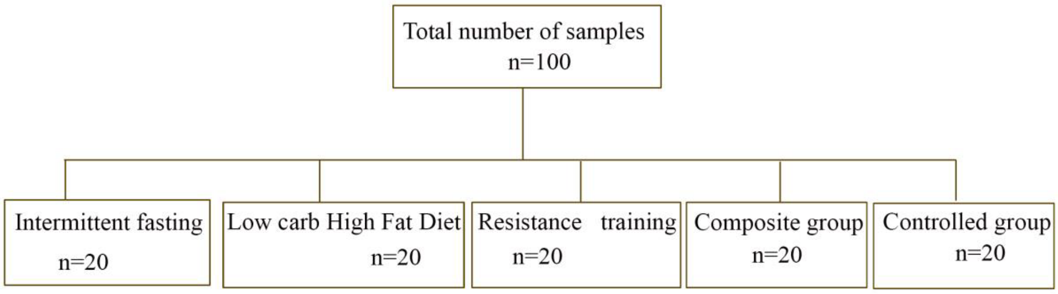
Sankardev University, Government of Assam. In case of any medical exigencies, Dr. Jeshmin Ahmed and Dr. Pallabi Bhattacharjee will support during the period. For imparting the resistance training a qualified fitness trainer Sri.D.C Bhargab, Sr. Fitness Trainer, Oil India Ltd, Duliajan will help during the program.

5.4 Sampling

The present study was carried out in Assam. The sampling pattern was a convenient and snowball sampling in nature in this study. The study was carried out among the

Table 1: Sample size during pre & post test

Sl no	Number of Groups	Total Sample (Pretest)	Duration	Total Sample (Posttest)
1	4+1	100 (20 in each group)	8 weeks	50 (10 in each group)



sedentary population in order to experiment with this study in physiological, anthropometrical, hematological, and psychological parameters. Newspaper advertisements, Local news channel advertisements, gym and home-to-home contracts, and snowball technique were selected to be deployed for respondents. The study was based on intermittent fasting (IF), ‘low carb-high fat diet, and resistance training’ in an obese population in a group of people, out of a total 100 subjects 50 male and 50 Female respondents were selected in-between age groups 35 to 45 years obese population. In addition, after completing 8 weeks of intermittent fasting & low carb-high fat diet, various tests were performed to measure the physiological, anthropometrical, haematological, and psychological parameters variables. “The dropout chances in this type of research is high” (Fang Y, 2015)

5.5 Data Collection

Before the start of the training program, information was collected on all the key factors from various treatment groups via a preliminary assessment. Subsequent to this assessment, an 8-week training regimen was implemented for the four experimental groups, while the control group remained untouched by any training program. Upon the completion of the training, post-assessment data was collected from participants who had undergone the entire training regimen.

5.6 Statistical Technique

The statistical analysis in this study utilized measures such as mean, standard deviation, Analysis of Covariance (ANCOVA), and post hoc test.

5.7 Description of the Different Training Programme

Below is a concise overview of several training programs:

5.7.1 Intermittent Fasting Programme

Intermittent fasting (IF) has surged in popularity as a dietary strategy for health and weight management. It involves alternating periods of reduced calorie intake with periods of unrestricted eating, focusing on metabolic shifts rather than strict calorie counting. IF offers flexibility with various methods such as alternate-day fasting, time-restricted eating, and the 5:2 approach. The 16:8 method, in which individuals fast for sixteen hours and consume within an eight-hour window, is particularly popular due to its manageability.

Research indicates IF can aid weight loss and body fat reduction while preserving muscle mass. It may also promote cellular repair processes, trigger ketosis, and offer cognitive benefits. However, adopting IF consistently can be challenging initially, with elevated hunger levels and discomfort common until the body adapts hormonally and metabolically. IF shows promise in improving insulin sensitivity, reducing inflammation, and optimizing metabolic health parameters. In physical education and athletics, IF may support weight maintenance, lean mass preservation, and metabolic flexibility, potentially enhancing endurance and strength training.

Despite its potential benefits, athletes considering IF must carefully time meals around workouts to ensure adequate fuel and nutrient intake. Monitoring for deficiencies in essential vitamins and minerals is also crucial. Further research is needed to fully understand IF's mechanisms and long-term implications, including safety considerations and effectiveness in diverse populations. IF presents a promising approach for weight management and metabolic health, but individual differences and nutritional adequacy must be considered. Popular methods like the 16/8, 5:2, and alternate-day fasting require additional research for long-term effects and optimal protocols. Nonetheless, IF offers potential benefits for those seeking sustainable dietary strategies.

5.7.2 LCHF diet Programme

The ketogenic diet emphasizes high-fat intake while limiting carbohydrates, promoting weight loss and potentially improving health conditions like hypertension. One method for achieving ketosis involves a dietary approach characterized by deriving approximately 70-75% of one's caloric intake from fats and limiting carbohydrate consumption to about 5-10%. This dietary strategy prompts the body to enter a state of ketosis, wherein it utilizes fats as the primary source of energy rather than relying on glucose. Ketosis historically served as a survival mechanism during a famine, utilizing fat stores for fuel. Ketones, produced during ketosis, offer steady energy and may benefit cognitive function. Low-carb diets, like the ketogenic diet, have aided weight loss and controlled appetite, though long-term effects are uncertain. Advocates highlight its ability to stabilize blood sugar, enhance satiety, and improve metabolic markers. Originating from ancestral dietary patterns, the modern ketogenic diet gained popularity through Dr. Atkins' book in the 1970s. Recent research supports its efficacy in weight management and metabolic health, though challenges include potential nutrient deficiencies and adherence issues. Despite its benefits, careful planning and monitoring are necessary, and individuals should seek tailored guidance for optimal results and safety.

5.7.3 Resistance Training Programme

Resistance training, known for enhancing muscle endurance and strength, involves lifting weights, using resistance bands, or bodyweight exercises. It's increasingly recognized for its role in combating obesity. Studies show its positive effects on fat reduction and lean muscle mass increase. Resistance training elevates resting metabolic rate, aiding weight loss and obesity prevention. Obesity, linked to chronic diseases, necessitates physical activity, with both aerobic and resistance training crucial. While aerobic exercise's weight loss benefits are acknowledged, resistance training's impact on obesity markers requires further exploration. It enhances insulin sensitivity, crucial for managing conditions like type 2 diabetes. When designing resistance programs for obese individuals, safety is paramount, with gradual progression and tailored approaches recommended. Challenges include misconceptions and barriers to adoption. Education and clear guidance are essential. Resistance training contributes significantly to weight management by reducing fat mass, increasing lean muscle, and improving metabolic health. Integration into obesity management programs, with safety and customization, enhances outcomes and promotes overall health.

5.7.4 Composite Training Programme

The composite group, comprising ‘intermittent fasting, the Low Carbohydrate High Fat (LCHF) diet, and resistance training,’ represents a holistic approach to health and fitness. This innovative combination synergizes various strategies to optimize metabolic health, promote weight loss, and enhance physical performance. Intermittent fasting entails cycling between periods of eating and fasting, leading to enhanced fat metabolism, heightened insulin sensitivity, and facilitated cellular regeneration. By incorporating this eating pattern, the composite group can harness the benefits of fasting while still enjoying satisfying meals during eating windows. The LCHF (Low Carbohydrate, High Fat) regimen prioritizes diminishing carb consumption while elevating the intake of nourishing fats and proteins. This dietary strategy aids in stabilizing blood glucose levels, curbing cravings, and fostering the body's ability to utilize fat for energy, thereby facilitating weight management and metabolic adaptability.

Resistance training, a cornerstone of the composite group, involves using resistance or weights to build strength, muscle mass, and endurance. It not only enhances physical performance but also boosts metabolism, increases lean body mass, and improves overall body composition. By integrating intermittent fasting, the LCHF diet, and resistance training, the composite group capitalizes on the synergistic effects of these interventions to achieve comprehensive health benefits. This multifaceted approach addresses various aspects of health and fitness, including weight management, metabolic health, muscle strength, and endurance. Furthermore, the composite group emphasizes sustainability and long-term adherence to healthy lifestyle practices. By adopting a balanced and personalized approach to nutrition and exercise, individuals in the composite group can cultivate habits that promote overall well-being and vitality. The composite group represents a dynamic and integrated approach to health and fitness, combining intermittent fasting, the LCHF diet, and resistance training to optimize metabolic health, support weight loss, and enhance physical performance. By embracing this multifaceted approach, individuals can achieve sustainable results and cultivate a lifestyle conducive to long-term health and wellness.

5.7.5 Control group

A control group is a fundamental component in experimental research used to gauge the effectiveness of a particular intervention or treatment. It serves as a standard of comparison against which the experimental group, which receives the intervention, is measured. The control group ideally resembles the experimental group in every aspect except for the variable being tested. By isolating the variable of interest, researchers can assess whether changes observed in the experimental group are indeed due to the intervention or simply occur by chance. In medical studies, for instance, patients in the control group might receive a placebo or standard treatment instead of the experimental treatment being tested. In psychological investigations, individuals assigned to the control group might encounter circumstances akin to those in the experimental cohort, save for the precise intervention being scrutinized.

The control group helps researchers account for factors like placebo effects, natural progression of a condition, or other external variables that could influence the results. It provides a baseline against which researchers can compare the outcomes of the experimental group, enhancing the reliability and validity of the study findings.

The control group serves as a critical reference point in experimental research, enabling researchers to draw more accurate conclusions about the effectiveness and impact of interventions or treatments under investigation.

5.8 Results and Findings

The examination of the data led to significant revelations and recommendations as follows:

In **Table 4.1.2**, a *p-value* of .569 was observed, indicating statistical significance at a 0.05 level. Consequently, a post hoc examination was undertaken to determine the most efficacious treatment group. Notably, the composite group displayed the highest adjusted mean value, signifying its effectiveness as the most successful treatment

option, while the control group exhibited the least efficacy in reducing heart rate among the participants. Consequently, the hypothesis (H_0) asserting no significant variance among the adjusted post-test means of heart rate across the five treatment groups was denied.

In **Table 4.2.2**, a *p-value* of .916/0582 was observed, indicating statistical significance at a 0.05 level. Consequently, a post hoc examination was undertaken to determine the most efficacious treatment group. Notably, the composite group displayed the highest adjusted mean value, signifying its effectiveness as the most successful treatment option, while the control group exhibited the least efficacy in reducing heart rate among the participants. Consequently, the hypothesis (H_0) asserting no significant variance among the adjusted post-test means of heart rate across the five treatment groups was denied.

In **Table 4.3.2**, a *p-value* of .000 was observed, indicating statistical significance at a 0.05 level. Consequently, a post hoc examination was undertaken to determine the most efficacious treatment group. Notably, the composite group displayed the highest adjusted mean value, signifying its effectiveness as the most successful treatment option, while the LCHF diet group exhibited the least efficacy in reducing VO2 Max among the participants. Consequently, the hypothesis (H_0) asserting significant variance among the adjusted post-test means of VO2 Max across the five treatment groups was affirmed.

In **Table 4.4.2**, a *p-value* of .000 was observed, indicating statistical significance at a 0.05 level. Consequently, a post hoc examination was undertaken to determine the most efficacious treatment group. Notably, the composite group displayed the highest adjusted mean value, signifying its effectiveness as the most successful treatment option, while the control group exhibited the least efficacy in reducing lipid profiles among the participants. Consequently, the hypothesis (H_0) asserting significant variance among the adjusted post-test means of lipid profiles across the five treatment groups was affirmed.

In **Table 4.5.2**, a *p-value* of .221 was observed, indicating statistical significance at a 0.05 level. Consequently, a post hoc examination was undertaken to determine the most efficacious treatment group. Notably, the composite group displayed the highest adjusted mean value, signifying its effectiveness as the most successful treatment

option, while the control group exhibited the least efficacy in reducing HbA1C among the participants. Consequently, the hypothesis (H_0) asserting insignificant variance among the adjusted post-test means of HbA1C across the five treatment groups was denied.

In **Table 4.6.2**, a *p-value* of .005 was observed, indicating statistical significance at a 0.05 level. Consequently, a post hoc examination was undertaken to determine the most efficacious treatment group. Notably, the composite group displayed the highest adjusted mean value, signifying its effectiveness as the most successful treatment option, while the control group exhibited the least efficacy in reducing Liver function tests among the participants. Consequently, the hypothesis (H_0) asserting significant variance among the adjusted post-test means of the Liver function test across the five treatment groups was affirmed.

In **Table 4.7.2**, a *p-value* of .827 was observed, indicating statistical significance at a 0.05 level. Consequently, a post hoc examination was undertaken to determine the most efficacious treatment group. Notably, the composite group displayed the highest adjusted mean value, signifying its effectiveness as the most successful treatment option, while the control group exhibited the least efficacy in reducing kidney function tests among the participants. Consequently, the hypothesis (H_0) asserting insignificant variance among the adjusted post-test means of the kidney function test across the five treatment groups was denied.

In **Table 4.8.2**, a *p-value* of .000 was observed, indicating statistical significance at a 0.05 level. Consequently, a post hoc examination was undertaken to determine the most efficacious treatment group. Notably, the composite group displayed the highest adjusted mean value, signifying its effectiveness as the most successful treatment option, while the control group exhibited the least efficacy in reducing water content among the participants. Consequently, the hypothesis (H_0) asserting significant variance among the adjusted post-test means of the water content across the five treatment groups was affirmed.

In **Table 4.9.2**, a *p-value* of .065 was observed, indicating statistical significance at a 0.05 level. Consequently, a post hoc examination was undertaken to determine the most efficacious treatment group. Notably, the composite group displayed the highest adjusted mean value, signifying its effectiveness as the most successful treatment

option, while the control group exhibited the least efficacy in reducing visceral fat percentage among the participants. Consequently, the hypothesis (H_0) asserting insignificant variance among the adjusted post-test means of the visceral fat percentage across the five treatment groups was denied.

In **Table 4.10.2**, a *p-value* of .000 was observed, indicating statistical significance at a 0.05 level. Consequently, a post hoc examination was undertaken to determine the most efficacious treatment group. Notably, the composite group displayed the highest adjusted mean value, signifying its effectiveness as the most successful treatment option, while the control group exhibited the least efficacy in reducing subcutaneous fat percentage among the participants. Consequently, the hypothesis (H_0) asserting significant variance among the adjusted post-test means of the subcutaneous fat percentage across the five treatment groups was deemed valid.

In **Table 4.11.2**, a *p-value* of .000 was observed, indicating statistical significance at a 0.05 level. Consequently, a post hoc examination was undertaken to determine the most efficacious treatment group. Notably, the composite group displayed the highest adjusted mean value, signifying its effectiveness as the most successful treatment option, while the control group exhibited the least efficacy in reducing body mass among the participants. Consequently, the hypothesis (H_0) asserting significant variance among the adjusted post-test means of the body mass across the five treatment groups was deemed valid.

In **Table 4.12.2**, a *p-value* of .000 was observed, indicating statistical significance at a 0.05 level. Consequently, a post hoc examination was undertaken to determine the most efficacious treatment group. Notably, the composite group displayed the highest adjusted mean value, signifying its effectiveness as the most successful treatment option, while the control group exhibited the least efficacy in reducing muscle mass among the participants. Consequently, the hypothesis (H_0) asserting significant variance among the adjusted post-test means of the muscle mass across the five treatment groups was deemed valid.

In **Table 4.13.2**, a *p-value* of .000 was observed, indicating statistical significance at a 0.05 level. Consequently, a post hoc examination was undertaken to determine the most efficacious treatment group. Notably, the composite group displayed the highest adjusted mean value, signifying its effectiveness as the most successful treatment

option, while the control group exhibited the least efficacy in reducing muscle mass among the participants. Importantly, the hypothesis (H_0) asserting significant variance among the adjusted post-test means of the muscle mass across the five treatment groups was not only confirmed but also validated, further strengthening the credibility of the study.

In **Table 4.14.2**, a *p-value* of .000 was observed, indicating statistical significance at a 0.05 level. Consequently, a post hoc examination was undertaken to determine the most efficacious treatment group. Notably, the composite group displayed the highest adjusted mean value, signifying its effectiveness as the most successful treatment option, while the control group exhibited the least efficacy in reducing muscle mass among the participants. Importantly, the hypothesis (H_0) asserting significant variance among the adjusted post-test means of the muscle mass across the five treatment groups was not only confirmed but also validated, further strengthening the credibility of the study.

In **Table 4.15.2**, a *p-value* of .000 was observed, indicating statistical significance at a 0.05 level. Consequently, a post hoc examination was undertaken to determine the most efficacious treatment group. Notably, the composite group displayed the highest adjusted mean value, signifying its effectiveness as the most successful treatment option, while the control group exhibited the least efficacy in reducing heart rate among the participants. Consequently, the hypothesis (H_0) asserting no significant variance among the adjusted post-test means of heart rate across the five treatment groups was denied.

In **Table 4.16.2**, a *p-value* of .000 was observed, indicating statistical significance at a 0.05 level. Consequently, a post hoc examination was undertaken to determine the most efficacious treatment group. Notably, the composite group displayed the highest adjusted mean value, signifying its effectiveness as the most successful treatment option, while the control group exhibited the least efficacy in reducing muscle mass among the participants. Importantly, the hypothesis (H_0) asserting significant variance among the adjusted post-test means of the muscle mass across the five treatment groups was not only confirmed but also validated, further strengthening the credibility of the study.

In **Table 4.16.2**, a *p-value* of .000 was observed, indicating statistical significance at a 0.05 level. Consequently, a post hoc examination was undertaken to determine the most efficacious treatment group. Notably, the composite group displayed the highest adjusted mean value, signifying its effectiveness as the most successful treatment option, while the control group exhibited the least efficacy in reducing muscle mass among the participants. Importantly, the hypothesis (H_0) asserting significant variance among the adjusted post-test means of the muscle mass across the five treatment groups was not only confirmed but also validated, further strengthening the credibility of the study.

In **Table 4.17.2**, a *p-value* of .000 was observed, indicating statistical significance at a 0.05 level. Consequently, a post hoc examination was undertaken to determine the most efficacious treatment group. Notably, the composite group displayed the highest adjusted mean value, signifying its effectiveness as the most successful treatment option, while the control group exhibited the least efficacy in reducing the family environment scale among the participants. Consequently, the hypothesis (H_0) asserting significant variance among the adjusted post-test means of the family environment scale across the five treatment groups was deemed valid.

5.9 Conclusions

In conclusion, this study delved into the effects of intermittent fasting, low carb-high fat diets, and resistance training on various components of obesity. Through a structured approach, the study aimed to examine physiological, hematological, anthropometrical, and psychological parameters to gauge the impact of these interventions. Hypotheses were formulated to guide the investigation, reflecting the multifaceted nature of the study. The research design incorporated a pre-test and post-test experimental setup, with participants from the obese population of Dibrugarh district, Assam. The sampling methodology employed convenient and snowball sampling techniques to recruit participants. The study groups underwent specific interventions tailored to each experimental condition, with a control group for comparison. Intermittent fasting, low carb-high fat diets, resistance training, and a composite program were implemented over an 8-week period, followed by post-program assessments. Statistical techniques such as mean, standard deviation, Analysis of Covariance (ANCOVA), and post hoc tests were employed for data analysis.

Findings revealed significant effects on various parameters across the intervention groups, indicating potential benefits for obesity management. The intermittent fasting program showed promise in enhancing metabolic health and weight management, while the low carb-high fat diet exhibited positive effects on blood sugar stability and fat metabolism. Resistance training demonstrated improvements in muscle mass, strength, and metabolic rate, contributing to overall weight management. The composite program, combining intermittent fasting, LCHF diet, and resistance training, showcased synergistic effects on multiple health outcomes, highlighting the value of holistic approaches in obesity management. Recommendations stemming from the study include integrating intermittent fasting into daily routines, emphasizing healthy dietary choices, designing tailored resistance training programs, and promoting consistency and patience in lifestyle changes. Long-term monitoring, personalized interventions, and community education are advocated for translating research findings into clinical practice and public health initiatives.

In essence, this study underscores the potential of intermittent fasting, low-carb-high-fat diets, and resistance training to address obesity and improve metabolic health. By embracing multifaceted approaches and fostering informed decision-making, individuals and healthcare professionals can effectively navigate the complexities of obesity management.

5.10 Suggestions

- Incorporate intermittent fasting into the daily routine, aiming for a fasting period of 16-20 hours per day, followed by a feeding window of 4-8 hours.
- Highlight the importance of prioritizing a diet abundant in healthy fats, lean proteins, and non-starchy vegetables, while reducing intake of processed carbohydrates and sugars.
- Design resistance training programs focusing on compound movements such as squats, deadlifts, bench presses, and rows to maximize muscle activation and metabolic rate.
- Implement progressive overload techniques in resistance training to continually challenge muscles and promote strength gains.
- Encourage obese individuals to monitor their calorie intake and ensure they maintain a caloric deficit while adhering to intermittent fasting and a LCHF diet.

- Educate individuals on the importance of hydration and adequate sleep to support overall health and optimize the effects of intermittent fasting, diet, and resistance training.
- Emphasize the significance of consistency and patience in achieving sustainable weight loss and metabolic improvements.
- Monitor progress regularly through measurements such as body weight, body fat percentage, waist circumference, and strength gains to track the effectiveness of the intervention.
- Provide ongoing support and guidance to obese individuals, including nutritional counseling, behavioral strategies, and motivation to maintain long-term adherence to the intervention.

5.11 Application/Recommendation of the Research

A. Long-Term Health Monitoring:

- Conduct longitudinal studies to monitor the long-term effects of intermittent fasting, low carb-high fat diets, and resistance training on overall health parameters in obese individuals.

B. Dietary Variations and Compliance:

- Investigate different variations of low carb-high fat diets to determine which are most sustainable and effective for weight loss and metabolic health in obese populations.
- Explore strategies to enhance compliance with dietary protocols among obese individuals participating in research studies.

C. Optimal Fasting Protocols:

- Compare various intermittent fasting protocols (e.g., alternate-day fasting, time-restricted feeding) to identify the most beneficial regimen for weight loss and metabolic improvements in obese subjects.
- Assess the feasibility and effectiveness of intermittent fasting in real-world settings, including its compatibility with different lifestyles and schedules.

D. Personalized Approach:

- Investigate the potential for personalized nutrition and exercise interventions based on individual characteristics such as genetics, metabolic profile, and lifestyle factors.
- Explore biomarkers and predictive tools that can help tailor interventions to the specific needs of obese individuals.

E. Psychological and Behavioral Factors:

F. Examine the psychological and behavioral aspects of adherence to intermittent fasting, low carb-high fat diets, and resistance training programs among obese individuals.

G. Identify strategies to address psychological barriers and improve motivation for long-term lifestyle changes.

H. Muscle Mass and Strength Preservation:

- Evaluate the impact of resistance training on muscle mass and strength preservation during weight loss in obese populations following low carb-high fat diets and intermittent fasting.
- Investigate optimal resistance training protocols and progression strategies for obese individuals to maximize muscle retention and metabolic rate.

I. Metabolic Health and Disease Risk Reduction:

- Assess the effects of combined interventions (intermittent fasting, low carb-high fat diets, and resistance training) on metabolic health parameters such as insulin sensitivity, lipid profile, and inflammation in obese individuals.
- Investigate the efficacy of these measures in mitigating the likelihood of diseases associated with obesity, such as type 2 diabetes, cardiovascular ailments, and metabolic syndrome.

J. Safety and Adverse Effects:

- Continuously monitor safety concerns and potential adverse effects associated with intermittent fasting, low carb-high fat diets, and resistance training in obese populations.
- Investigate strategies to mitigate risks and optimize the safety profile of these interventions, particularly in individuals with pre-existing health conditions.

K. Translation to Clinical Practice:

- Translate research findings into practical guidelines and recommendations for healthcare professionals working with obese patients.
- Develop evidence-based interventions and resources to support the implementation of intermittent fasting, LCHF diets, and resistance training in clinical settings.

L. Community Education and Outreach:

- Enhance societal comprehension of the potential advantages and constraints associated with intermittent fasting, LCHF dietary regimens, and resistance exercises in addressing obesity.
- Provide accessible educational resources and programs to empower individuals to make informed decisions about their lifestyle habits and weight loss strategies.

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Consent letter & Prior permission

By signing this document, I acknowledge that I have voluntarily chosen to participate in Intermittent Fasting, Low Carb-High Fat Diet, Resistance, and composite Training for Obese Population. I have also been informed of needing a physician's examination and approval before beginning this exercise program. In signing this document, I acknowledge being informed of the strenuous nature of the program and the potentiality for unusual but possible physiological results, including but not limited to abnormal blood pressure, fainting, heart attack, or subjected to the possibility of even death. Within the time frame for the course of conduct framed by the program authority, I also understand that I may be stopped from participating in any training session at any time. By signing this document, I assume all risk for my health and well-being and any resultant injury or mishap that may affect my well-being or health in any way and harmless of any responsibility the instructor, Trainer, facility, or persons involved with the program, i.e., will no longer be responsible for the above.

Signature

Name

Date and Place

Enrolment Form for Intermittent Fasting, Low Carb-High Fat Diet, Resistance and Composite Training on Obese Population

Name: Address: Phone no. :	Sex : Age: Veg/ Non-veg: Date of birth:
Family doctor :	Phone No:
Height: Hip circumference: Weight • Waist circumference: Resting heart rate/min: (in the morning in bed in a supine position)	

(To be filled in by the Trainee, please tick or cross mark)

Arthritis		High Blood Pressure	
Back Pain		Coronary Disease	
Knee or other Injury		Heart Disease	
Shin Splint		Any Known Heart Problem	
Foot Pain		Stroke	
Muscle pain		Epilepsy	
Other pain		Are you Diabetic	
Fainting		Surgeries, Hospitalization	
Chest Pain at the Rest		Family history of heart disease	
Hernia		Thyroid Gland Related Disease	
Do you Smoke or use tobacco?		Other information	
Asthma, Emphysema, Bronchitis			

মেদবহুলতা ব্যৱস্থাপনাৰ ওপৰত আমাৰ গৱেষণা অধ্যয়নত যোগদান কৰক

আপুনি ৩৫-৪৫ বছৰৰ ভিতৰৰ আৰু মেদবহুলতাৰ সৈতে যুঁজি আছে নেকি?

আমি আপোনালোকক মেদবহুলতাৰ ওপৰত ৮ সপ্তাহৰ গৱেষণামূলক অধ্যয়নত অংশগ্ৰহণ কৰিবলৈ আমন্ত্ৰণ জনাইছো। এই কাৰ্যসূচী যোগ্য চিকিৎসক, জিম প্ৰশিক্ষক, আৰু পুষ্টিবিদসকলৰ সৈতে বহুবিষয়ক পদ্ধতিৰ জৰিয়তে ব্যাপক সহায় প্ৰদান কৰিবলৈ ডিজাইন কৰা হৈছে।

অধ্যয়নৰ আভাস

সময়সীমা: ৮ সপ্তাহ
যোগ্যতা: মেদবহুল (BMI ≥ 30)
বয়স: ৩৫-৪৫ বছৰৰ ব্যক্তি

অংশগ্ৰহণ কিয় কৰিব?

ব্যক্তিগত যত্ন: আপোনাৰ নিৰ্দিষ্ট স্বাস্থ্যৰ প্ৰয়োজন অনুসৰি কাষ্টমাইজড পৰিকল্পনা লাভ কৰক।
বিশেষজ্ঞৰ নিৰ্দেশনা: আমাৰ চিকিৎসক, জিম প্ৰশিক্ষক, আৰু পুষ্টিবিদৰ দলৰ বিশেষজ্ঞতাৰ পৰা লাভৱান হওক।
সামগ্ৰিক পদ্ধতি: চিকিৎসা, শাৰীৰিক আৰু খাদ্যৰ হস্তক্ষেপসমূহ একত্ৰিত কৰা এটা কাৰ্যসূচীত জড়িত হওক।
স্বাস্থ্য উন্নতি: মেদবহুলতা পৰিচালনা আৰু সামগ্ৰিক স্বাস্থ্য উন্নত কৰাৰ বাবে সঁজুলি আৰু জ্ঞান লাভ কৰা।

উপাদানসমূহ

চিকিৎসা তত্বাৱধান: আমাৰ অভিজ্ঞ চিকিৎসকৰ দলৰ সৈতে নিয়মীয়াকৈ পৰীক্ষা আৰু পৰামৰ্শ।
শাৰীৰিক প্ৰশিক্ষণ: প্ৰমাণিত জিম প্ৰশিক্ষকৰ অধীনত গাঁথনিগত ব্যায়াম।
পুষ্টিৰ সহায়: পেছাদাৰী পুষ্টিবিদসকলে সৃষ্টি কৰা ব্যক্তিগতকৃত খাদ্য পৰিকল্পনা।

অংশগ্ৰহণকাৰীৰ সুবিধা

স্বাস্থ্য মূল্যায়ন: অগ্ৰগতি অনুসৰণ কৰিবলৈ প্ৰাৰম্ভিক আৰু চূড়ান্ত স্বাস্থ্য মূল্যায়ন।
শিক্ষামূলক কৰ্মশালা: পুষ্টি, ব্যায়াম, আৰু সুস্থ জীৱনশৈলীৰ অভ্যাসৰ ওপৰত কৰ্মশালা।
সম্প্ৰদায়ৰ যোগদান: একেধৰণৰ প্ৰত্যাহ্বানৰ সন্মুখীন হোৱা সমনীয়াৰ সৈতে সংযোগ স্থাপন কৰা।

অধিক তথ্যৰ বাবে আমাক ফোন কৰক
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অধ্যয়নৰ সময়ত সংগ্ৰহ কৰা সকলো তথ্য গোপনীয় কৰি ৰখা হ'ব আৰু কেৱল গৱেষণাৰ উদ্দেশ্যে ব্যৱহাৰ কৰা হ'ব।

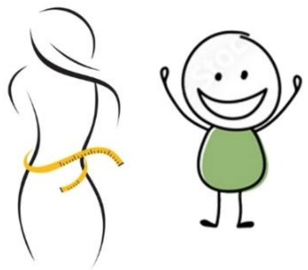
Join Our Research Study on Obesity Management

Are You Aged Between 35-45 and Struggling with Obesity?

We invite you to participate in an 8-week research study focused on the management of obesity. This program is designed to provide comprehensive support through a multidisciplinary approach involving qualified doctors, gym trainers, and nutritionists.

STUDY OVERVIEW

Duration: 8 weeks
Eligibility: Individuals aged 35-45 years classified as obese (BMI ≥ 30)

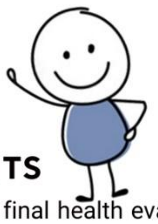


WHY PARTICIPATE?

Personalized Care: Receive customized plans tailored to your specific health needs.
Expert Guidance: Benefit from the expertise of our team of doctors, gym trainers, and nutritionists.
Holistic Approach: Engage in a program integrating medical, physical, and dietary interventions.
Health Improvements: Gain tools and knowledge to manage obesity and improve overall health.

PROGRAM COMPONENTS

Medical Supervision: Regular check-ups and consultations with our team of experienced doctors.
Physical Training: Structured exercise under certified gym trainers.
Nutritional Support: Personalized diet plans created by professional nutritionists.



PARTICIPANT BENEFITS

Health Assessment: Initial and final health evaluations to track progress.
Educational Workshops: Workshops on nutrition, exercise, and healthy lifestyle habits.
Supportive Community: Connect with peers facing similar challenges in a supportive environment.

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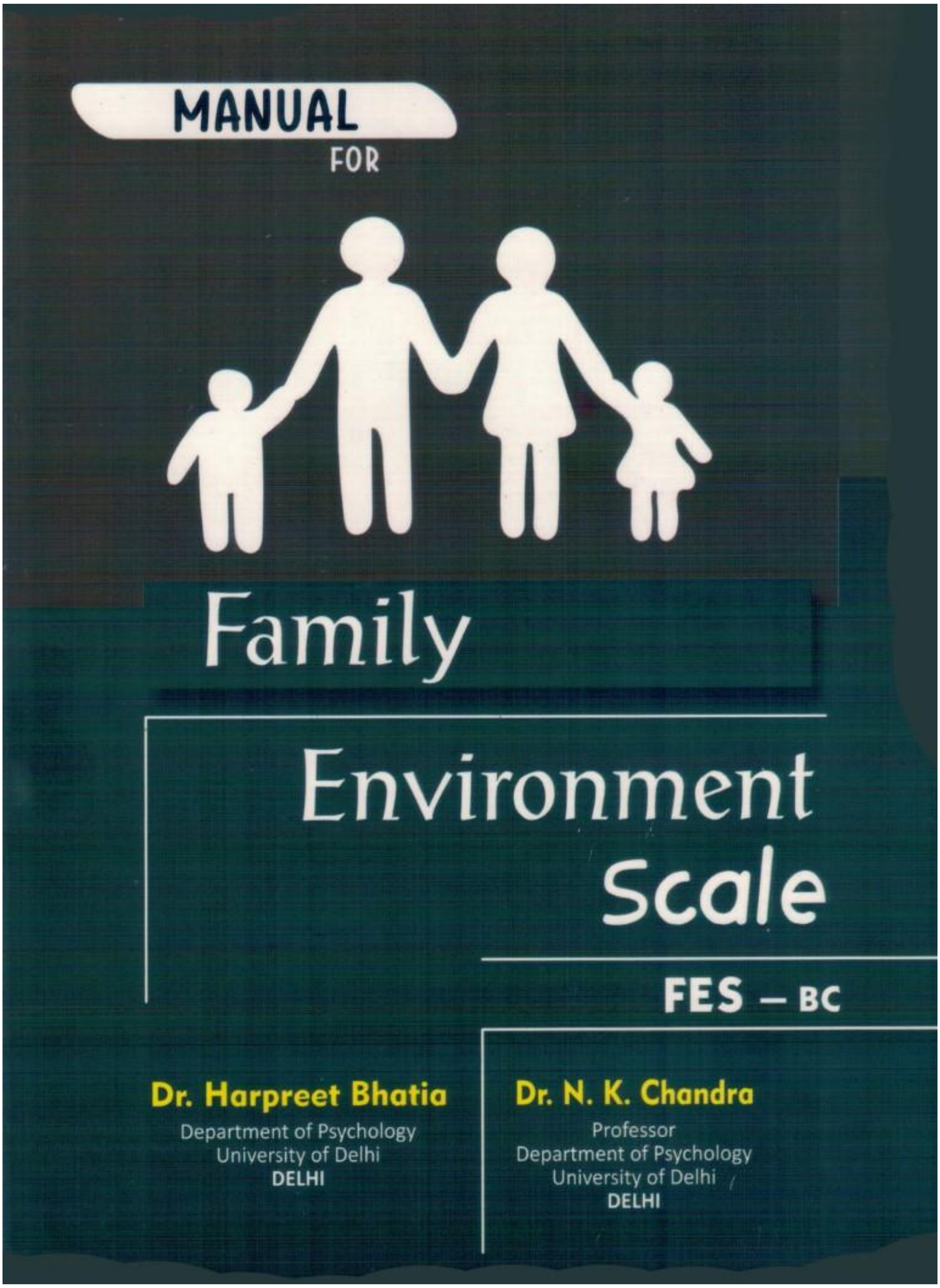
All information collected during the study will be kept confidential and used solely for research purposes.


MANUAL
FOR
Family
Environment
Scale
FES – BC
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DELHI
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Manual *for* FAMILY ENVIRONMENT SCALE

FES-BC

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NATIONAL PSYCHOLOGICAL CORPORATION

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INTRODUCTION

The family is the oldest and the most important of all the institutions that man has devised to regulate and integrate his behaviour as he strives to satisfy his basic needs. The family is basically a unit in which parents and children live together. Its key position rests on its multiple functions in relation to overall development of its members, their protection, and over all well-being. Therefore, it would emerge that not only the social and physical well-being of the individual is taken care of by the family, but the psychological well-being as well.

The family is the first to affect the individual. It is the family which gives the child his first experience of living. It gets him when he is completely uninformed, unprotected, before any other agency has had a chance to affect him. The influence of the family on the child is, therefore, immense. The influence of other agencies, although indispensable, must build upon groundwork furnished by the family.

However, to understand the influence of the family on the child, it is important to understand the family and its functions. Family has been defined in the Oxford Dictionary as : (1) the body of persons who live in one house of under one head, including parents, children, servants, etc., (2) the ground consisting of parents and their children, whether living together or not ; (3) a person's children reared collectively; and (4) those descended, or claiming descent from a common ancestry.

Connecting Family Environment

The family environment is influenced by a number of factors like the nature of family constellation; number of children in the family; marital relationships between husband and wife; maternal (paternal) employment; and socio-economic and religious background of the family.

The family environment possesses a certain consistency so that the impact of the same basic values, individuals, material objects etc., is felt over and over. Parental influence may not be felt in a specific situation, but the attitudes and ideas expressed day after day inevitably leave their mark.

In certain ways the influence of the family can be negative. All too often, members of the family take out all their frustrations on each other. Moreover, "instead of being a readymade source of friends, the family is too often a readymade source of victims and enemies, the place where the cruelest words are spoken....".

Selection of Dimensions

This family environment scale is based on the family environment scale by Moos (1974). This scale consists of three dimensions which are taken from Moos' scale. Although the concept of dimensions was taken from Moos' scale,all the sub-scales in each dimension were operationally defined with certain modifications of original definitions. Three of the original sub-scales were dropped, and one new sub-scale was added.

The dimensions, alongwith their operational definitions and contents, were given to eight judges. After making the suggested changes and contents, were given to eight judges. After making the suggested changes and modifications, they were again given to five other judges. Only those dimensions and contents of the dimensions having atleast 75% agreement were retained. These are :

Relationship Dimensions

I. Cohesion—Degree of commitment, help, and support family members provide for one another.

II. Expressiveness—Extent to which family members are encouraged to act openly and express their feelings and thoughts directly.

III. Conflict—Amount of openly expressed aggression and conflict among family members.

IV. Acceptance and Caring—Extent to which the members are unconditionally accepted and the degree to which caring is expressed in the family.

Personal Growth Dimensions

V. Independence—Extent to which family members are assertive and independently make their own decisions.

VI. Active-Recreational Orientation—Extent of participation in Social and recreational activities.

System Maintenance Dimensions

VII. Organization—Degree of importance of clear organization structure in planning family activities and responsibilities.

VIII. Control—Degree of limit setting within a family.

Item Selection

It was decided to write 13 to 17 items under each sub-scale. The items were written sub-scalewise to avoid overlapping among items. An initial pool of 121 items was made ready for the entire scale. These items were given to eight experts for rating on the following rating scale :

TABLE 1

Not acceptable	Doubtful	Acceptable
0	1	2

Only those items with 75% approval of the experts were retained. Thus, out of the initial 121 items, 17 items were rejected and 104 were further subjected to item analysis.

Item Analysis

The scale was administered to an unselected sample of 350 subjects. The age range of the subjects was 17 to 50 years and they belonged to the middle-class socio-economic strata. Subjects were asked to respond to the items by marking any one of the five response options : *Strongly Agree, Agree, Neutral, Disagree* and *Strongly Disagree.* The items were scored as Table 2.

TABLE 2

Scoring System

Nature of Item	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Positive	5	4	3	2	1
Negative	1	2	3	4	5

On the basis of the total score of subjects, the group was divided into two–a high score group and a low score group. These scores were then subjected to chi-square ($\chi 2$) computation. Only those items with atleast 0.05 level of significance were retained. Thus, out of the 104 items retained after rating, 35 items were rejected and 69 items were retained for the final form. The final scale alongwith the response categories is as follows :

Scoring Key

TABLE 3 : *Dimension-wise Distribution of Items*

Sr. No.	Dimensions	Nature of Items	No. of Items	Total No. of items	Total
Relationship Dimensions					
I.	Cohesion	Positive	1, 9, 24, 37, 43, 55, 60, 63, 66, 69	10	13
		Negative	*17, 31, 49*	*03*	
II.	Expressiveness	Positive	10, 25, 38, 44, 56	05	09
		Negative	*2, 18, 32, 50*	*04*	
III.	Conflict	Positive	11, 19, 39, 51, 61, 67	06	12
		Negative	*3, 26, 33, 45, 57, 64*	*06*	
IV.	Acceptance and Caring	Positive	8, 16, 36, 42, 48, 54, 59, 62	08	12
		Negative	*23, 30, 65, 68*	*04*	
Personal Growth Dimensions					
V.	Independence	Positive	4, 27, 46, 52	04	09
		Negative	*12, 20, 34, 40, 58*	*05*	
VI.	Active-Recreational Orientation	Positive	5, 13, 21, 28, 47	05	8
		Negative	*35, 41, 53*	*03*	
System Maintenance Dimensions					
VII.	Organization	Positive	14	01	02
		Negative	*6*	*01*	
VIII.	Control	Positive	7, 22	02	04
		Negative	*15, 29*	*02*	
	Positive Items = 41 + Negative Items = 28			**Total Items**	**69**

Reliability

Split-half reliability was found for the present scale. For this purpose, the present scale was split into two halves. The scores of each dimension were also split into two halves. The scores for each of these halves were then correlated. From this self-correlation of the half-tests, the reliability coefficient of the whole test was estimated using the Spearman-Brown Prophecy formula. The reliability coefficients thus obtained are as follows :

TABLE 4

Sr. No.	Sub-Scale	Reliability Coefficients
I.	Cohesion	0.92
II.	Expressiveness	0.88
III.	Conflict	0.84
IV.	Accepting and Caring	0.86
V.	Independence	0.70
VI.	Active-Recreational Orientation	0.48
VII.	Organization	0.75
VIII.	Control	0.48

Overall Test Reliability Coefficient = 0.95

Validity—Both face and content validity were tested by giving the scale to eighteen experts to evaluate the test items. Only those items with atleast 75% agreement among the judges were retained.

For content validity, the dimensions of the family environment were selected and clearly defined for the purpose of measuring the specific aspects of the environment. These definitions were also subjected to the judgement of the eight experts in the first step, and five experts in the second step.

Norms—Specific norms need to be formulated separately for each specific group under study.

However, the qualitative norms for the sample of the age range of ***17 to 50 years*** are presented here :

TABLE 5

Sr. No.	Sub-Scales	Raw Score	Qualitative Norms
I.	Cohesion	61 and above	High
		46 to 60	**Average**
		45 and below	Low
II.	Expressiveness	40 and above	High
		28 to 39	**Average**
		27 and below	Low
III.	Conflict*	52 and above	Low conflict
		38 to 51	**Average conflict**
		37 and below	High conflict
IV.	Acceptance and Caring	55 and above	High
		41 to 54	**Average**
		40 and below	Low
V.	Independence	41 and above	High
		31 to 40	**Average**
		30 and below	Low
VI.	Active-Recreational Orientation	34 and above	High
		26 to 33	**Average**
		25 and below	Low
VII.	Organization	10	High
		7 to 9	**Average**
		6 and below	Low
VIII.	Control	18 and above	High
		14 to 17	**Average**
		13 and below	Low

* In this sub-scale, high score is indicative of low conflict and viceversa.

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SCORING KEY of FES-BC

Item No.	Strongly Agree	Agree	Neutral	Dis-Agree	Strongly Disagree	Item No.	Strongly Agree	Agree	Neutral	Dis-Agree	Strongly Disagree
1.	5	4	3	2	1	21.	5	4	3	2	1
2.	1	2	3	4	5	22.	5	4	3	2	1
3.	1	2	3	4	5	23.	1	2	3	4	5
4.	5	4	3	2	1	24.	5	4	3	2	1
5.	5	4	3	2	1	25.	5	4	3	2	1
6.	1	2	3	4	5	26.	1	2	3	4	5
7.	5	4	3	2	1	27.	5	4	3	2	1
8.	5	4	3	2	1	28.	5	4	3	2	1
9.	5	4	3	2	1	29.	1	2	3	4	5
10.	5	4	3	2	1	30.	1	2	3	4	5
11.	5	4	3	2	1	31.	1	2	3	4	5
12.	1	2	3	4	5	32.	1	2	3	4	5
13.	5	4	3	2	1	33.	1	2	3	4	5
14.	5	4	3	2	1	34.	1	2	3	4	5
15.	1	2	3	4	5	35.	1	2	3	4	5
16.	5	4	3	2	1	36.	5	4	3	2	1
17.	1	2	3	4	5	37.	5	4	3	2	1
18.	1	2	3	4	5	38.	5	4	3	2	1
19.	5	4	3	2	1	39.	5	4	3	2	1
20.	1	2	3	4	5	40.	1	2	3	4	5

contd...

Item No.	Strongly Agree	Agree	Neutral	Dis-Agree	Strongly Disagree	Item No.	Strongly Agree	Agree	Neutral	Dis-Agree	Strongly Disagree
41.	1	2	3	4	5	56.	5	4	3	2	1
42.	5	4	3	2	1	57.	1	2	3	4	5
43.	5	4	3	2	1	58.	1	2	3	4	5
44.	5	4	3	2	1	59.	5	4	3	2	1
45.	1	2	3	4	5	60.	5	4	3	2	1
46.	5	4	3	2	1	61.	5	4	3	2	1
47.	5	4	3	2	1	62.	5	4	3	2	1
48.	5	4	3	2	1	63.	5	4	3	2	1
49.	1	2	3	4	5	64.	1	2	3	4	5
50.	1	2	3	4	5	65.	1	2	3	4	5
51.	5	4	3	2	1	66.	5	4	3	2	1
52.	5	4	3	2	1	67.	5	4	3	2	1
53.	1	2	3	4	5	68.	1	2	3	4	5
54..	5	4	3	2	1	69.	5	4	3	2	1
55.	5	4	3	2	1						

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Family Environment Scale

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Consumable Booklet
of
STATEMENTS

FES–BC

Dr. Harpreet Bhatia *(Hyderabad)*
Dr. N. K. Chadha *(New Delhi)*

(English Version)

Please fill in the following informations :– **Date** ☐☐☐☐☐☐☐☐

Name ____________________

Age ____________________ **Sex** ____________________

Family Income ____________________

INSTRUCTIONS

This booklet contains some statements. These Statements are about your family, you have to decide which of these statements are applicable to you about your family and which are not. Alongside the statements have FIVE cells (☐). If you **'Strongly agree'** with the statement, mark tick ☑ under the cell labelled **'Strongly Agree'**. If you **strongly disagree** with the statement, mark tick under the cell labelled **'Stongly Disagree'**. For in between preferences mark accordingly **'Agree'**, **'Neutral'** or **'Disagree'**.

Give us your general impression of your family. There are no right or wrong answers to any statement. Your responses will be kept in strict confidence and will be used for research purposes.

Please respond to each statement and do not leave any statement unanswered. Your help will be duly acknowledged.

SCORING TABLE

Sub Scale of FES	I	II	III	IV	V	VI	VII	VIII
Raw Score								
Interpretation								

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Sr. No.	STATEMENTS	Strongly Agree	Agree	Neutral	Dis-agree	Strongly Disagree	Score
1.	We enjoy doing things together.	☐	☐	☐	☐	☐	
2.	Family members often do not express their feelings.	☐	☐	☐	☐	☐	
3.	Breaking things in anger is quite common in our family.	☐	☐	☐	☐	☐	
4.	Making decisions independently is strongly encouraged in our family.	☐	☐	☐	☐	☐	
5.	In our family everyone is encouraged to play and interact with neighbours.	☐	☐	☐	☐	☐	
6.	Responsibilities are not taken seriously in our family.	☐	☐	☐	☐	☐	
7.	All members of the family are expected to be together for at least one meal in a day.	☐	☐	☐	☐	☐	
8.	Affection is expressed openly, quite often in our family.	☐	☐	☐	☐	☐	
9.	Togetherness is the basic feeling of our family.	☐	☐	☐	☐	☐	
10.	Our feelings of happiness are shared openly with others in our family.	☐	☐	☐	☐	☐	

Area	I		II		III	IV	V	VI	VII	VIII
Item No.	1	9	2	10	3	8	4	5	6	7
Score										
Total										

Sr. No.	STATEMENTS	Strongly Agree	Agree	Neutral	Dis-agree	Strongly Disagree	Score
11.	Beating up people in anger is not seen in our family.	☐	☐	☐	☐	☐	
12.	There are a lot of restrictions in our family.	☐	☐	☐	☐	☐	
13.	Freinds and guests are always welcome in our family.	☐	☐	☐	☐	☐	
14.	Everyone in our family is well aware of their responsibilities.	☐	☐	☐	☐	☐	
15.	Nobody in our family is bothered about rules of my kind.	☐	☐	☐	☐	☐	
16.	Everyone in our family listens to what each one of us has to say.	☐	☐	☐	☐	☐	
17.	Whenever any work comes up, every-one tries to get out of the situation.	☐	☐	☐	☐	☐	
18.	It is difficult to express ourselves openly for fear of some one reacting to it angrily.	☐	☐	☐	☐	☐	
19.	Everyone tries to sort things out if there is a disagreement in the family.	☐	☐	☐	☐	☐	
20.	Thinking for ourselves is not encouraged in our family.	☐	☐	☐	☐	☐	

Area	I	II	III		IV	V		VI	VII	VIII
Item No.	17	18	11	19	16	12	20	13	14	15
Score										
Total										

Sr. No.	STATEMENTS	Strongly Agree	Agree	Neutral	Dis-agree	Strongly Disagree	Score
21.	We often go out together for movies in our family.	☐	☐	☐	☐	☐	
22.	Going for programmes without informing at home is not accepted in our family.	☐	☐	☐	☐	☐	
23.	Nobody bothers to look after any-one else in our family.	☐	☐	☐	☐	☐	
24.	Any new situation that arises is discussed openly in the family in order to get ideas and suggestions from every body.	☐	☐	☐	☐	☐	
25.	We talk about our personal problems to each other in our family.	☐	☐	☐	☐	☐	
26.	When members are angry, they do not talk to each other for days together.	☐	☐	☐	☐	☐	
27.	In our family, members ask for what they need, quite openly.	☐	☐	☐	☐	☐	
28.	Having hobbies is encouraged in our family.	☐	☐	☐	☐	☐	
29.	Quite often members of our family stay out without informing at home.	☐	☐	☐	☐	☐	
30.	Only when we do something well we get praise and attention from others in our family.	☐	☐	☐	☐	☐	

Area	I	II	III	IV		V	VI		VII	VIII	
Item No.	24	25	26	23	30	27	21	28	–	22	29
Score											
Total											

Sr. No.	STATEMENTS	RESPONSES: Strongly Agree	Agree	Neutral	Dis-agree	Strongly Disagree	Score
31.	Family members do not get along with each other.	☐	☐	☐	☐	☐	
32.	Complaining about something that we dont't like is not accepted in our family.	☐	☐	☐	☐	☐	
33.	Finding faults with each other is quite common in our family.	☐	☐	☐	☐	☐	
34.	It is difficult to do something on your own in our family, without someone feeling rejected or left out.	☐	☐	☐	☐	☐	
35.	Watching T.V. is our only form of entertainment.	☐	☐	☐	☐	☐	
36.	There is plenty of time and attention for everyone in our family.	☐	☐	☐	☐	☐	
37.	Everyone comes together to sort out any new situation that may arise in our family.	☐	☐	☐	☐	☐	
38.	At home we feel free to anything we want to.	☐	☐	☐	☐	☐	
39.	Shouting in anger is not common in our family.	☐	☐	☐	☐	☐	
40.	Everyone is expected to accept all decisions made in the family, whether they like it or not.	☐	☐	☐	☐	☐	

Area	I		II		III		IV	V		VI	VII	VIII
Item No.	31	37	32	38	33	39	36	34	40	35	–	
Score												
Total												

Sr. No.	STATEMENTS	Strongly Agree	Agree	Neutral	Dis-agree	Strongly Disagree	Score
41.	Our family members are just confined to either work or school.	☐	☐	☐	☐	☐	•
42.	We are careful not to hurt anyone in the family by making thoughtless remarks.	☐	☐	☐	☐	☐	
43.	Whenever something needs to be done in the house, everyone joins in, happily.	☐	☐	☐	☐	☐	
44.	When any member is feeling upset, he/she talks to some one in the family.	☐	☐	☐	☐	☐	
45.	The members of our family constantly keep bickering over small matters.	☐	☐	☐	☐	☐	•
46.	Whenever a marriage takes place in our family the person concerned is asked his/her views.	☐	☐	☐	☐	☐	
47.	We go out often to visit friends or relations.	☐	☐	☐	☐	☐	
48.	In our family if anyone is upset, there is always some one to comfort them.	☐	☐	☐	☐	☐	
49.	There is no sense of closeness in our family.	☐	☐	☐	☐	☐	•
50.	Family Members often keep their feelings to themselves.	☐	☐	☐	☐	☐	•

Area	I		II		III	IV		V	VI		VII	VIII
Item No.	43	49	44	50	45	42	48	46	41	47	–	–
Score												
Total												

Sr. No.	STATEMENTS	Strongly Agree	Agree	Neutral	Dis-agree	Strongly Disagree	Score
51.	Whenever anyone in our family is angry with another member, he makes sure to sort out things with him.	☐	☐	☐	☐	☐	
52.	The decision to take on or continue a particular job is taken by the family members concerned in consultation with other family members.	☐	☐	☐	☐	☐	
53.	Joking and laughing is not encouraged in our family.	☐	☐	☐	☐	☐	•
54.	When things get taugh there is always someone in the family whom we can turn to.	☐	☐	☐	☐	☐	
55.	When someone is sick in our family everyone participates in looking after the person.	☐	☐	☐	☐	☐	
56.	Expressing an opinion about matters at home is strongly encouraged in our family.	☐	☐	☐	☐	☐	
57.	Whenever a family member does something well, the other members feel upset about it.	☐	☐	☐	☐	☐	•
58.	All major decisions in our family are taken by the elders in our family, without asking anyone else's opinion..	☐	☐	☐	☐	☐	•
59.	There is a lot of affection amongst our family members..	☐	☐	☐	☐	☐	
60.	When a family vacation is planned we all give our suggestions.	☐	☐	☐	☐	☐	

Area	I		II	III		IV		V		VI	VII	VIII
Item No.	55	60	56	51	57	54	59	52	58	53	–	–
Score												
Total												

Sr. No.	STATEMENTS	Strongly Agree	Agree	Neutral	Dis-agree	Strongly Disagree	Score
61.	Our family believes in not letting differences continue unsorted out.	☐	☐	☐	☐	☐	
62.	If any member gets into trouble he/she gets help and sympathy from other family members.	☐	☐	☐	☐	☐	
63.	When in trouble, all of us stand up for our family member.	☐	☐	☐	☐	☐	
64.	Quite often members of our family fail to arrive at a mutually acceptable solution.	☐	☐	☐	☐	☐	•
65.	When anyone makes a mistake, the other members ridicule him.	☐	☐	☐	☐	☐	•
66.	In our family, we enjoy sitting together and talking to each other.	☐	☐	☐	☐	☐	
67.	Showing anger by banging doors is rarely seen in our family.	☐	☐	☐	☐	☐	
68.	Members of our family are very critical of each other.	☐	☐	☐	☐	☐	•
69.	All of us participate together in family functions/programmes.	☐	☐	☐	☐	☐	

Area	I			II	III			IV			V	VI	VII	VIII
Item No.	63	66	69	–	61	64	67	62	65	68	–	–	–	–
Score														
Total														