CHAPTER ONE
INTRODUCTION

Background to the study

Threat of obesity as an epidemic and its unbridled international spread is raising apprehension on the global scene. It is becoming more noticed among the youth in the entire world mainly identified as critical public health problem in the 21^{st} century, as a consequence of surplus adiposity. The startling increase of obesity in America and other European countries has become a major problem. Nigeria and other parts of the world are gradually being enmeshed in the problem of obesity due to lifestyle adopted consequent to improvement on the standard of individual's living. Obesity is a disorder necessitated by anomalous or disproportionate fat amassed in the adipose tissue of the human body. Obesity could also be seen as a medical condition that could warrant degeneration of health and increase the likeliness of early death due to excess fat in the body accumulated over a period of time. Consumption of food beyond the required measure needed by the body for energy and body building could be the pivot for accumulation of excess fat. It could therefore be concluded that obesity develops from surplus energy ingestion as well as overuse of energy (Fabunmi 2011).

Obesity has been classified based on body mass index (BMI), a method that measures an appropriate weight to height of an individual (*WHO Expert Consultation, 2004*). Acoording to World Health Organization (*WHO*) (2000) range from class I to class III. Pre-obese BMI 25.0 to 29.9 pre-obese, BMI 30.0 to 34.9 class 1 obesity, BMI 35.0 to 39.9 class 2 obesity and BMI ≥40.0 class 3 obesity, while Japan (2013) Body Mass Index (BMI) cut-off point ranges from 25.0 to 30.0 class 1 obesity, 30.0-35.0 class 2 obesity, 35.0-40.0 class 3 obesity and 40.0 above class 4 obesity. This has equally been subdivided by Kromeyer-Hauschild and Zellner (2007) into mild obesity, super obesity and abdominal obesity. Ogden, Carroll, Kit and Flegal (2012) stated that a public health predicament is generated when a larger percentage of a particular population is threatened by the prevalence of an epidemic. Such outbreak could have consequential effect on the financial burdens and creates a large financial liability of the society. In other words, youth obesity meets these above stated conditions, which can bring about economic consequences, substantial health care costs and low academic performance. Pvoane, Steyn, Brandshaw, Laubscher and Fourie (2008) stated that the early appearance of obesity at younger age could actually predict higher possibility of obesity at later years and could also forecast higher likelihood of related ailments such as: insulin resistance, coronary diseases, abnormal high blood pressure, sleep apnea, arthritis, cancer, stroke and heart failure in latter life. This was also confirmed by a report of Sidhu and Kumari (2006) that obesity among youth seriously leads to many acute and habitual health conditions, including; diabetes, high blood pressure and elevated lipid profiles as well as cancer, orthopedic and psychological problems.

Several diseases have been associated with obesity. Some of them are: type 2 diabetes mellitus, hypertension, cardiorespiratory diseases, cancer, sleep apnea and gallstones. Ogden, Carroll, Kit and Flegal (2012) established that obesity could increase risk of death by 1% per annum for each 0.5kg increase in weight and reduces life expectancy by 7.1 years in men and 5.8 years in women. According to WHO (2000), it was reported in 2015 that approximately about 2.3 billion population in the world were overweight while 700 million were obese. In the United States, for example, the prevalence of obesity is very high, affecting 26.6 percent of men and 32.2% of women older than 21 years. The report of WHO holds that 1.4 billion adults from 20 years of age and beyond are either overweight or obese. From the 1.4 billion stated, at least 200 million men and 300 million women are likely to be obese. A projection has also been made that by 2030, the population of overweight and obese persons in the world would be 2.16 billion and 1.12 billion respectively (Kelly, Yang, Chen, Reynolds and He, 2008)

Ajala (2006) reported that obesity is the major nutritional complaint of recent years in Western societies and that the development is becoming common in Nigeria as well. Ayenigbara (2010) opined that in Nigeria, obesity is a health problem which has emanated from change in culture, environment and the entire society. In Africa, more than one third of young women and a quarter of young men are overweight and obese (Adefule, Adu, Ogundahunsi, Caxton-Martins, Otulana and Adesanya; 2014). It was further documented that the occurrence rate of overweight and obesity was found to be 15% and 3.3% respectively with females accounting for obese individuals while overweight was more prevalent in males (24%) than females (8.6%) among South Western Nigerian young adults.

Independence associated with adulthood characterizes the youth age. Williams (1998), for the purpose of measurement, put the age of youth between 15 and 30 years. Health habits adopted by the youths of this generation have been significantly different compared to those of earlier two generations. Similarly, lifestyles, healthy and unhealthy behaviors are formed during these years, which may influence adult behaviors and health status (Amusa, Goon, Amey and Toriola, 2011). Some of the causes of low use energy among youth populace comprise lessened walk from home to school, reduced sporting events in school, and excess period devoted to video games and television viewing at home. Bonne, Gordon, Adair and Popkin (2007) stated that even with bouts of physical activity, elongated period is dedicated to television. This could be said to be a major cause of obesity among the youth. Females are said to be more prone to this than their male counterparts. Exact sources of obesity in addition include; endocrine diseases like hypothyroidism and Cushing's syndrome, and intake of drugs like steroid and oral contraceptive pills among others.

In Nigeria, screen watching (television), video game play, computer use and mobile phone games are the most popular leisure time activities for this group. Likewise, the emerging of fast foods as breakfast and lunch for them contribute to obesity. It could be concluded that these situations are offshoots of globalization, technological advances, and widespread economic development. Youths encounter several risks that affect their health and entire wellbeing in the process of their development to adulthood (Malnnis, 2004). According to Onyechi and Okolo (2008) the prevalence of obesity among undergraduates in the University of Nigeria, Nsukka revealed that 21% of the participants were obese, 8.1% are males and 13.1% are females resulting into sedentary screen-based behaviors among the youths.

It has been established that obesity-related diseases have risk factors including; body composition and cardiorespiratory consequences beginning from youthful stage to a targeted intervention. Body composition measurements are used to determine human being's nutritional and general health status. It has been used for identification, for the purposes of understanding human and physical variation. Fatima (2011) stated that body composition is a set of non-invasive, quantitative methods for evaluating an individual's percent body fat through the processes of measuring, recording and analyzing specific dimensions of the body, such as height, weight, skinfold thickness, and body circumference at the waist, hip and body mass index (BMI).

Body composition is an expression that refers to the comparative amounts of fat, bone and muscle mass in the human body (Nicholas, 2012). Body fat percentage is basically the percentage of fat which the body comprises. The body requires specific proportion of fat to ensure its proper functioning as it controls body temperature, cushion and insulate organs, tissues, and it is the primary form of the body‘s energy storage. If obesity is caused by an excess body fat, the method used to measure percent of body fat such as subcutaneous skin fold thickness, body mass index (BMI), waist-to-hip circumference (WHC) and waist-to-height ratio (WHtR) require to be in line with standard norms. The WHC compares the circumference of the waist to that of the hip while WHtR is dividing waist circumference by height. This is an indicator of body fat distribution and skinfold measurement on the principle based that the amount of subcutaneous fat (fat immediately below the skin) is directly proportional to the total amount of body fat.

Persons suffering from obesity have developed tissues that are fat provoke vascular resistant, thereby increasing the rate at which their heart exerts force to pump blood circulating round the body (Jones, Davis and Green, 2005). Fat tissue accumulation impairs ventilatory function in adults and children (Lazarus, Sparrow and Weiss, 1997). According to ventilatory mechanics and pulmonary functions the excessive build-up of fat have a tendency to cause dysfunctions of the numerous organs constituting the respiratory system, predominantly the muscles that actively participate in breathing. This may lead to changes in pulmonary functions due to the upsurge in respiratory effort and the compromise of gas transport (Santiago, Silva, Davidson and Aristóteles, 2008).

Cardiorespiratory variables are the systems which transport blood all through the human body; it comprises the lungs, blood vessels and the heart which transport oxygenated blood to the working muscles. It also refers to organs of the lungs and heart responsible for the absorption of gas, processing of blood and its adequate distribution to the body for proper functioning. Some studies among the youth showed association between obesity and cardiorespiratory factors such as high blood pressure, high resting heart beat and sleep disordered breathing; includes chronic obstructive pulmonary disease (COPD), asthma, obstructive sleep apnea and obesity hypoventilation syndrome. Flohr, Todd and Tudor-Locke (2006) documented that blood pressure increases by increased intake of sodium level and thickening of the arteries. Therefore, obese youth are at risk of cardiorespiratory diseases.

In addition, sedentary lifestyle, excessive alcohol intake, and lack of required vitamins may also lead to rise in the blood pressure. The relationship between obesity and hypertensions among youths was reviewed by Daniel (2009), linking reports in literature that cut across races and several habits , showing that there is higher prevalence blood pressures and/or higher prevalence of hypertension among obese compared to lean youth. Obesity-related hypertension could constitute 78 percent and 65 percent of essential hypertension in men and women, respectively. In the conclusion of Ali and Crowther (2005), hypertension is commonly linked with a systolic blood pressure surpasses or equals 140mmHg or a diastolic blood pressure of 90mmHg. Schmitz and Jeffery (2000) confirmed that obesity has a profound impact on the cardiorespiratory disease development, and it is often associated with a reduced overall survival.

Increasing BMI is characteristically related to a decrease in peak expiratory flow rate (PEFR), vital capacity (VC), total lung capacity, functional residual capacity and expiratory reserve volume (Inselma, Milanese and Deurloo; 1993).Vital Capacity (VC) is the totality of air that can be vehemently respired, after utmost inspiration average value 3 to 4 litres for women, and 4 to 5 litres for men. Inspiratory Reserve Volume (IRV) is the amount that can be inhaled at the end of normal inspiration normal value is 2.5 to 3.5 litres. Previous studies reviewed by Inselma, Milanese and Deurloo (1993) revealed that obesity could affect the performance of the respiratory system by altering lung volume, airway caliber and the strength of the respiratory muscle. Obviously, VC and PEFR are strong indicators of lung function, which weakens as a result of obesity and sedentary lifestyle (Jakes, Day, Patel, Khaw, Oakes and Luben; 2002). Kumar, Puri, Sinha, Hasan, Agarwal and Mishira (2013) confirmed that pulmonary activities could reduce by age, but their findings further revealed that the rate of reduction of the PEFR in obese persons is higher as a result of the association of increased airway resistance and respiratory muscle dysfunction emanating from excess fat deposit.

There have been numerous propositions on the potential effects of obesity on cardiorespiratory function. Commonly reported anomalies are reduced expiratory reserve volume and functional residual capacity due to reduced chest wall and lung compliance and increased respiratory resistance (Pankow, Podszus, Gutheil, Penzel, Peterand Von Wichert; 1998). There is also a supposition which increases the volume of pulmonary blood causes congestion resulting in the airway wall thickening; thus reducing the size of airway.

Restrictive patterns clinically significant to the total lung capacity less than 85 percent foretell is regularly seen mainly in massive obesity, in which the patient’s weight-to-height ratio is 0.9 to 1.0 kg/cm or more (Biring, Lewis and Liu; 1999). However, a restrictive disorder could also be caused by over fat (obesity) when the weight-to-height ratio is less than 0.9 kg/cm. This usually happens in the presence of central fat deposit, and is shown by a waist-to-hip ratio of 0.95 or greater (Canoy, Luben and Welch; 2004). In view of the above, United States of America (U.S.A) policy has since been focused primarily on controlling and preventing youth obesity.

Many interventions have been suggested on the ways to lower the prevalence of youth obesity but there is no consensus on the best way to prevent and manage it. Atkinson (2007) stated that ranges of physical activities interventions have been used to enhance the health of this age group. Many of these interventions have been aimed at obese and inactive youth with a focus on improving overall lifestyles, such as nutrition and addressing physical inactivity. The Swedish Councils on Technology Assessment in Health Care (2002) published a report which examined the body of scientific evidence on intervention to prevent and treat youth obesity (Flodmark, Marcus and Brittons, 2006). The report emphasized that an obese individual needs to follow a strict planned aerobic exercise programme to help them burn up calories. According to Uzoalor (2006) it was reported that most obese individuals have negative attitude towards the change in their eating habits and are lukewarm towards required exercises. It was reported that high dropout was recorded.

The focus of this study was to investigate an activity which burn calories but not necessarily immediately seen as exercise. Obese persons need activities that are exciting, interesting and fun-packed. Aerobic dance exercise and circuit training are among the aerobic exercises that depend primarily on the aerobic energy-generating processes. Circuit training is a series of exercises done in order of stations and at a fast pace with only a short break period between exercises and a bit longer rest between stations (Kumar, 2013). It is a type of aerobic training aimed in improving the body structure and cardiorespiratory fitness of the exercisers. Accordingly, the muscular strength, speed, flexibility, power and endurance could be developed through aerobic training. It involves the use of a number of exercise stations where the participants perform a given exercise within specific time. Circuit training can be programmed into a combination of resistance training and moderate to high-intensity aerobics designed in an easy way to follow and target fat loss, muscle building and heart fitness. Traditionally, the interval between exercises in circuit training is little, often with rapid movement to the next exercise and the circuit is completed, once the subject performs the exercise at all designated stations.

Aerobic dance exercise is a physical exercise that is usually performed to the rhythm of music and may be practiced in a group setting, led by an instructor (fitness professional). According to Moore (2010) aerobic dance exercise is distinct in the sense that the rhythmic aerobic exercise with strength training and stretching procedures with the aim of developing all features of fitness (flexibility, body composition, muscular strength, and cardiorespiratory fitness). Moore (2010) categorized aerobic dance into low–impact, high–impact, water dance aerobics and step aerobics dance exercises. High impact exercises, owing to its name, involves monotonous intensive workout which include, jumping actions harmonized with designed music. Step aerobic dance uses step bench, and the water aerobic dance is carried out in waist – deep water, usually in a swimming pool.

The combination of these two training methods is termed aerobic dance circuit training (ADCT). Thus, ADCT in this study is a training programme that consists of series of aerobic dance exercises performed to improve cardiorespiratory variables and to reduce fat. It is a form of physical exercise that combines rhythmic aerobic exercise to pre-set music with stretching and strength training routine in a circuit manner (circuit training). The ADCT can usually be completed easily by participants of all ages and fitness level. This is one of the unique characteristics of ADCT, in that the same step can be modified by the participants to meet the needs of her individual workout. A typical ADCT workout fulfills the cardiorespiratory and body composition training principles (Frequency, Intensity, Time, and Type of activity). It is similar to any cardiorespiratory workout classes which begin with a warm up of light activity and stretching exercise for 10 minutes, progress to the 20-30 minutes workout phase and then have a gradual cool down period for 10 minutes. Thus, it is the purpose of this study to examine the effects of a 12-week aerobic dance circuit training programme on body composition and cardiorespiratory variables in obese female college students with the intension of finding a way to prevent the likely health consequences of obesity at a latter stage of their life.

Statements of the problem

There are evidences from studies that youth obesity is approaching epidemic proportion in Nigeria, mainly due to indoor sedentary screen-based behaviour such as watching of television, video game play, computer use and mobile phone games. These have displaced physical activity and are independently associated with obesity and other adverse health outcomes in later life such as; hypertension, diabetes, coronary heart diseases, respiratory problems and sleep apnea. Okuneye, Adeogun, and Idowu, (2010) documented that physical activity drops exponentially during the youth period. Male youths of all ages participate more in physical activity than Nigeria female youths, especially vigorous physical activity. Females also take fewer steps per day and are less active than males during recess time. This has been raising a great concern among health and fitness experts, which if not urgently addressed could increase the risk of obesity across gender and most especially among females.

According to Kumar, Puri, Sinha, Hasan, Agarwal and Mishira (2013) studies have claimed that much fat in female is responsible for the poor respiratory function while fat reduction will bring improvement in respiratory function. Studies have further shown that obese individuals are not physically fit and are unable to carry out their daily activities effectively. Increased in the occurence of obesity and physical inactivity have resulted in increased obesity associated with impaired respiratory function. Since participation in aerobic exercise is an important desire of all to be able to live a fitness lifestyle, every individual must be involved in a physically active life. A way of achieving this is participating actively in physical activity that can attract obese female towards the use of aerobic dance circuit training to reduce obesity risk factors in later stage of life.

Aerobic dance is currently one of the most commonly practiced youth fitness activities, especially among those in the urban areas. More than half of the researches pertaining to this form of exercise supported its application as a valid cardiorespiratory training alternative, if they are performed according to the American College of Sport Medicine (2009) guidelines on exercise testing and prescription. But there is limited research being conducted with the use of aerobic dance as circuit training for reducing youth obesity. Therefore, there is a strong call for obese females' engagement in physical activity programmes that can motivate them to adopt lifelong physical activity habits. A range of activities must be offered if obese female youth are to be motivated to take advantage of physical activity opportunities. Developing effective exercise programme that will motivate them is a strategy that, this study intends to focus, on the need for decreasing college female obesity and help them in limiting associated health problems at the latter stage of life.

General objective of the study

The general objective of this study was to determine the effects of a 12-week aerobic dance circuit training programme on body composition and cardiorespiratory variables of 19 to 30 years old obese female college students.

Specific objectives of the study:

The following objectives were accomplished:

(i) The investigation of the effect of 12-week aerobic dance circuit training on body composition variables of obese female college students.

(ii) The determination of the effect of 12-week aerobic dance circuit training exercise on cardiorespiratory variables of obese female college students.

Research questions

This study provided answers to the following research questions:

(i) What are the physical characteristics of obese female college students in Oyo Town?

(ii) What are the obesity classifications of the participants?

Hypotheses

The following hypotheses were tested in the study:

1. There will be no significant main effects of treatment on:
    a. Body composition variables [Percent body fat (%bf), Waist-to-hip ratio (WHR) and Waist-to-height ratio (WHtR)]
    b. Cardiorespiratory variables [(Diastolic Blood Pressure (DBP), Systolic Blood Pressure (SBP), Mean Arterial Blood Pressure (P_{mean}), Vital Capacity (VC), Inspiratory Reserved Volume (IRV), Peak Expiratory Flow Rate (PEFR), Heart Rate Reserved (HRR) and Maximal Oxygen Uptakes (VO_2max)] of obese female college students in Oyo Town
2. There will be no significant main effects of age on:
    a. Body composition variables [Percent body fat (%bf), Waist-to-hip ratio (WHR) and Waist-to-height ratio (WHtR)]

b. Cardiorespiratory variables [(Diastolic Blood Pressure (DBP), Systolic Blood Pressure (SBP), Mean Arterial Blood Pressure (P_{mean}), Vital Capacity (VC), Inspiratory Reserved Volume (IRV), Peak Expiratory Flow Rate (PEFR), Heart Rate Reserved (HRR) and Maximal Oxygen Uptakes (VO_2 max)] of obese female college students in Oyo Town

3. There will be no significant main effects of class of obesity on:
    a. Body composition variables [Percent body fat (%bf), Waist-to-hip ratio (WHR) and Waist-to-height ratio (WHtR)]
    b. Cardiorespiratory variables [(Diastolic Blood Pressure (DBP), Systolic Blood Pressure (SBP), Mean Arterial Blood Pressure (P_{mean}), Vital Capacity (VC), Inspiratory Reserved Volume (IRV), Peak Expiratory Flow Rate (PEFR), Heart Rate Reserved (HRR) and Maximal Oxygen Uptakes (VO_2 max)] of obese female college students in Oyo Town
4. There will be no significant interaction effects of treatment and age on:
    a. Body composition variables variables [Percent body fat (%bf), Waist-to-hip ratio (WHR) and Waist-to-height ratio (WHtR)]
    b. Cardiorespiratory variables [(Diastolic Blood Pressure (DBP), Systolic Blood Pressure (SBP), Mean Arterial Blood Pressure (P_{mean}), Vital Capacity (VC), Inspiratory Reserved Volume (IRV), Peak Expiratory Flow Rate (PEFR), Heart Rate Reserved (HRR) and Maximal Oxygen Uptakes (VO_2 max)] of obese female college students in Oyo Town
5. There will be no significant interaction of treatment and class of obesity on:
    a. Body composition variables variables [Percent body fat (%bf), Waist-to-hip ratio (WHR) and Waist-to-height ratio (WHtR)]
    b. Cardiorespiratory variables [(Diastolic Blood Pressure (DBP), Systolic Blood Pressure (SBP), Mean Arterial Blood Pressure (P_{mean}), Vital Capacity (VC), Inspiratory Reserved Volume (IRV), Peak Expiratory Flow Rate (PEFR), Heart Rate Reserved (HRR) and Maximal Oxygen Uptakes (VO_2 max)] of obese female college students in Oyo Town
6. There will be no significant interaction of age and class of obesity on:

a. Body composition variables [Percent body fat (%bf), Waist-to-hip ratio (WHR) and Waist-to-height ratio (WHtR)]
b. Cardiorespiratory variables [(Diastolic Blood Pressure (DBP), Systolic Blood Pressure (SBP), Mean Arterial Blood Pressure (P_{mean}), Vital Capacity (VC), Inspiratory Reserved Volume (IRV), Peak Expiratory Flow Rate (PEFR), Heart Rate Reserved (HRR) and Maximal Oxygen Uptakes (VO_2 max)] of obese female college students in Oyo Town.

7. There will be no significant 3-way interaction effects of treatment, age and class of obesity on:
   a. Body composition variables [Percent body fat (%bf), Waist-to-hip ratio (WHR) and Waist-to-height ratio (WHtR)]
   b. Cardiorespiratory variables [(Diastolic Blood Pressure (DBP), Systolic Blood Pressure (SBP), Mean Arterial Blood Pressure (P_{mean}), Vital Capacity (VC), Inspiratory Reserved Volume (IRV), Peak Expiratory Flow Rate (PEFR), Heart Rate Reserved (HRR) and Maximal Oxygen Uptakes (VO_2 max)] of obese female college students in Oyo Town.

Delimitations of the study

This study was delimited to the following:

1. Pretest-posttest control group quasi experimental research design
2. 12-week aerobic dance circuit training programme.
3. Seventy (70) obese female students of colleges of education (Emmanuel Alayande College of Education, Oyo and Federal College of Education (Special), Oyo) as participants.
4. Obese students in college of education with BMI ≥25.0
5. Independent variable of a 12-week aerobic dance circuit training programmes.
6. Dependent variables of body composition variables (%bf, WHR and WHtR) and cardiorespiratory variables [Resting Blood Pressure (DBP and SBP), VC, IRV, PEFR and P_{mean}, HRR and VO_2max].
7. Eight (8) trained research assistants as aerobic dance instructors.

8. Descriptive statistics of range, mean, standard deviation, pie chart, bar chart, frequency and percentage.
9. Inferential statistics of Analysis of Covariance (ANCOVA) and Cochran Q test was used to analyze the data set at 0.05 level of significance
10. The use of the following instruments for data collections:
    Digital sphygmomanometer.
    Spirometer.
    Mini Wright Peak Flow Meter
    Bathroom weight scale.
    Non-elastic measuring tape.
    Skinfold caliper
    Stop watch.
    DVD sound system player
    Aerobic dance music sound track
11. 3-sites skinfold measurements: abdominal, suprailliac, and triceps.
12. Metronome
13. Heart rate wrist monitor
14. Test location: Exercise Physiology Laboratory, Physical and Health Education Department, Emmanuel Alayande College of Education, Oyo and Federal College of Education (Special), Oyo

Limitations of the study

Participants found it difficult to cope with regular training attendance. Effort was made to encourage regular attendance through provision of incentives. However, more than enough samples were recruiited hence the sample size was not affected.

The researcher did not have total control over the participants' diet and other physical activities engaged in, outside the training.

Norms that were used for this study are not African based

Significance of the study

This training programme was moderate-to-vigorous intensity exercise which was of benefit to the exercise programmers working on way to enhance cardiorespiratory fitness. Thus, aerobic dance circuit training programme help to reduce the level of obesity and improve respiratory function. The results may serve as data based on the body composition and cardiorespiratory analysis of obese college students in Oyo Town.

The study may encourage and sustain the youth in aerobic dance circuit training on regular basis to establish a foundation for fitness and wellness lifestyle. It may provide baseline data which would aid physical educators and fitness therapists in planning rehabilitative exercise for the obese individuals. The study will provide data that can be used for comparison with related data abroad in similar studies, thereby encouraging the promotion of cross-cultural efforts in research on the youth. This also added to the body of knowledge and may encourage other researchers to work more on the uses of aerobic dance circuit training on other respiratory functions not used in this study as it relates to female obese in different institutions. These may also encourage researchers to use aerobic dance in other training methods such as interval training, fartlek training, plyometric training and continuous training in improving respiratory function of obese individuals.

Operational definition of terms

The following terms were operationally used in this study:

Aerobic exercise: a type of physical activity involving the uses of oxygen that enhance respiratory and circulatory efficiency.

Aerobic dance: a type of aerobic exercise that combines rhythmic music for the goal of improving all elements of physical fitness.

Circuit training: a type of combined high-intensity aerobic and endurance exercises designed and performed at six designed stations of 12 weeks, 3 days per week of 20-60 minutes.

Aerobic dance circuit training: It is a form of routine rhythmic exercise (aerobic dance) performed in a circuit manner of six stations (circuit training).

Body composition variables: refer to percent body fat, body mass index (BMI), waist-to-hip ratio (WHR) and waist-to-height ratio (WHtR).

Cardiorespiratory variables: these include heart rate reserved, resting blood pressure (systolic and diastolic), Mean Arterial Pressure (P_{meam}), vital capacity (VC), Peak expiratory flow rate (PEFR) Inspiratory reserved volume (IRV) and Maximal Oxygen Uptakes (VO_2max)].

Obesity: it is the condition in which excess fat has accumulated in the body, mostly in the subcutaneous tissues to BMI of ≥25.0.

Youth: person between the ages of 15 and 30 years

Youth obesity: a condition that affects youth as a result of over fat or fat accumulation in adipose tissues.

Obese female college students: female youths in colleges of education between BMI ≥25.0 and 40.0

CHAPTER TWO

REVIEW OF LITERATURE

The purpose of this research work was to investigate the effect an aerobic dance circuit training programme would have on the body composition and cardiorespiratory variables of obese female college students in Oyo State. The review of related literature was done under the following sub-headings:

1. Conceptual framework for the study
2. Kinetography Laban theory of movement
3. Theory of overload principles
4. Theoretical/conceptual review:
   (a) Concept of college students
   (b) Concept of obesity.
   (c) Classification of obesity.
   (d) Deleterious health implication of obesity.
   (e) Overview of nature and nurture of obesity
5. Overview of Aerobic Capacity.
6. Concept of body composition.
7. Concepts of cardiorespiratory function indices.
8. Overview of aerobic dance exercise
9. Concept of circuit training.
10. Empirical review of literature:
11. Cultural and social dimension effects of obesity epidemics in Africa
12. (a) Trends of obesity epidemics in Africa.
    (b) Prevalence of obesity in Nigeria.
13. (a) Strategies for prevention of obesity
    (b) Management of obesity
14. Aerobic dance exercise effects on body composition variables.
15. Cardiorespiratory variables response to aerobic dance exercise.
16. Cardiorespiratory variables response to circuit training.
17. Peak expiratory flow rate assessment in obese youths.

18. Effect of circuit training on body composition.
19. Aerobic Dance and Step Exercise of Resistance Training effects on Body Fat Percent and Lipid Profiles in Sedentary Females
20. Appraisal of literature reviewed

Conceptual frame work for the study

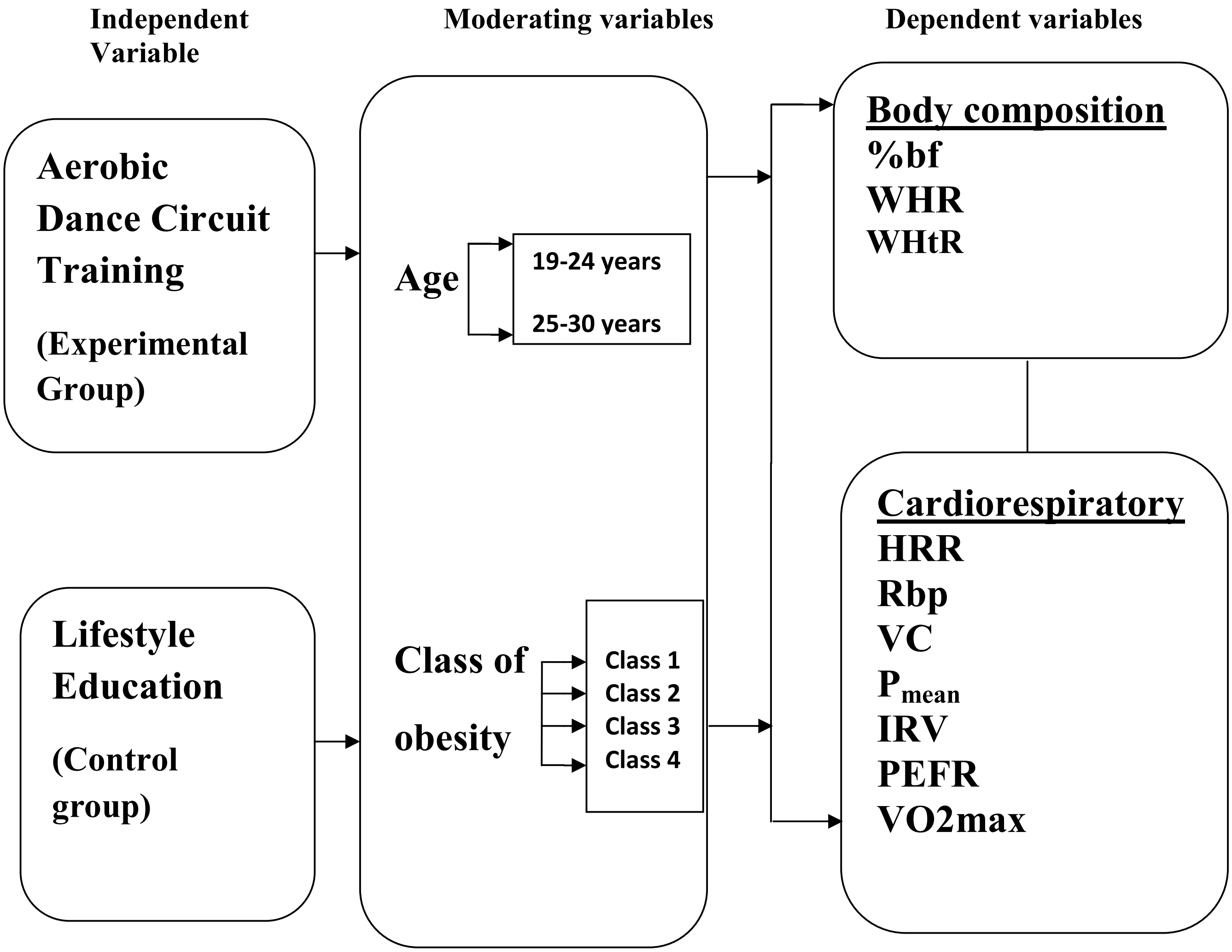


Figure 1: *self-developed conceptual framework of the study.*

This framework was self-developed concept for the study, designed to show the relationship between independent variables (Aerobic dance circuit training ADCT) and dependent variable (Body composition variables; BMI, %bf, WHR, WHtR and cardiorespiratory variables; HRR, Rbp (systolic and diastolic), P_{mean}, VC, PEFR, IRV and MaxVO_2).

The relationships between the two variables are causal and effectual whereby the training intervention (ADCT) provided evidence of changes in the dependent variables (Body composition and cardiorespiraory variables). Whatever, changes in the dependent variables were presumed to be caused by the independent variables; which means that, dependent variable is a function of the condition of the independent variables.

Theoretical Framework

Kinetography Laban theory of movement

Interaction movement based of technology is an emerged area in physiological aspects of an active human body. It has been described as entertainment interactive and interactive art; and rehabilitation. The human movement is the mechanics of the moving body in space as a result of time, the space as the movements paths, the rhythm and timing of the body movements involved, human action perception and its activity. This is a system of analyzing and orginal movement recording which was developed by Rudoff Laban in 1920 and later developed by Hutchinson at Dance Notation Bureau in New York

Kinetography Laban theory was based on dance choreography, observation of movement, computerized analysis of human motion, computer vision and recognition of human movement. Hutchison (1977) describes this theory as a system for ballet based on an abstract stick figure representation on music. There are three essential forms of movement incorporated by Labanotation;

1. Motif: describe the salient feature of a movement at the dancing ballroom; and walking and any other aspects of the movement represented.
2. Effort: this describes quantitative and aspects of movement expressive and the inner mover attitude in weight, space, time and flow.
3. Structural: the fullest provision and most specific movement description in clearly and measurable terms; in space of the body and its parts, time and dynamics.

Labanotation theory can be analysed on this movement analysis based on the game play movements' characteristics:

Table 1: Movement analysis of Kinetography Laban theory

Movement	Descriptions	Examples
Reach move	Extension of hands on an object	By up stretching an object
Waves	Hand or arm movement in and out repeatedly	Goodbye in waving
Slaps	Hit something with open hand quickly	Thigh slap
Swats	Abtruptly hard hit	Flies swaitting
Slashes	Quickly Swinging of the arm freely in space	Grass cutting
Punches	Forcefully with closed fit striking an object	Boxing
Flicks	Sharp delivery and quickly blow retracted	Flipping of dust away

Kinathrography or Labanotation theory and movement underlying analysis system offer with understanding interaction of the moving body. All the above stated movements are related and also linked to aerobic dance circuit training based on sequence of movement applied in this study.

Theory of overload principle

This is the gradual increase of stress placed upon the body during exercise training. It was developed by Thomas Delorme, M.D. while he rehabilitated soldiers after World War II. (Kraemer; Fleck, and Steven 2007)). The technique is recognized as a fundamental principle for success in various forms of strength training programs including fitness training, weight lifting, high intensity training and physical therapy programs.

The principles of overload are important to consider when planning a circuit training programme. According to Williams (1993), the principle of overload indicates "your body systems must be stressed beyond their normal levels of activity if they are to improve."

The three main dimensions of overload are intensity (how hard?), time (how long?) and frequency (how often?). These dimensions are altered to ensure overload occurs, e.g. increasing the ‘time on’ for each exercise as it applied in this study. The principle of progression deals with the manner in which this overload is applied. Dick (2002) highlighted the importance of this principle when he said that it is “necessary to provide a progressive heightening of the stressor to oblige the body to seek a higher status of adaptation.” The stressor is the exercise stimulus; circuit training in this case. It is necessary to apply this principle to circuit training to ensure that physiological adaptations continually occur. The principle is related to Selye’s (1956) General Adaptation Syndrome (GAS) model, which refers to the manner in which humans react to stress. Selye’s GAS model contains three stages: Alarm, Resistance and Exhaustion.

During the alarm, or shock, phase, the body experiences a new or more intense stress, such as during the first circuit training session of the training. The response to the new stimulus is generally shock, and the participant experiences soreness, stiffness and a temporary drop in performance. During the resistance phase, however, the body begins to adapt to the repeated stressor. Initially the body will return to a normal functioning level and if the stressor continues, the physiological changes will go to a higher level. This phase of adaptation is often called super-compensation. If the stressor is continually applied or the intensity continually increased for prolonged periods, participant will reach the exhaustion phase. At this point physiological functioning drops below that which would be considered to be normal functioning levels, i.e. the participant underperforms. The participant is now beginning to over-train, and the same symptoms experienced during the alarm phase will reappear.

Selye’s GAS model has to be applied to the principle of overload to ensure that the participant reaches the super-compensation phase, while avoiding the exhaustion phase.

The following guidelines relate the application of this principle to Aerobic Dance Circuit Training (ADCT). This was achieved by altering the frequency, intensity or time dimensions of overload. Specifically, it was achieved basically with the uses of metronome for aerobic dance tempo to determining 40%-69% MaxHR in this study by:

Increasing the number of repetitions of each exercise,

Increasing the amount of time on,

Increasing the number of circuits,

Increasing the degree of difficulty of each exercise,
Decreasing the time off between exercises,
Reducing the recovery time between circuits,
Making the recovery time more active,
Increasing the resistance of the exercises by altering the body position.

Theoretical/Conceptual Review

(a) Concept of College Students

The college students are considered young adults in age; and refer to transition between childhoods to adulthood. From the perspective of Altschuler, Strangler, Berkley and Burton (2009), it is viewed as a period characterized by freshness, vigor, spirit, and other features associated with young persons. Scholars have not been able to agree on a specific age range to define who a youth actually is. In like manner, there are no precise activities as work or sexual behaviours to denote youth.

Level of dependency and personal experiences, cultural outlooks, beliefs and individual experiences are sometimes the determinants of the period of youth. Traditions entrenched in culture as experienced by individuals and the level of dependence of individuals on family in economic, social and emotional terms are vital measures to weigh maturity (Konopka, 1973). Several English expressions have been used to refer to youth; some of them include adolescent, teenager, kid, and young person (Konopka, 1973). Another school of thought opines that the period of youthful as a definite period of rapid changes in a person's life in which awareness of the environment and other persons such as the opposite sex becomes conspicous (Altschuler, Strangler, Berkley and Burton; 2009).

As noted by Andy (2013), while the United Nation recognizes the fact that member states have their perspective to age range identified with youth, it however established for statistical purpose that the youth age should be within the range of 14 to 24; young adults should be within the range of 18 to 32 years; and teenagers be categorized from age 13 to 19. Children are referred to as individuals under the age of 14 as specified under the African Youth Charter 15-35. Thomas (2003) noted that self-concept is being constructed at the period of youth. This period is characterized by choice making, relating with peers, developing lifestyle, integrating into culture and understanding gender differences. Sub-Saharan African nations associate youth termed as young men ranging from age 15 and 30–35. Specifically in Nigeria, all citizens that are from 18-35 years are recognized as youths (*Nigeria National Youth Policy, 2009*).

Youths all over the world are being introduced to sedentary lifestyles through technological advancements which allow for ease of operations that eliminates movements from one place to another. This development contributes to obesity among youths. As reported by WHO (2008), about 30% in the world does not engage in sufficient exercise. Children are also being observed to be getting entangled in the same predicament due to their engagement in inactive pleasure like screen viewing (television) and leading to less physical activities.

Several studies have identified that there is consistent increase of inactive pleasure endeavours and that adults, youths and children spend considerable higher period of time before television compared to other activities that require physical exercise (Salmon and Timperio, 2007). A review of 63 out of 73 studies found that childhood obesity is on the increase because of early exposure of children to the media which allows for sedentary lifestyle. (*Media + Child and Adolescent Health, 2008*).

Most cases of obesity could be traced to excess intake of energy producing food without consumers engaging in sufficient physical exercise (Lau Douketis, Morrison, Hramiak and Sharma, 2006). Bleich, Cutler, Murray and Adams (2008), however asserted that there are a few cases of obesity that could be linked to genetics, medical reasons such as psychiatric illness. Access to fattening foods, over dependence on cars and other facilities enabled by technological advancement are obviously contributing immensely to sporadic growth of over fat (obesity).

Contributors to the increase of obesity recently include:

(1) Inadequate sleeping,

(2) Disruptors of endocrine,

(3) Low variability of ambient temperature,

(4) High level of medications uses that resulted to increase in body mass,

(5) Heavier increased as a results of ethnics and age groups,

(6) Late pregnancy,

(7) Risk factors of epigenetic,

(8) Increase in BMI, and

(10) Matting assortative that leads to the risk of over fat.

All these leads to an increase number of obese people based on population increase.

It could be said that certain traits developed during the youthful period could become permanent into adulthood thereby increasing some ailments especially among those that have developed poor health habits. The youthful period involves rapid changes involving complex switches from the role of a child to that of a young adult. At this period, individuals begin to have feelings of independence, developing new perspective about life and adopting new ways of life.

With manifesting changes in young people resulting from puberty, these physical changes precede the role assumption, accepting accompanying responsibilities and exploring the benefits. The experiences of youth in Africa are fond to be in terms of biological changes in relation to growth. Akiboye identified three main factors that are cogent in the development of youth in Nigeria and Africa. They are:

1. Rapid biological maturation culminating in puberty and the expression of secondary sexual characteristics.
2. Development of abstract thinking capability and
3. Increased social awareness and peer group influence

This establishes that youthful is a state of psychosocial growth that commences in the preteen years, also at the stage when puberty begins and continues till the stage an adolescent reaches the stage of adulthood. Akinboye (1996) corroborated this and pointed out the five the five levels of control under which biological changes in youth could be considered. These are: the hypothalamus, pituitary gland, testes and ovaries, sex hormones and changes in body mechanisms (*Fig. 2*.).

Levels of changes in biological control of youth

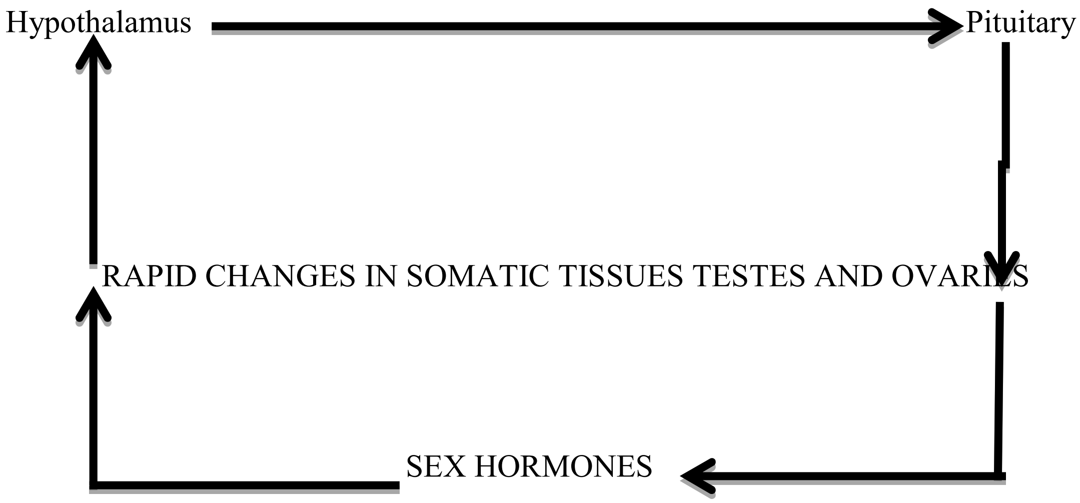


Fig. 2: (Source: Akinboye, 1996)

The scholar noted that consideration of the biology of youthful should start with the brain in which the hypothalamus is stimulated. This stimulates the pituitary gland through the hypothalamic hormones. The pituitary gland then secretes hormones which regulate the activities of the gonads (testes and ovaries). The sex hormones are then secreted into the blood stream. The blood carries the hormones to the various organs of the body where they influence the often observed rapid growth patterns in youth. The emergence of puberty shows, the maturation of human capacity to reproduce his kind. This forms an aspect of the biological changes that produce the youthful phenomenon. At puberty, growth rate alteration that occurs includes body size increase, composition of the body and shapes changes and rapid gonads growth and secondary sexual characteristic, this process is however, based on normal hormonal functioning as cases of cretinism could dwarf the process.

(b) Concept of Obesity

Obesity is accumulation of disproportionate fat which has the tendency to damage health. Bray (2005) affirmed the fifth foremost death hazard in the world is obesity-*cum*-overweight, noting that at least about 2.8 million adults die every year as consequences of obesity and overweight. Bray (2005) further establishes that obesity and overweight are responsible for 23% of cases of the ischemic heart disease, 7% to 41% of cases of certain cancer diseases. Furthermore, it was reported and projected by WHO (2000) that above 1.4 billion of the world population would be obese and overweight from the year 2008. 200 million of this population would constitute male youth while 300 million would be their female counterparts.

Uzoalor (2006) reported that 40 million children below five years were overweight. This same source also noted that economically developed countries, especially in urban population, have begun to experience higher rate in record of cases of obesity and overweight. It was also reported in developing countries that overweight children has increased up to 35 million and developed countries with 8 million. Compared to underweight, more deaths have been linked to overweight and obesity all over the world.

The major causes of increase in weight and increase in body fat could be refered to disproportionate between the calories consumption and expend of energy, that is a very high increase on the consumption of fatty foods saturated with sugar and salt without required vitamins, minerals and other micronutrients. This situation is also accompanied with sedentary living occasioned by the nature of work environment, transportation system and urbanization that do not encourage expence of energy. Bergouignan and Blanc (2006) asserted that there are no policies to support healthy living habits; all sectors of human endeavors have been significantly influenced by modernization; and the environmental developments do not encourage healthy habit formation. They further argued that obese and overweight youth have higher risk of premature death and disabilities at adulthood.

Moore (2010) acknowledged that, many middle and low-income countries being faced with diseases of "double burden". The vulnerability of youth in low- and middle-income countries is now very high owing to poor pre-natal, infant and young nutrition’s child. In the same vein, due to financial inability to purchase quality foods, they consume more fat, more sugar, and more salt, and micronutrient-poor foods leading to metabolic and cardiovascular diseases. Inadequate nutrition and sedentary living culminate into soaring cases of fat deposit.

An abstract entity of children and youth that are overweight in the United States as reported by CDCP (2007) has increased to 17%, from 2003-2004. The WHO (2014) report also stated that globally, as at 2013, 42 million children between the ages 5-19 years were obese while approximately 31 million of them are from developing countries. The case of obesity has developed into a key national worry in the USA to the extent that a mass mobilization in being done to campaign against it. Therefore, this is the most burdensome conditions of public health issues faced by the USA nation.

(c) Classifications of Obesity

There are several approaches to classifying obesity: age, fat distribution, nature of fat and BMI. Individuals with excess fat from between 20% to 40% overweight are said to be have mild obesity; severe (over 100% overweight) and moderate (41% to 100% overweight) (Falase and Akinkugbe, 2003). Hyperplastic obesity could also occur as a result of body weight increase at equilibrium with the quantity of fat cells. Hypertrophic occurs when fatty cells enlarge without any relative change to fat cells numbers. Juvenile obesity is also known as hyperplastic adult obesity is called hypertrophic obesity (Park, 2010).

Obesity could be categorized as fat distributions, as central and abdominal and gluteal or peripheral. Comorbidity and mortality risk is high with abdominal obesity. In the peripheral as a result of fat layers under the skin while abdominal, and partially under the skin involves more in the visceral organs. The age of onset of obesity could also be used to classify it into childhood obesity, i.e early childhood, and middle age obesity (Law, 1992), which refers to dangerous stages of growth of obesity. Occurrence of obesity in childhood could also be linked to increased nutrition risk during fetal life that may add directly to growth in size, composition and figure of the human body of the unborn which is due to the incompetence of metabolic micronutrients in the child. A relationship has also been found between pattern of the development of intrauterine as risk factors of state of being fat in the abdomen and its comorbidities in year later. Adiposity rebound is said to be the main cause of obesity in the beginning of childhood; arises between the ages of 5 and 7 years. It is however incomprehensible, what determines the timing of adiposity rebound (Dorosty, Enmett, &Cowin; 2000). The vulnerability of the adolescent is also very high at this level due to self-awareness and the high tendency to adopt the predominant social trends in fashion, food and general behaviours which may have negative impact on health (Eyam, Eberechukwu, Eyam and Nsan; 2013).

Although obesity at adulthood could be predicted based on changes of BMI and weight during youthful, it has however not been established that early adiposity rebound could be a determinant risk of obesity in the year later. If a child still remains overweight at older age, the tendency is high that the overweight could be permanent at adulthood (Booth, Wake, Armstrong, Chey, Hesketh, and Mathur; 2001). Reduced activity could be responsible for obesity at middle age. Females could start to experience this from the age of 19 while males could start experiencing it from age 30 (Wing, 1995). As noted by Ohlin and Rossner (1990), in women, this could be within the time of pregnancy and menopause.

Obesity at the period of pregnancy is usually referred to as gestational obesity. This could be valued to the fact that pregnant women develop change in taste and increase their rate of food consumption. Likewise their physiological features change as a result of certain hormonal secretion coupled with sedentary living (Must, Jacques, Dallal, Bajema and Dietz; 1992). Falase and Akinkugbe (2003) classified it with the use of pathogenic mechanism as metabolic or regulatory. WHO (2000) has also classified adult's obesity with the use of BMI and identify below:

Normal = BMI 18-24.5

Overweight (25-29.9)

Severe obesity (30-40.0) and;

Super obesity (>50.0).

But, these criteria have underestimated in Indian subcontinents in which International Obesity Task Force (IOTF) (2011) proposed adults obesity standards in Asia and India as;

BMI>23= overweight

BMI>25 =obesity.

In 1997, when WHO initiated the formation of the IOTF proposed the cut-off point for overweight and obesity as BMI >25 and BMI >30 respectively. If we acept the criteria of BMI ≥30 to indicate obesity, it would appear that the prevalence of obesity in Japan of less than 3% has changed little during the last 40 years and we cannot explain the rapid increase in incidence of obesity associated chronic diseases due to overeating, errors of eating pattern, inactivity, heredity and disturbance in thermogenesis. These also contributed to the increased incidence of obesity in Nigeria among the youth. Therefore, Japan (2003) describes its BMI cut-off points as it was adopted in this study:

Obese class 1 (25.0-30.0)

Obese class 2 (30.0-35.0)

Obese class 3 (35.0-40.0)

Obese class 4 (40.0-above)

(d) Deleterious health implication of obesity

Obesity makes affected persons to become vulnerable to health problems and worsen their health conditions. Lucas and Gilles (2003) observed that the risk of provoking other chronic conditions by victims of obesity could be very high. Some of those chronic diseases are: type-2 diabetes, cardiovascular diseases, gall bladder disease, osteoarthritis, back pain and some cancers. In addition, an independent risk factor of abdominal obesity includes; diabetes, cardiovascular diseases, breast cancer and psycho-social problems. It could also degenerate into low self – esteem, and poor self-image. Furthermore, it has been established that systolic blood pressure rises by 6.5mmHg for every 10% rise in relative weight. Likewise the plasma cholesterol rises by 12mg per dl and fasting blood glucose rises by 2mg per dl (Kings, 2002). Therefore, obese people have higher tendencies to have hypertension compared to non-obese individuals; those that are obese and hypertensive also have higher risk of mortality compare to those that are only hypertensive or only obese. Russel (1996) discovered that myocardial infarction, diabetes, sudden death and coronary insufficiency are closely linked with obesity and a high BMI. He further noted hypertension (78%) in men and women (65%) could be directly linked to obesity while Mokdad (2001) admitted that individuals with excess abdominal fat are more likely susceptible to diseases than persons with excess fat at the hips and thighs.

Cursory observation has it that most people in the contemporary world detest being tagged as fat. However, in Nigeria, especially in the rural environment, being overweight is considered affluence, except among the educated and sophisticated ladies to whom fatness is repugnant. Alade (2001) noted that obese people do not appreciate the fatness and the undue attention they receive which could negatively impact on their self-concept. According to Alade (2001), severe obesity produces tiredness and may lead to difficulties in moving around. Fleck and Kraemer (2004) reported that, fat individuals are very prone to home accidents and are even more often subject to motor accident mortalities. Obesity is also related to difficulties in pregnancy and child birth.

Ajala (2006) confirmed that, disability, diminished efficiency, and diminished longevity are the common results of gross obesity. In addition, this disorder has a secondary harmful effect on a large number of diseases and other conditions ranging from suicide to heart diseases. Also, obesity has some observed psychosocial effects like social stigma, low self-esteem and poor self-image effect of obesity is psychological (Lucas and Gilles, 2003). Nevertheless, since it is well recognized and documented that with obesity, arteriosclerosis, high blood pressure, myocardial infarction, diabetes mellitus, dental decay and osteoporosis will afflict an increasing proportion of the population, prevention through lifestyle modifications are the solutions in Nigeria because, most of these diseases are incurable in places where there are best medical practices.

(e) Overview of nature and nurture of obesity

It has been noted that corpulence is not a disease but rather a harbinger, BMI has been adjudged a very good measurement to determine adults' obesity. However, in children, the effect of age and sex is a challenge in using BMI. The conclusion of the WHO in this regard is that any child that weighs above 95% of their peers within the same age bracket and height should be concluded as obese. 7% of Irish children have been confirmed obese (Williams, 2009)

Nature

Genetic components have been found to constitute a great determinant overweight and obesity (O'Rahilly and Farooqi, 2006). A study focused on family, twin and adoption found that genes significantly contributed 40 and 70 percents of the difference between the children regarding their weight (Willer, Willer, Speliotes, Loos, Li, Lindgren, Heid, and Hirschhorn, 2009). The heritage of an average person are really lesser for those for height; a trait almost unquestioningly. The susceptibility to obesity could be very high among children from families where obesity is rampant (Bouchard, 2009).

Recent studies as reported by Farooqi and O'Rahilly (2006) have established a correlation between obesity and a change in the gene that regulate the production of leptin (Farooqi and O'Rahilly, 2006). Whenever there is a change in the gene that produces leptin, it could lead to hyperphagia (increased appetite) thereby provoking obesity.

Obesity has also been linked with a change of gene that produces proopiomelanocortin (POMC) (Farooqi and O'Rahilly, 2006). It also produces melanocortins in the hypothalamus regulates individual's appetite (O'Rahilly and Farooqi, 2006). The absence of melanocortin leads to hyperphagia which intensifies the appetite for food and increases food intake thereby increasing the likelihood of state of being obese (O'Rahilly and Farooqi, 2006). The contribution of the environment also significantly determines if the genes could activate obesity. Lack of exercise as factors and high fat consumption have also been linked to high risk in obesity as confirmed in control experiments. Mutation on mice with the POMC gene became hyperphagic and obese on a high fat diet without a standard balanced (Farooqi and O'Rahilly, 2006). This is an environmental importance on obesity. Bouchard (2009) reported results of mutations in genes encoding leptin and POMC together account for only about 5% cases of obesity. Therefore, the value of this research work in prevention and management of obesity is limited because the results is applicable to only 5% of obese female which is at the extreme end of the spectrum.

The need to further substantiate this finding is paramount to further clarify their relationship with environmental influences. It could therefore be concluded from the above that the influence of environment has a role in obesity, although it has been concluded that genetics affect child obesity. The imbalance between energy food consumption and expend of energy could best explain causes of obesity, especially among persons that are vulnerable to obesity. Hence, it could be concluded that lack of exercise or energy dispensing activities with poor feeding could be major causes of obesity (Gopinath, Hardy, Baur, Burlutsky and Mitchell, 2012).

Nurture

Food intake and food quality

Dietary has been correlated with obesity. Type, quality and amount of food with avenues for energy expend are very cardinal factors considered in relation to obesity (Moreno and Rodriguez, 2007). Although it was found in that food intake has no association with obesity because of limited reports of food consumed, yet a study on cross-sectional on two occasions showed a positive association between energy intake and youth obesity, to the extent of managing physical inactivity and parental body weight. Parental role is a critical factor to consider in obesity and overweight condition. Mothers that are overweight are said to give larger servings to their children at meal periods. Most of these meals are said to be fatty thereby encouraging accumulation of fats in the body (Nguyen, Larson, Johnson and Goran, 1996). The actions of significant others are the examples copied by children as posited in Social Learning Theory (Bandura, 1999). The tendencies is therefore very high that the habit of overeating that children have copied as they were growing up, from the parents continues with, thereby giving them health complications in later years (Bandura, 1999).

It has been established in literature that when the fatty food is consumed higher it is related to the weight of the consumer. Moreno and Rodriguez (2007) compared obese and lean children and found that fatty food consumption, parent's weight and inactivity were predominant among the obese children unlike the lean ones. Fatty foods contain high energy as they are also usually very sweet, thereby encouraging higher consumption, leading to obesity and overweight as they keep piling in the body. Soft drinks are also said to be sources of obesity among youth. Their consumption of solid food is usually increasing as they also gain additional calories through soft drinks, thereby increasing in weight continually. It was also established that obese mothers' influence have also been identified in obesity and children emulate the eating habit of their mothers.

Eating Patterns

Patterns of eating could be associated with obesity among children. Disproportionate eating, especially when high energy food is consumed for dinner and low energy food is consumed for the breakfast and lunch could explain consistent weight gains, whereas, youth do not dissipate energy in the evening. This is owed to the fact that they are usually engrossed in either viewing television or exploring video games (Maffeis, Proveral, Filippi, Sidoti, Schena, Pinelli and Tato, 2000). Consistent increase in weight could also be associated with consistent consumption of fried foods (Moreno and Rodriguez, 2007). Youth and children are also overindulged by parents who keep serving them more than enough nourishing foods. TV dinners in youth 'eat mindlessly' as they are engrossed in watching TV could promote higher intake of calories.

Youth could lose their frequency control ability and the amount of high energy food consumed as a result of their feeling of satiety. Fighting negative emotions by youth has been identified as a coping mechanism.

Genetics could also be said to impact significantly on insatiable appetite for food. Bouchard (2009) reported that overfed total number obtained by the twins is between 3 kg and 12kg. It was concluded that heredity predominantly predicted the impact of diet on weight gain. From the earlier reviewed literature, it could be established that genetic influence also determined the impact of food on weight gain and obesity. Exercise and active living could also greatly determine if high and excess energy would be retained or released from the body (Hill and Wyatt, 2005). A study that focused on 130,000 youth from 34 countries found that obesity could be linked to sedentary living or physical activities.

Physical Activity

Physical activities could be impeded by several factors which include gender and parking availability and perceived competence as reported by Sallis, Prochaska and Taylor, in year 2000. However, a review would be done on video games, television and how they affect involvement of children in physical activities. Janssen *et al* (2005) correlated overweight with television viewing. Han, Lawlor and Kimm (2010) however argued that this assertion has not been substantiated by consistent evidences. Another study also argued that the appetite of children for fatty foods could be stirred through television advertisements that portray fatty and high energy foods as very appealing, thereby encouraging them to increase eating high fatty foods leading to weight gain (Vandewater, Shim and Caplovitz, 2004).

As found by Vandewater, Shim and Caplovitz (2003), there is a correlation between time spent on playing video games and weight gain. The study however did not establish the effect of video game on obesity. The interpretation is that uses of video games reduce time spent in exercising which contributed to obesity. People that are overweight shy away from exercise and they are positively disposed to using entertainment media. Spending more than enough time before television and video games without time for other physical activities could be said to have an impact on weight gain.

Broader Environmental Influences

The environment significantly influences activities that children are engaged in, whether active or inactive. There are several environmental influences that could activate or suppress obesity. If playing ground is available and children are given access to it, it could encourage exercise, thereby reducing body fat. However, people in the city area do not allow their wards to exercise; this is due to an easy access to transportation, thereby dissipating little or no energy. Sedentary lifestyle has been adopted by several people thereby decreasing the amount of energy dissipated for daily activities (Prentice and Jebb, 1995). This situation of heritage theory favored individuals with parsimonious energy metabolism which is excess fats as results of energy stored is highly challenging. It has been proven that genetics also control the relationship between physical activities and weight (Esparza, Fox, Harper, Bennett, Schulz, Valencia and Ravussin, 2000). Summarily, there are validations from studies that focus on family, twin and adoption studies that heredity could affect how genetics could be vulnerable to obesity.

Prevention and Treatment

Individuals, families and organizations stand to benefit a great deal from preventive measures to combat obesity (Han *et al.,* 2010). WHO is advocating prevention to avoid the need for children to start going through the rigors of weight loss (*WHO, 2004*). Children are targeted for preventive approach because their eating habits could still be influenced as they have not fully formed rigid habits like the adults who may not find it easy to change. Training on strength development among children has yielded tremendous benefits as overweight children developed strenght and appeared to be stronger than their counterparts (McCambridge *et al*., 2006). Trekking a long distance with pedometer assists in weight reduction (McCambridge *et al*., 2006). Encouragement from parents assist children to engage in physical activities, eat nutritious and appropriate portions of food thereby aiding weight loss (Hawkins, Coles & Law 2009).

The role of government at institutional level is paramount. The Irish government recommended that the school curriculum should include physical activities that would engage students for at least two hours every week during the school hours to prevent obesity; and Ireland on recommended daily 60 minutes' exercise.

Overview of Aerobic Capacity

Capacity of aerobic describes the efficiency and effectiveness of the cardiorespiratory collection structures includes; the heart, lungs and blood vessels. The maximum amount of oxygen that could be used by the body for certain activities such as exercise is referred to as aerobic capacity. The function of cardiorespiratory system is the ability to remove and utilize oxygen maximally from circulating blood. Canoy, Luben and Welch (2004) noted that in order to ascertain maximum aerobic capacity, individuals are made to undergo exercise procedures under the supervision of exercise physiologist or physician. Spirometer is usually attached to the person being tested to monitor the amount of consumed oxygen surplus on period of time during exercise.

As the endurance level of the cardio respiratory organ increases, so also does the rate of oxygen consumed increases and in like manner does the capacity of the individual to exercise increases. In a more condensed and explicable manner, as the aerobic capacity increases so does the fitness of the individual. The multistage and cooper fitness test can be used also to access functional aerobic capacity for specific job or activities (Mcfarlin, Brian, Mitchell, Joel Mcfarlin, Merechitch, Shenhoff and Gina, 2003).

There exists a variation in the degree to which individuals could increase aerobic capacity through exercise. Approximately, 17 percent average response to training increasess maximal oxygen uptakes

Concept of Body Composition

There are two main sections in the human body: the fatty tissue and the lean body mass. The main component of the fat compartment is the adipose tissue, while muscles, bone, non-bone tissue and total body water are resident in the LBM. The largest portion of the lean body mass is occupied by the total body water. Body water could be also found in every cell (intracellular water) and around the cell. Water in large quantity is also contained in blood. Major components of the body could be measured directly or indirectly. Adipose tissue is higher in obese person and if the degree of obesity is higher in a body, the adipose compartment will continue to enlarge. Therefore, persons that are morbidly obese have higher quantity of adipose tissue, and fat which constitutes that major weight. A few of obese persons also store excess water that adds to their weight.

Two major parts of the body usually store excess energy as observed by Abraham and Llwellyn-Jones (1992). The first is the adipose tissue where energy is stored. It is easy to recognise this on the obese person. 80% fat, 18% H_2, and 2% protein are contained in the adipose tissue. Glycogen water pool is the second storage area. Glycogen could be found in muscles and each gram of glycogen is bound to 3.5g of H_2O. It is difficult to measure the water pool but an assumption could be made that the weight is 3.5kg among persons that are not obese while obese persons could be at about 5.5kg. Energy could only be released at the point the glycogen-water is almost drained.

Development of fat stores: The development of obesity is gradual as accumulation of fatty foods compounds and the overall energy remaining (net energy) supersedes the energy expended (Abraham and Llwellyn-Jones, 1992). The net energy is the energy that is left (excess energy) after the required energy has been expended. When the excess energy is higher than required, it could lead to overweight or obesity. Sedentary living and overeating are jointly contributed to overweight and obesity as asserted by Arner (2000). It could be said that excess fat is accumulated when a major gene interact with several minor genes. Hormone sensitive lipase, beta 2 and beta 3-adrenoceptors, tumor necrosis factor alpha, low density lipoprotein receptor, uncoupling protein-1 and prexisome proliferators activated receptor gamma-2 are the human genes that are susceptible to obesity. Arner, (2000) noted that obesity could be developed through interaction of these identified genes in the body (gene-gene interaction). He also noted that genes responsible for major obesity as revealed through genomic scans are found on chromosomes. The use of energy is predominantly necessary to ensure proper functioning of certain important organs of the body (e.g. heartbeat, muscle functions, respiration); digest, store food and perform physical activities. The component largest of daily energy using and physical exercise is resting metabolic rate (RMR) which is related to energy expenditure. As reported by Goran (2000), several longitudinal investigations affirmed that low use of energy constitute a risk factor aiding growth of obesity. The belief of Goran stands that energy balance changes several time and the ability to regulate energy in the body were the major dependent variables to be examined instead of energy expenditure.

Waist-to-hip ratio (WHR) is the dimensionless ratio of the circumference of the waist to that of the hips. This is calculated as waist measurement divided by hip measurement ($W \div H$). For example, a person with a 30″ (76 cm) waist and 38″ (97 cm) hips has a waist-hip ratio of about 0.78. The WHR has been used as an indicator or measure of health, and the risk of developing serious health conditions. WHR correlates with fertility (with different optimal values in males and females).

The strong correlation between these indices in females compared to males was interestingly noted. Obesity in women is a matter of great concern because more than half of the subjects studied were obese. Obesity among women is likely to be rooted in the social norms and gender roles in our societies. Women are seen mainly as child bearers and rearers, confined to their homes due to their pressing household duties with little chance for recreational or sporting activities. In male only WC and BMI were significantly correlated. Other parameters BMI Vs WHR and WHR Vs WC were not statistically correlated. This is similar to the findings of Kamel *et al*. (2000) who found that in 22 obese women, WC and WHR were equally correlated with total intra-abdominal fat. However, in men there was no correlation with WC or WHR. The correlational analysis in this study suggests that in obese men, WC is a better predictor of the distribution of adipose tissue among several fat compartments in the abdominal region than WHR index.

This also buttresses the importance of WC as a preferred index over WHR in detecting global obesity (Ferland *et al*., 1989; Pouliot *et al*., 1994). A study of 210 men and 200 women in India (Kaushik, 2006) confirmed the preference of WC over WHR as predictive index for obesity. In their study, three indices; Waist Circumference (WC), Waist-Hip Ratio (WHR) and Conicity Index (CI) were undertaken to determine which measure of abdominal adiposity best relates with Body Mass Index (BMI). It was shown that, in both sexes, WC had the strongest partial (age controlled) correlations with BMI (Men = 0.56, Women = 0.80).

Thus WC can be used as an excellent screening tool in medical practice. Moreover, it is an easy, convenient and single measurement in assessing regional obesity unlike WHR which requires two measurements waist and hip circumference which may contribute to summative measurement error. Further studies on the determinants of female obesity such as nutritional norms and practices are urgently required to obtain a full picture of the burden of overweight and obesity in women.

Waist-to-height ratio (WHtR) has been shown to be a useful screening tool for metabolic syndrome and cardiovascular disease (CVD). We investigated the association of WHtR with CVD incidence by age group. Recently, waist-to-height ratio (WHtR) was shown to be a useful global clinical screening tool for cardiometabolic risk and CVD (Browning, Hsieh, and Ashwell, 2010).

WHtR is easy to measure, and the cut-off point for WHtR is subject to less ethnic variation (Ashwell, Gunn, and Gibson, 2012). However, WHtR could differ among age groups because whole-body fat distribution and WC change considerably with age and because height differs among generations. It is thus important to consider age in assessing the association between WHtR and CVD risk, but few previous studies have done so (Gelber, Gaziano, Orav, Manson, Buring, and Kurth, 2008.)

Two previous studies, in the United States and in China, reported that the association between WHtR and CRD risk was stronger among female younger adults as compared with elderly adults (Gelber, Gaziano, Orav, Manson, Buring, and Kurth, 2008.). It was observed that a significantly stronger association between WHtR and CRD risk among relatively young adults (age 20–39 years) as compared with elderly adults (age ≥40 years), which supports the results of previous studies. Consequently, these findings suggest that age stratification is important in estimating the association between WHtR and CRD risk.

In addition, the *National Health and Nutrition Examination Survey* in Japan noted that height clearly differed by generation (Browning, Hsieh, and Ashwell, 2010).

This generational difference in physical frame, as well as ageing, could lead to age differences in the association between WHtR and CRD risk.

A recent meta-analysis reported an optimal cut-off point of 0.50 for WHtR in both sexes. (Browning, Hsieh, and Ashwell, 2010).

The WHtR ratio was originally proposed more or less simultaneously in Japan (Hsieh and Yoshinaga 1995a, 1995b) and the UK (Ashwell 1995, Ashwell 1996, Cox and Whichelow 1996) as a way of assessing body shape and monitoring risk reduction. It was suggested that WHtR values above 0.5 should indicate increased risk (Ashwell 1995, Hsieh and Yoshinaga 1995b, Ashwell *et al* 1996, Cox and Whichelow 1996). It was also suggested that values above 0.6 indicate substantially increased risk (Cox *et al* 1997). Prospective studies have also shown that waist circumference and WHtR are better than BMI at predicting deaths from coronary heart disease and all-cause mortality (Cox and Whichelow 1996, Hadaegh *et al* 2006, Lu *et al* 2006, Chei *et al* 2008). WHtR is a slightly better predictor than waist circumference alone.

This is probably because there is a positive association between waist and height in global populations of mixed ethnicity that include a wide range of heights. An advantage of using WHtR over waist circumference in a public health context is that boundary values can be set that are the same for men and women. The suggested boundary value of 0.5 proposes that individuals should 'keep waist circumference to less than half your height'.

Another boundary value of 0.6 indicates that adults should 'take action'.

A second advantage of these suggested boundary values, is that the estimated proportion of the population 'at risk' from health problems associated with obesity is similar to that estimated by the traditional BMI, meaning that a similar amount of public health resources can be redirected to the sub-population who will benefit more. Therefore governments need not get alarmed that they will have to pay more, but they can be reassured that their money is being spent on the most needy cases. Another point is that the proportion of men at risk using WHtR is usually greater than the proportion of women, reflecting the greater propensity for men to have central obesity (Ashwell 1996).

Concepts of Cardiorespiratory Function Indices

The concept of cardiorespiratory is entrenched in the capacity of the capacity of the blood circulating system and breathing systems to transmit oxygen to the skeleto-muscular systems in the process of continuous physical activity. Efficiency of the system which enlarges the heart muscles as moving blood to parts of the body is made possible on physical exercise. The respiratory system is improved through exercise. During exercise the amount of oxygen inhaled is high and this affects all tissues of the body. The health of the heart and lungs are improved and the general state of wellbeing is improved through cardiorespiratory fitness.

Resting heart rate (RHR) and Heart rate resrve (HRR): Intensity of exercise is a primary component of exercise prescription and refers to the relative amount of energy required to perform a specific aerobic activity (ACSM, 1991). Studies suggest that exercise intensity is the most important factor for the development and maintenance of cardiorespiratory fitness (ACSM, 1990). To determine and maintain a desired training intensity, oxygen uptake (Vo2) or some equivalent index must be measured. Since heart rate (HR) is easy to measure and is linearly related to Vo2, it is often used to monitor aerobic training intensity.

There are three common methods for establishing training intensity based upon HR. The most direct method requires the measurement of steady-state HR and Vo2 at two or more submaximal exercise intensities and the subsequent calculation of a regression equation relating these two variables. This method, although accurate, is time-consuming and requires elaborate laboratory equipment. Another way to calculate training intensity based upon HR is the percent of maximal HR (%HRmax) method. This method computes the training HR as a percentage of HRmax. Although this method requires only the measurement of HRmax, it is limited by the individual variability in the relationship between relative HRmax and relative VO_2max. This variability is due partially to differences among individuals in resting HR. (Karvonen, Kentala and Musta, 1957)

The third method of establishing training intensity from HR uses the subject's potential HR increase (HR reserve) and assumes that resting HR represents zero intensity (Karvonen, Kentala and Musta, 1957). This corrects for the nonzero value of resting HR. A percentage of the difference between maximal HR and resting HR is calculated and the resulting value is then added to the resting HR. This method is referred to as the Karvonen or Heart rate reservs method and requires valid measurements of both resting and maximal HRs. Numerically, the %HRmax method exceeds % VO_2max whereas Heart rate reservs relates closely with % VO_2max through a wide range of exercise intensities in young and middle-aged subjects.

Based on studies with cardiac patients, Hellerstein (2003) stated that the close relationship between Heart rate reservs and % VO_2max is independent of age, fitness, or extent of coronary artery disease. However, the relationship between HR and VO_2max has not been systematically studied among the youth. Several studies suggest that Heart rate reserves underestimates % VO_2 max during submaximal exercise in the elderly (Karvonen, Kentala and Musta, 2007). This has significant implications for the prescription of exercise in older adults since %VO_2max achieved using Heart rate reserves to establish intensity may exceed safe or desirable limits.

Heart rate (HR) is an easy to measure but important indicator of cardiorespiratory health. Though the heart rate dynamics during and after cessation of exercise have been used extensively as markers of cardiorespiratory health, it is only in the past few years that resting heart rate (RHR) has gained attention as a simple but powerful marker of cardiorespiratory health. A number of studies have linked an increase in RHR to increased incidence of cardiorespiratory and non-cardiorespiratory mortality (Karvonen, Kentala and Musta, 1957).

Obese people tend to have increased RHR as autonomic responsiveness has been shown to diminish in obese individuals. This could lead to a reduced ability in the obese to adapt to environment. Obesity is a major health problem affecting young and old throughout the world and is associated with a number of cardiorespiratory diseases and metabolic syndrome (Karvonen, Kentala and Musta, 2007). Thus obesity is leading directly or indirectly to increased morbidity and mortality. General obesity which is usually described in terms of body mass index

(BMI) is calculated by dividing the patient's weight in kilograms by height in meters squared (kg/m2). A person with a BMI ≥25 is classified as overweight/obese. Central or visceral obesity (abdominal obesity) can simply be assessed by measurement of waist circumference. A waist circumference of 88 cm or above in females of Asian origin is indicative of central obesity.

Other measures including waist-to-hip ratio and waist to height ratio are also used to assess central obesity. Abdominal obesity is considered to be more dangerous than general obesity because the visceral fat has been shown to secrete certain cytokines and chemicals that are involved in atherogenesis and alterations in the autonomic balance (Karvonen, Kentala and Musta, 1957). There is evidence that elevated resting heart rate (>80–85 beats/min) is directly associated with risk of developing hypertension, atherosclerosis and plaque disruption leading to various cardiorespiratory events (Hellerstein, 2003). Increased RHR is considered as an independent risk factor and a prognostic factor for cardiorespiratory and non-cardiorespiratory related diseases. Though the RHR is influenced by several constitutional and environmental factors, the most important determinants are parasympathetic and sympathetic influences. Thus, quantifying RHR can give an index of the load imposed on the heart and the state of imbalance between sympathetic and parasympathetic activity (Pollock and Wilmore, 1990). The autonomic dysfunction associated with obesity could lead to changes not only in RHR and arterial blood pressure; it could also alter the responses to changes in posture (Hellerstein, 2003).

General recommendations for aerobic exercise prescription include manipulation of training frequency, intensity, duration, and mode of activity according to the age, fitness level, and clinical condition of the exercising individual (Hellerstein, 2003). Intensity is arguably the most important of these variables, due to its relative efficacy in altering cardiorespiratory fitness when manipulated (Pollock and Wilmore, 1990).

According to the American College of Sports Medicine (ACSM) (1990), the current 'gold standard' method for prescribing aerobic exercise intensity is the application of the linear relationship between percentages of heart rate reserve (HRR) and oxygen uptake reserve (VO2R). Specifically, exercise intensities between 40% and 85% HRR or VO2R are recommended to promote health in adults and mid-adults. From a practical perspective, the HRR can be used to monitor and adjust power output to achieve the target intensity, and the VO2R can be used to determine the duration of exercise required to elicit target energy expenditure.

Accurate determination of energy expenditure associated with exercise is particularly important when prescribing exercise to promote weight loss and maintenance.

The ACSM recommendation for using %HRR and %VO2R is based on the assumption that there is a 1:1 relationship between these two variables (Pollock, Foster, Rod and Wible, 2002). Two important issues must be considered concerning this hypothetical 1:1 ratio and the use of the ACSM metabolic equations, however. First, the use of heart rate as an indicator of relative metabolic intensity is based on validation studies that employed cardiopulmonary exercise tests (CPETs), characterized by a relatively short duration maximal incremental exercise. Whether the change in heart rate is a valid marker of change in relative metabolic intensity during more prolonged constant power output exercise is uncertain. A question therefore arises regarding the extent to which results obtained by studies that described the hypothetical 1:1 relationship between the %HRR and %VO2R during CPET, extrapolate to training bouts characterized by relatively long duration and constant power output. Furthermore, exercise modality influences the magnitude of cardiorespiratory responses at submaximal and maximal intensities. However, no study has investigated directly the extent to which different exercise modalities affect the %HRR-%VO2R relationship.

***Blood pressure*:** The pressure of the blood refers to the force exerted to pump blood from the blood vessels walls. As used without further specifications, pressure of the blood could be termed as the arterial pressure in the systemic circulation. The measurement of blood pressure is usually done from the upper arm of an individual. When pressure of the blood is at maximum level, it is referred to as systolic. At the minimum level, it is referred to as diastolic. The standard measurement of blood pressure is in millimeters of mercury (mmHg). It is a vital sign alongside rate of respiration, heart rate, oxygen saturation, and body temperature. In adults, 120/80 mm Hg is the normal resting blood pressure (American Heart Association, 2011).

Mean Arterial Pressure (P_{mean}): refers to a medical terminology used to explain an individual's average blood pressure. It is referred to as the normal arterial pressure throughout a particular cardiac cycle. Approximately, normal resting heart rates P_{mean} can be measured through systolic and diastolic pressures, SP and DP (American Heart Association, 2011).

Vital Capacity: This is one of the indices of respiratory function defined by Guyton (1981) as the maximum volume of air one could expire sequel to one maximum aspiratory effort.

According to Ganongit, (1983) is frequently measured clinically as an index of pulmonary function. Vital capacity does not limit endurance performance unless the individual has a significant pulmonary disease or he is exercising at altitude. Sanya and Adesina (1998) carried out a study and employed vital capacity for the assessment of respiratory function at the University College Hospital, Ibadan. Vital capacity can be measured using a spirometer and according to Guydon (1981) the measurement should be taken while the participants is in upright position at full inspiration. The subject places the mouthpiece of the instrument in the mouth such that air does not leak. There should be a forceful and complete exhalation through the mouth. The volume of air expelled should be read off the calibration and recorded in milliliters (mls). According to Green, (1982) the typical values for male is 4.5 litres and for female is 3.2 litres. The best of three trials is taken.

Inspiratory Reserve Volume (IRV): In a normal subject at least 83% of the vital capacity can be expired in the second (Green, 1982). The volume of air expired at the time is dented by FEV_1 (forced expiratory volume in 1^{st} second). Maximal expiration after a maximal volume of air can be expelled in the first and second maximal expiratory after inspiration and useful measure of how quickly full lungs can get emptied. Dowie (1977) opined that FEV_1 served as an important index of airway narrowing but also related to vital capacity. The influence of age, sex, and subject stature by expressing FEV_1 as a percentage of vital capacity or forced vital capacity are important. Orie (1999) utilized FEV_1 in an African study in assessing respiratory function.

Peak Expiratory Flow Rate (PEFR): it is the highest limit continuity generated during expiration performed with maximal force and starting after full inspiration. PEFR is an estimation of pulmonary function as convenience tool, monitoring respiratory status of obese individual and predicting risk of asthma, which can be easily measured with peak flow meter. Lumar, Puri, Sinha, Hassan, Agarwal and Mishira (2013) affirmed on the pulmonary functions which tend to reduce with age, and also found that PEFR to reduce more in obese individuals, the results of excess fat deposit is an association of increased airway resistance and respiratory muscle dysfunction. Obesity induced deterioration in lung function is demonstrated by measuring lung volume and capacities (spirometery). However, many researchers for this purpose used measurement of PEFR because of its simplicity, convenience and cost-effective advantage. Decrease in PEFR indicates a restrictive pulmonary defect because of coarse limitation to the chest expansion due to accumulation of excess fat that interferes with movement of chest and descent of diaphragm. PEFR is influenced in many factors such as age, sex, posture, obesity, environmental and racial factors.

Maximal oxygen uptake (VO_2max): The ability to utilize oxygen to perform work is related to an individual's mechanical efficiency. Therefore, when applying a given equation to estimate VO_2max, which is generally assumed that all subjects have the same mechanical efficiency, which is biologically incorrect and likely explains most of the errors of estimate of VO_2max x. Among the factors that likely influence mechanical efficiency, one of the most clinically relevant is body composition, primarily as per the increased prevalence of obesity in recent decades. Over fat, particularly central obesity may hinder the mobilization of the lower limbs, possibly reducing the mechanical efficiency for activities such as cycling or walking; therefore, there may be an increased error of estimate of VO_2max in obese and overweight subjects. Currently, little data were available regarding the role of central obesity as a modulator of the error of estimate of VO_2max. When estimating VO_2max from the peak workload achieved during maximal exercise testing, some variables may influence the error of estimate, including body composition. First, the relationship between workload and oxygen consumption during cycling, that is, the net mechanical efficiency, has been shown to vary among lean and obese individuals. VO_2max [mL.(kg. min)-1] values were predicted by gender-specific equations: 60 - 0.55 x age (years) for men and 48 - 0.37 x age (years) for women. Maximum values of HR were age-predicted by a previously validated equation: HR max beat per minute = 208 - 0.7 x age (years).

Overview of Aerobic Dance Exercise

Physical activities that encourage the blood pumping to the human body through the heart, allowing oxygen to penetrate the muscles, are referred to as aerobics exercises. As expressed by Moore (2010), aerobic could be interpreted to mean 'with oxygen'. aerobic exercise involves all the muscles used in the body for a longer period of time on a consistent basis, usually accompanied with sound or music. With aerobic exercise, the cardiovascular system and the entire body metabolism are well conditioned and constantly improved. When hearts enjoy vitality and strength, the body is energized to efficiently circulate oxygen throughout the body. Olson, Williford, Blessing and Greathouse (2008) identified the inclusion of music of any kind as accompaniment to aerobic exercise.

As emphasized by Corbing and Pangrazi (1998), several body movements aimed at increasing effective functioning of the heart characterize aerobic dance. Music of several genres such as folk, jazz, social dance and many more are usually employed for aerobic dance. Aerobic dance is said to be a supplement to other forms of fitness activities like jogging, bicycling, swimming, and so on. It became popular in the 70s through Jackie Sorensen. Subsequently, it has from thence been christened under several appellations such as rhythmic aerobics, jazzercise, dancercise and many more. Dance aerobic is an exercise that is choreographic in nature as participants respond to the rhythm of the song. Certified instructors may tailor dance routines to individuals, but many dance routines are preplanned; e.g. dance aerobic videos. Most of the early programmes were considered to be high-impact because; they included jumping, leaping, and hopping dance steps that resulted in stress on the feet and legs (Olson, Williford, Blessing and Greathouse, 2008).

In other to reduce injury or soreness risk, low-impact dance aerobics were developed. Aerobic dance activities now include: low-impact aerobics dance, moderate-impact aerobics and high-impact aerobics. Aerobic dance has been categorized as high – impact exercises, low – impact, step aerobics and water dance aerobics; high impact exercises, as the names imply, involve great activity routines which include jumping actions synchronized with the music. Step aerobics uses the step bench, and the water aerobics is carried out in waist – deep water, usually in a swimming pool (Moore, 2010)

Dance and step aerobics, when planned appropriately for individual participants, can be very effective in building cardiovascular fitness for both men and women. Lafogia, Withers and Gore (2006) stated that one problem with dance aerobic is that, it is a preplanned exercise programme; therefore, it requires all participants to perform the same activity in respect of their fitness or activity levels. The target heart rate that must be reached and maintained which help to reduce calories and fat at a faster rate and improve cardiorespiratory strength and metabolic rate is 70%-85% of MHR age 16 -estimated THR is 142 - 173.

Fun has been associated with aerobic dance by Dance, Blossner and Borghi (2012), noting that while activities to encourage adequate flow of blood is ongoing, pleasure is simultaneously enjoyed. For three times a week, 20 minutes of aerobic dance has been recommended for children. One of the avenues to encourage aerobic dance is the period set aside for physical education (PE) on the school time-table. The following procedures have been identified by Blossner and Borghi (2012) for effective aerobic dance class:

Warm-up – Aerobic dance should be gradual as participants should be encouraged to start slowly spanning about 5-10 minutes before it is increased. This ensures that injuries that could arise from starting quickly are avoided.

High Impact – The real aerobic dance activity should not exceed 20-30 minutes after the warm-up stage. Slow and consistent exercise for beginners is recommended so they would not be frustrated from exhaustion arising from fast pace.

Cool Down – The last 5-10 minutes should be spent to relax, stretching the muscles and allowing the heart beat to gradually come down.

***Aerobic Dancing - Choosing Tunes*:**

The choice of music to accompany aerobic dance is also very important as it determines the level of participation. It should be music that will encourage fun. Instructors are usually advised to choose music based on the preference of the participants. Aerobic dance should also not be mainly fast music; there should be cool music, especially towards the end of the exercise to allow the heart to gradually normalize. Suitable for aerobic dance are a good pair of comfortable snickers. Rigorous routine of exercise characterizes the high impact exercises; the low impact is done with minimum and less rigorous activities; step aerobics is done with the aid of the step bench while water aerobics is carried out in waist-deep water.

From the observation of Moore (2010), individuals involved in aerobic dance are expected to do aerobic breathing apart from responding to the rhythm of music through dance. This is aimed at saturating the blood stream with oxygen to rejuvenate the body.

According to Petrofsky, Batt and Morris (2008), despite the fact that fun is associated with aerobic dance, the benefits derivable from it are multifarious. It encourages weight loss and firms up the muscles of the body. The strength of the bones on which the body rests is also further strengthened while the cardiovascular muscles are also strengthened. As applicable in other forms of exercise, aerobic dance increases blood circulation; reduces cholesterol and high blood sugar and ensures that circulation of oxygen within the heart, lungs and blood vessels which ultimately reflect on the wellbeing of participants. Furthermore, it builds immunity; encourages creativity; and reduces stress. Aerobic dance is not continued to one specific place, it could be done at home and it is fun-filled (Petterson, 2011).

Overview of Circuit Training

Circuit training involves a set number of designed physical activities performed at each designated stations to make void of exercising the same group of muscle consecutively. Each exercise takes place at a station for a length of time e.g. 30secs, or a set number of times. It is the most adjustable training pattern and can be devised or modified to develop any components of the fitness. After finishing unit of exercise motion, the participants move on to the next station for another exercise. Another way to use a circuit is to have a skill circuit for a particular sport. In this case, instead of doing different exercises at each station, a skill from a sport can be practiced. It is an improvement of cardioresipratory fitness that leads to resistance and endurance improvements. An effective way of developing and maintaining fitness all rounds is by completing three to four at least 20 minutes at 3 days in a week.

Gettman and Pollock (2001) analyze the following circuit training guidelines:

1. Creation of 6 to 12 exercises or path which target the entire participants' body.
2. Each exercise is performed for 30 to 90 seconds; and rest for 15 to 30 secs between each station.
3. Completed 2 to 4 times per week.
4. Opt weights/resistance that allows performing the exercise for the entire period of time for challenge.
5. Based on the training improvement, increase the exercise time, increase the weights or resistance used, i.e adding more difficult exercises, or decreasing the amount of time one rests between stations.
6. By increasing the intensity at each path and the rest time between stations to allow full muscular recovery between the exercises (muscular strenghth).
7. Decrease the intensity of the exercise at each station while increase the length of time spent at each station, and shorten the rest between stations to keep heart rate elevated continuously (cardiorespiratory endurance).

The advantages as reported by Gettman and Pollock (2001) include:

1. It includes fitness in all round,
2. having strength, endurance, power, flexibility and speed through aerobic and anaerobic activities,
3. involves people of all levels of fitness, ability and makes people work hard and can be highly motivated to succeed,
4. also uses a wide range of activities,

Fleck and Kraemer (2004) maintained that the benefits derived from circuit training can also be equated in aerobic dance, because it also improves cardiorespiratory fitness. This is an example of circuit training programme:

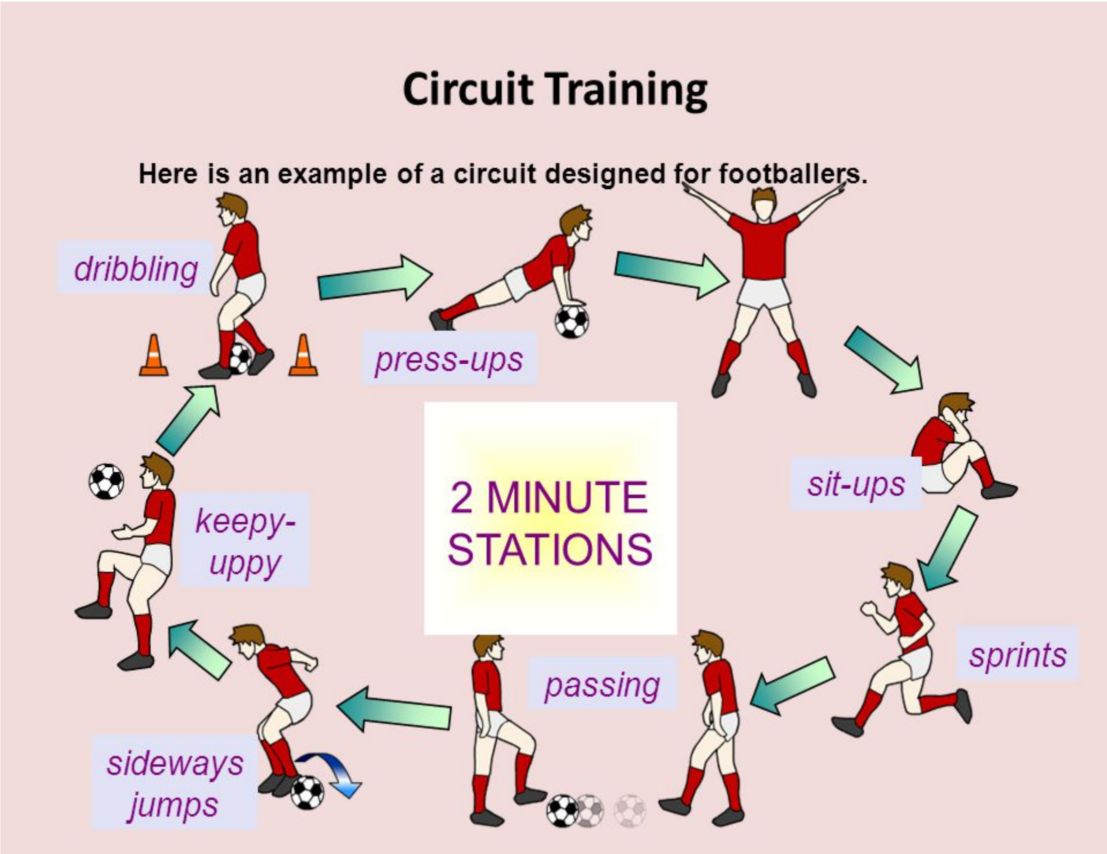


Figure: 3 circuit training

Cultural and Social Dimensions Effects of Obesity Epidemics in Africa

There are elements of cultures which make individuals susceptible to obesity. In Africa, individuals that are obese or overweight are assumed to be rich, attractive, influential and self-sufficient and generally regarded as successful, affluent and comfortable. In Africa culture recognizes tribes to be royal and warlike as a result of the kind of fatty foods and carbohydrate consumed by them. This explains why some diseases are rampant in certain parts of Africa and among some ethnic groups. Categorization of people is done in Africa based on ethnicity which is characterized by culture, language, ancestry, background, religion, traditions, dietary preferences and history. The preferences of specific cultural backgrounds encourage obesity. For instance some cultures place pride on the fatness of women so they ensure young girls go through the fattening process before marriage (Rguibi and Belahsen, 2006).

The acceptability and recognition that obesity enjoys in Nigeria has shifted the perception of the majority from it as a health challenge as reported by Iloh, Amadi and Nwakwo (2010) conducted a survey on obesity reported 9,296 obese adults in Nigeria. The study found that 14.8% admitted to being obese. 46.5% admitted that change in lifestyle could encourage obesity. Meanwhile, more than half of 72.3% of those with knowledge of modification of demonstrations of lifestyle low knowledge level. It is evident that social and environmental; sedentary living and improper diets are factors that significantly predict obesity. The findings of Oyeyemi, Adegoke, Oyeyemi, Deforche, Bourdeaudhuij and Sallis (2012) revealed that environment that does not allow for exercise activities due to high level of crime and bad road networks could breed overweight and obesity. Their study also found that women were more susceptible to obesity compared to men based on environmental, social and lifestyle factors aforementioned.

Other studies have also investigated on obesity as it related to lifestyle. Mokhtan *et al.* (2001) noted that some fatty foods that could lead to obesity are associated with social status in some African countries; this indicated that in Tunisia and Morocco, female youth take beyond the required calories, also high fat intake as reported in Tunisia as high as 31 percent higher while in Morocco the carbohydrate intake is between 65% and 67%. Deficiencies in micronutrients and increased rate of malnutrition have become public health issues. As revealed in current investigations Tunisia is witnessing abundant supply of food, a situation that has positive and negative effect. Positively, it could encourage consumption of balance diet while it could also negatively lead to overeating, which leads to overweight and obesity as it was reported by Tessier, Traissac, Maire, Bricas, Eymard – Duvernay, El-Ati, and Delpeuch 2008).

Likewise, media advertisement and cultural traditions were also factors that could influence obesity, although the findings of Allegri, Turconi and Cera (2011) noted that they do not significantly predict obesity. They however noted that the environment significantly impact on diet which could determine the degree of obesity. Unrestrained viewing of television has also been found as another social factor that could lead to obesity. Studies have shown that cardiorespiratory disease risk factors, too much of eating high calorie, lower energy expenditure and high-fat foods could be linked to much more screen viewing (television). A study carried out among Americans of Cuban, Haitian and African descents showed that obesity could become rampant among this population as the average time spent before television by them daily was five hours (Huffman, Vaccaro, Exebio, Zarini, Katz, and Dixon, 2012). The study by Sission, Shay, Broyles & Lewa (2012) corroborated the earlier findings, noting that better dietary has been made possible among a selected group in the USA as a result of controlled television viewing. They noted that sedentary lifestyle could also be eliminated if some electronic gadgets were avoided.

The misconception of black women in South Africa associating thinness with HIV/AIDS as documented by Arojo and Osungbade (2013) noted that these women engaged in over consumption of fatty foods and sedentary living, thereby encouraging obesity. In the same vein, Davidson and Knafl (2006) found that fatness depicted beauty in some communities. Onayemi (2004) cited in Arojo and Osungbade (2013) found the preference of Yoruba men for fat women agains thin women. Overindulgence in consumption of fatty food could make individuals susceptible to type 2 diabetes (Kruger, Puoane, Senekal and vanderMerwe, 2005). Relationship has also been found between obesity and hypertension. The study of Akintunde, Akinwusi, Adebayo, Ogunyemi, and Opadijo (2010) established that hypertension was an offshoot of obesity as two thirds of hypertensive patients had obesity.

Obesity Epidemic Trends in Africa

High epidemics and increase in obesity among youth in some African countries has been reported by Arojo and Osungbade (2013). Environmental and developmental factors have been identified as major causes of this rise (Rudkowska and Perusse, 2012). Inactivity, rapid urbanization and change in nutrition have also be found as significant contributors to diseases and rate of death in Africa (Oyeyemi *et al.*, 2012). The perception of Africans on fatness, thickness of the body as signs of good health and prosperity has to change before the fight against obesity could be won in Africa. Several ethnic groups in Africa need to be reoriented on the impact of fat on health. Moreover, it is clearer now that different racial groups with different ratio of fat-to-lean tissues at BMI equivalent and the magnitude of the multiple co-morbidities associated with high BMIs may also differ among different ethnic groups for reasons that may reflect the impact of environmental–genetic interaction.

Obesity is not limited to Africa, WHO (2015) noted that worldwide spread of obesity is becoming rampant, especially among children and infants. This development has also been found to be rampant among low- and middle-income countries (LMICs). In 2013, some 42 million children (8.5%) have been reported as overweight or obese. 12 million children in Africa, as at 2010, have been reported as obese or overweight. This record could escalate to 12.7% by 2020. Asian record put obese and overweight children at 70 million (4.9%). If the situation continues the record would be overwhelming by 2025.

Likewise in USA, the count of children and youth obesity which was 7% as at 1980 had increased 18% by 2012 (Ogden, *et al* 2012). In Lagos, Nigeria, it was gathered that obesity among male adolescent was 33.1% while that of female was 54% (Johnson, 1999). WHO (2004) put the statistics of obese persons in the world at 300 million. The 2015 report of the same organization noted that the figure has soared to 700 million. The growth of obesity all over the world seems to be on the increase despite mobilizations against it. It could therefore be inferred that further ideals need to curtail the spread of obesity.

The perception of people in the developing countries is worrisome as this consider obesity the sign of elitism (*WHO, 2012*). Obesity has the tendency to aggravate other disease conditions in the body (Arojo and Osungbade, 2013). The most conspicuous factor that has been observed especially in Africa as a leading cause of obesity is the change in diet occasioned by socio-economic development and modernization. Multinational companies provide refined foods containing high fat, oil and carbohydrates which in turn worsen the health of individuals that consume them. Ease of transportation and automated work environment occasioned by technological advancement also contribute to spread of obesity in developing countries (Arojo and Osungbade, 2013).

Issues relating to gender and obesity have also been investigated in several studies. The study conducted by Kanter and Cabellero (2012) found female to be more prone to obesity that men. Their study also affirmed that women eat more sugar than their male counterparts. However, the change in diet of individuals as a result of socio-economic change has affected th weight of both male and female gender in recent studies. As recorded by Gupta, Goel, Shah & Misra (2012), male and female children also have their share of obesity in Africa with Northern Africa recording the highest: in every six school aged youth, one is obese. In south Africa, obesity among males and females aged 9-18 was 17% and 11% respectively. Gupta, Goel, Shah &Misra (2012) presented the following on record of obesity among pre-school children in Africa: Eastern (7%), Middle Africa (9%), Southern Africa (8%) and Western Africa (6%).

Age, environment, ethnicity and level of education are identified as factors contributing to obesity and weight gain. \this finding was made in South Africa by Puoane et al. (2008). Ziraba, Folso and Ochako (2009) reported that obesity cannot be classified by financial status as both the rich and the poor are said to be obese at very close range. Musaiger (2011) however noted scarcity of statistical data on the rate of increase in obesity and overweight in North Africa. Godwin (2006) noted that obesity in Nigeria began with discovery of oil which led to prosperity that encouraged affordability of food. Arojo and Osungbade (2013) also found that obesity is prevalent among the less educated females in Nigeria and majority of them live in urban areas. Another study by Kruger, Venter, Vorster and Margetts (2002) also established that women in the city have higher level of obesity comparing with rural women were found of lower mean of BMI compared to their counterparts in urban area.

The shifting of rural areas to the city in South Africa has been identified as one of the causes of obesity as migrants are exposed to modern food filled with sugar, fat and oil (Pieters and Vorster, 2008). A study on weight and diet loss compared Kenyan and South African women. The study found that rural women in both countries had lowered liable of obesity compared to those living in the city. This collaborated with the fact that Body Mass Index increases with age and abdominal obesity also increases with age. A report from Nigeria on urban and rural dwellers obesity also established that those in rural areas have lower cases of obesity compared to those residing in the urban areas. Age was also correlated with weight increase in the study.

The white, Asian and black population of South Africans who were economically buoyant were compared in relation to obesity. The investigation revealed that white men had higher number of obesity compared to black men. However, black men have higher percentage of obesity compared to the black women. Asian men and women had lowest percentages of obesity. Increase in obesity has been linked to globalization and urbanization. The effect of globalization and urbanization has impacted greatly on the taste and preference of the population as foods that are rich traditional food that have better nutritional values are ignored in favor of processed food that lack good nutritional content. This socio-economical change could lead to further degeneration of health as obesity has greater tendency of stimulating other maladies. In other related visible study, physical inactivity has been found to be associated with high level of obesity among the women in African in suburban and urban areas (Kruger *et al.*, 2002). This is evident in the free movement of South Africans as they interact internationally on economic issues thereby getting exposed to several eating habits that could predispose them to obesity (Bourne, Lambert and Steyn, 2002; Senekal *et al.*, 2003). These changes in eating habit have led to accelerated ageing process, emergence of diseases, early death occasioned by heart diseases (Tucker and Buranapin, 2001).

Arojo and Osungbade (2013) have established that public health is one of the major issues is obesity among the adolescent population locally and globally. Excess calorie intake and low energy use combined with gene, behaviour and environmental changes have been at the frontline of causes of obesity (Karnik and Kanekar, 2012). The most threated population among the youth all over the world is the female gender. Obesity becomes conspicuous in the female youth from age 10 (Monyeki, Vanlenthe and Steyn, 1999). A study that focused on 447 children from rural areas found that obesity may not be so conspicuous in boys until the age of fifteen. At age 17, the sign of obesity could be so evident as it reflects in the thickness of their skin (Cameron and Getz, 1997).

Prevalence of obesity in Nigeria

Nigeria has begun to have her own share of the prevalence of obesity and it has gradually started attracting the concern of health workers, the government and households being plagued by the disease. This rise in obesity has spanned over twenty years in Nigeria (Morrill and Chinn 2004). Increase from 12.9% to 27.3% as reported by Popkin (2007) could be seen in the increase of obesity among youth from Nigeria. This anomaly could be blamed on adults as they are the determinants of food consumed by their children. Obesity is a great burden to the person suffering from it, hence it could be said that the Nigerian population would have several issues to contend with in the future as the number of persons that will have several complications resulting from obesity would affect the economy. In the United States, statistics revealed that cases of obesity escalated from 4% in 1965 to 15% in 2001.

Luckner, Moss and Gericke (2012) in a study found that Italian youth also recorded 4.2% cases of obesity. The record in Nigeria is higher than this. For instance, the record in Oyo state as at 1991, the youth in the urban area had 4.8% while those in the rural areas had 4.5% of obesity cases. In same Nigeria by 1995, Kwara state recorded 9.5% and 6.3% among urban and rural youth respectively among school age youth (*Nigerian Tribune*, 2007). This could predict a great health challenge through obesity and overweight among the school age youth. Alade and Ezeokeke (1990) also reported obesity on the percentage of 44.6 and 26.3 among the University of Ilorin female nurses and University of Ilorin female undergraduate students respectively. The report of Johnson (1999) on obesity among Lagos state youth revealed that male accounted for 33.1% while female was put at 54% of the population sampled.

The increase in cases of obesity was also reported by Ayenigbara (2010), recording an icrease of 0.9 to 2.7% among females aged 16 and male from 0 to 1.9%. Ealier studies had recorded increase but this report is a complete deviation. Some of the earlier studies have recorded 3.2% for male and 5.1% for female (Akesode and Ajibade, 2003). Inconsistencies that have been identified in the reports above could also be as a result of sample sizes that were not the same. In Nigeria, nutritional deficiencies lead to the cause of overweight and obesity. This does not signify absence of food but wrong combination of food being eaten. In some situations, it is even over-nutrition that is responsible for obesity despite the fact that Nigeria is a developing country. Individuals tend to focus more on spending money that should be invested on feeding. This assertion has been corroborated by Wang and Lobstein (2010) that over-nutrition is gradually becoming a challenge in developing countries as individuals have developed new taste resulting from modernization. New types of food tasting sweet and delicious but lacking nutritional value has become appealing to growing percentage of youth in developing countries, thereby increasing the risk of obesity. Obesity was measured using skinfold thickness among youth, it was found that obesity was 0-2.4% in males and 0.8-3.8% in females. Monyeki *et al,* (2006) also made findings that aligned with this conclusion.

Obesity among youth in Nigeria, especially among those that are resident in the urban areas has grown to a stage of concern. In Ibadan, 43.2% were found to be obese (Adebayo, Ige, Ilesanmi, Ogunniyan and Ojo, 2011). In Ilorin, larger percentage of female gender was also found to be obese (Alade and Ezeokeke; 1990). In Niger-Delta, among the Kalabari tribe, 49.34% of persons between 20-70 years were found to be obese (Adienbo, Hart and Oyeyemi, 2012). Increase in obesity has almost tripled from 1980 t0 2002 (Ogden, Flegal and Carroll, 2002). The risk of obesity is high among female youth in every part of Nigeria (Ajala, 2006). The need to reduce the rate of increase in obesity has been canvassed by Healthy People (2010).

Contributions of Centers for Diseases Control and Prevention (CDCP) (2007) recorded that 5.2 million college students are obese. Philips (2013) found that obesity is on the increase because nine out of ten students do not eat recommended daily fruits and vegetable servings; six out of ten do not engage in recommended exercise that should last for thirty minutes at least three times a week. From the perspective of Lang (2003), late night eating, overeating during weekends and eating of over refined foods contribute to obesity among college students. Levitsky (2013) affirmed that eating at the cafeteria and free flow of foods significantly contributed 20% to cases of overweight among college students. The discovery of Cornell (2011) shows that first year students amassed 0.3 pound weekly, weight that surpasses that of average 18 to 30-year-old American 11 times, 21 times higher than that of adults. In addition, sedentary living resulting from long lectures, fattening foods taken during night study, alcohol and overindulgence are some other contributing factors to obesity among college students.

Strategies for Prevention of obesity

In many human cultures all over the universe, obesity had been linked with physical attractiveness, strength and fertility. In some other cultures, African cultures inclusive, obesity has equally been considered as a symbol of wealth and social status. Nevertheless, there are some modern western cultures that regard obese body shape as unattractive. Social stigma and negative stereotypes are commonly associated with obese adults and youth in such a culture. In western culture, contrary to what obtains in the developing nations, lower socio-economic status has been related to obesity. Whichever one belongs to the fact remains that obesity has increasingly been resulting to the problem of public health.

The good thing about obesity is that it can be prevented through lifestyle modification. Asinobi (2007) opined that the prevention of diseases such as obesity and overweight is very important because, scientists have proved that chronic diseases of adults have their origin in childhood, even while yet in the womb. The risk factor is that youth obesity has been accompanied with numbers of serious critical conditions like; diabetes, coronary heartdisease, hypertension, cancer and stroke, asthma, breathing problems, gallbladder disease and depression just to mention a few (BlomNoffinan, 2004; Asinobi, 2007). The concern of this research is to indicate the preventive measures that the parents/guidance and the school personnel can employ to reduce the incidence of youthful obesity. It becomes important therefore and much more economical beginning to preventive efforts early in childhood, especially as obesity and overweight in youth stage has become the stronger predictor of obesity in adulthood.

Causes of obesity

Obesity and overweight has resulted to a combination of many factors ranging from genetic, environment and negative behaviours. Most people believe that excessive nutrient intake combination is the main cause of the epidemic. Akinpelu,Oyewole and Oritogun (2008) explained that obesity normally evolves from practical, where the eating pattern fails to adjust to a decline in physical activities, increasing energy intake and decreasing energy expenditure. They further explained the following:

1. ***Lack of Activity***

Akinpelu, Oyewole and Oritogun (2008) stated that lack of activity had been a major cause of obesity. The research they conducted revealed that there are less activity among the obese than lean people. When lean people intake of calorie was controlled, they were still active but when people with over fat in the body lose weight they do not become more active either. It boils down to the fact that change in weight does not affect the level of obese people’s activity. It has been observed too that school run has made youth to become less active too. About two or three decades ago, youth and youth would trek or walk to school and back home. Today, the reverse is the case where cars are already stationed at the gate of school to convey the children home, while the less wealthy will board the school bus home. When children are out of school, the main activity they often engage in is television viewing or listening to music. In addition, parents would prefer to lock up their children in their flat rather than allow them to play as at when due.

2. ***Eating Wrong Foods***

In this regard many people are victims of the prevailing factors in their environments. In developing countries for instance, people eat what is available and not what they need to eat. This kind of attitude has been linked with poverty. In Africa, most of the staple foods prevalent are carbohydrate based. So, majority rely on energy-dense meals and diets. Correspondingly in developed countries, people often eat wrong foods for lack of adequate nutritional knowledge. For instance, the availability spread of school information on nutrition and on the internet, Centre for Disease Controls and Prevention (2007) indicated that overeating remains a substantial problem in most developed countries. In developing countries, increased marketing and advertisement of junk food to children have been linked to public health problem. Furthermore, upward review of salary correspondingly, increased the number of restaurants and takeout meals. Such meals are not often the best for the family.

3. ***Sedentary Lifestyle***

Sedentary living equally is a significant role in the levels of obese youths. The prevailing environment in our society has established negative agent's which result to physical inactivity and increased in caloric consumption (Morrill and chin 2004). In addition, many workers spend their entire workday behind desks or computers and not for one day in a week have time for exercises. Others would stay back after working hours to do overtime in a bid to make more money as they are not there to give examples to adolescent on how to recreate. The clarion call therefore is that, government policies, parents and caregivers need to address these causative factors from youth' environment. Consequently, to evolve preventive strategies for youth and adolescent obesity prevention is said to be better than cure and cost less too!

Management of obesity

Obesity emanates from several factors and has long term effects which reflect on all aspects of human endeavors. It affects attitude, physiological features and other internal organs of individuals suffering from it. Obesity and overweight are reported to be on the increase among youth all over the world. Withers (2004) discovered that 72.5 million obese adults were recorded in USA as national epidemics. The prevalence of obesity was also recorded in 2007 and 2008 in which 32.4% were among men and 35.5% were among women (Daniel, 2009). It could be concluded that about 6% of American adults have BMI of 40 kg/m2; 31.7% of American children are overweight; about a quarter of 17 to 24 years old Americans are too heavy for military engagements. The cost of treatments related to obesity as at 2006 was $147 billion. Persons with cases of obesity were said to have spent $1,429 more than persons that have normal weight (Mayer, 2006).

The second foremost source of deaths that are preventable in the US has been identified as obesity. Obesity is also responsible for above 112,000 preventable deaths annually (Russel, 1996). Several factors could have been associated with obesity. Obesity is protractive in nature and has tendencies to affect an individual's entire life. Every organ of the body is usually affected by obesity. Obesity is better prevented than treated in view of evidences that it is virtually incurable and that, obesity predisposes individuals to chronic diseases such as; diabetes, gall bladder diseases, cardiovascular diseases, osteoarthritis, back pains, cancer, hypertension and others. (Stewart and Brook, 1983; Alade, 2001; Lucas and Gilles, 2003; and Ajala, 2006). Therefore, the following preventive and management measures through lifestyle modifications may be adopted:

1. ***Healthy Lifestyles Education*:-** people valuing health as a worthwhile assets as an objective of health education in order to live a long life and feel well; and to obtained what they can do as individuals, families and communities to protect and improve their own health. When people value health, they will be willing to modify their lifestyle and safeguard the promotion of their own health. At the personal level, individuals need to prepare effort made on such matters as; exercise, diet and discipline with regard to food consumption. In effect, health education is designed to alter attitudes and behaviours in the matter concerning health. The more people know about their own health, the better they are able to take appropriate measures in such personal matters as diet, exercise, use of alcohol and hygiene. In order to ensure health problems detections earlier, it is important to educate the public about the danger signals that could indicate serious illness and to encourage them to seek help. Whenever these occur, for example chronic cough,

abnormal bleeding, overweight, lump in the breast and others, they show serious signals, that beg for attention.

2. ***Physical Exercises*:-** Physical exercises have been recommended by experts to enhance optimum health because of its value in strengthening the muscles of organs and systems in the body, improving respiration, absorption of nutrients, fighting chronic diseases, and burning excess fats in the body (Ajala 2006). The objective of any exercise should be to prevent any accumulation of excess fat under the skin. So, the basic principle in using physical exercises to prevent obesity is to balance energy expenditure. Individuals may be involved in deliberate participation in exercises such as jogging, bicycling, playing games, swimming and aerobic dance. Other exercises may be those involving one's job or household chores such as; tilling the ground, washing of clothes and plates, yam pounding, sweeping, grinding and so on. These latest exercises are particularly useful in the rural areas where sports' facilities and equipment are non-existent. It should be noted however that exercises which involve the large muscles of the body are recommended for preventing obesity. To this end, individuals should cultivate the habit of performing their responsibilities by themselves rather relying on house helps. Nevertheless, before individuals embark on physical exercises, particularly the vigorous ones, medical evaluation is important.
3. ***Nutrition Education*:-**Adequate knowledge about nutrition *vis-à-vis* value of nutrients in the body, its relation to optimum health maintenance and health promotion is essential. To prevent and manage obesity, the individual should have knowledge of what to eat, the caloric value of the nutrients, and the quantity to consume. Ability to choose the right type of food from available varieties is also essential and depends on individual's age, sex, situation, occupation and health status. Again, one should have adequate knowledge of calorie dense foods, which is a food with high concentration of energy which must be avoided. Such foods as rich in fats, oils and sugars must be substituted with foods or low calorie concentration as cray fish, fish or chicken for beef, garden eggs and others. To this end, Ajala (2006) suggested that, one should avoid too much fats, saturated fat and cholesterol but shift to adequate amounts of starch and fiber such as; vegetables, fruits, potatoes, yams, corns, peas and grain cereals more often.

4. ***Medical Examination*: -** Regular medical examination is necessary in preventing and managing obesity and its onset, particularly among children. Routine periodic medical examination is required to detect any complications that may require medical attention. Such medical examination should also provide the opportunity for discussing with patients about their health problems and their needs. It should include screening for body type and whether the individual is likely to develop obesity or is already obese. The outcome of such medical examination could be used to place the individual on special diet, drugs or exercise as may be found appropriate. Moreover, when one is obese, it's important to go for regular medical check up to assess its impact on the organs and systems of the body.
5. ***Pharmacologic Treatment*:** - Treating obesity is difficult (Lucas and Gilles 2003), and crash diets are rarely successful. Also, the use of reducing drugs does not have a lasting effect on weight reduction (Alade 2001). Therefore, other therapies such as; diet and exercise may be combined. Nevertheless, it is affirmed that,orlistat and Sibutramine drugs could be used for weight reduction (*Concise Oxford Medical Dictionary 2003*).
6. ***Surgical Operation*:-** Obesity may also be treated through surgical operation. Two commonly adopted surgical operations involve the creation of a short bowel of malabsorption production of ingested calories, and the creation of a small stomach so as to reduce reservoir of food intake. Both methods require the best of medical practice for the operations to succeed. Besides, serious complications do exist such as; hypokalemia, hypoglycemia, hepatic toxicity, renal calculi and polyarthritis. Other potential operative risks, according to Alade (2001) include; anastomotic leaks, transient gastrojejunostomy, obstruction, pulmonary embolism among others. On account of these problems, in addition to the cost of operation, the risks of high mortality, morbidity, and failure rate, surgical operation as a treatment option for obesity is very unpopular in Nigeria.
7. ***Attitudinal and Cultural Change*:-**Among Nigerians in the rural areas and semi-illiterates in urban centers, endomorphs with protruded bellies, short and thick necks and flabby arms are accorded a lot of respect and adoration by members of the public. These reverence and praises accorded these obsessed, more often than not, were borne out of

ignorance. This tradition should stop as it encourages them not only to put on more weight but also to maintain it.

Aerobic Dance Exercise Effects on Body Composition Variables

The need to prevent the widespread of obesity has come to the fore considering its high rate of spreading among children. Obese children and youth usually grow to adulthood as obese (Ogden *et al*, 2006). A correlation has been shown in frequency of follow-up and achievement in treatment of preadolescent obesity. It has also been pointed out that post weight reduction maintenance is poor in both adult and children (*America Obesity Association, 2006*). This explains why it is better to adopt a preventive approach to reduce obesity in children. Children need to be introduced early to exercise in order to prevent gaining undue weight and becoming obese. If children develop this habit of exercising early, it could help them in maintaining good body structure as energy is constantly dissipated. Increased weight is an offshoot of low use of energy and high intake of energy building substances (Mayer, 2006). Russel (1996) found that inactive preschool children would gain more triceps of subcutaneous fat at about four times compared to the active ones.

The significance of a 6-week aerobic dance programme has been reported by Okuneye, Adeogun and Idowu (2010). They noted that the programme had positive response of WHR in adult males' fitness. Improved leg power, flexibility and muscular endurance have been identified after the completion of the programme. The aerobic dance significantly decreased the WHR, improved the flexibility of the trunk, leg power and endurance/strength abdominal. A major threat to health which provokes obesity is sedentary lifestyle. Sedentary living weakens tissues of the body and makes the body susceptible to all forms of diseases. Early intervention is therefore paramount to ensure that the spread of obesity is curtailed on time (WHO, 2004). Good nutrition habits and regular exercise are cardinal to preventing excessive fat and excessive weight gain. Several restorations have been witnessed due to exercises as worsening medical conditions were eliminated (Fatima, 2011).

The perimeter of the waist is usually measured to determine how fat an individual is. The circumference of a female's waist should therefore not be more than 88 cm to avoid the risk obesity (Olson, Williford, Blessing and Greathouse, 2008). Several studies attest to how aerobic dance exercise has influenced suppression of obesity. Consistent and regular aerobic dance ensures reduction of overweight and maintenance of smart and moderate body weight not susceptible to diseases. Coronary artery diseases could be reduced through weight reduction achievable by aerobic dance exercise (Terbizan and Strand, 1998). Furthermore, Terbizan and Strand (1998) noted that excess body mass (weight), body mass index (BMI) and %bf were reduced, resulting from aerobic dance exercise. A study that centered on an aerobic dance group found that reduction of BMI and the %bf were a major accomplishment of the exercise. Comparing this group to control group, it was evident that the BMI and level of excess weight loss was far better compared to control group. This was further established through measurement of the perimeters of the waist which reduced greatly with aerobic dance compared to control group ($p<0.05$) (Fatima, 2011).

12 week dance aerobic as found by Corbin and Pangrazi (1998) resulted in lessening of the fat composition. The same has been corroborated by Olson and others (2008) in their findings. Body weight reduction has also been found after six weeks of treadmill exercise which involved seven women within the age range of 21.0±0.8 years (Szmedra, Lemural and Shearm, 1998). In another related study by Amano, Kanda and Maritani (2001), a significant decrease was recorded among obese male and female population based on twelve weeks of aerobic dance for thirty minutes, three times a week. The decrease reflected on BMI, fat mass, %bf LBM.

An earlier study has also discovered that aerobic dance could generate more result with nutritional, leading to loss of body fat and LBM (Amano, Kanda and Maritani, 2001). The line of the waist and waist-hip ratio are paramount in detecting central obesity. It is however true that obesity could be conspicuous but the standard measurement is through the waist and the hip. It is appropriate to conclude that if aerobic dance could result in significant waist loss, it could therefore be effectively engaged for physical fitness and a panacea to some risk factors associated with sedentary lifestyle.

Obesity and percentage of body fat

The percentage of fat in the body is usually referred to as body fat percentage. The entire weight on a scale is total body weight, which includes muscle, organ tissue, blood, fat and bones. The total body weight can fluctuate daily due to hormonal changes, diet and stress. The ratio of body mass lean to mass of body fat is known as composition in the human body. It is essential to know the required level of body fat required for the entire being of an individual. Although fat have some benefits to the body as fat plays a cushion effect to certain organs and tissues. There is certain amount of essential fats in the body that is used to cushion organs and tissues, regulate body temperature and store energy. Knowing and controlling percentage of body fat, not only help to make realistic weight loss goals, but it can help to prevent many problems of health such as; diabetes, different cancers, heart diseases, metabolic and diseases of cardiorespiratory.

Body Mass Index and Obesity

The BMI is the technique adopted in measuring fat in an individual's body fat by calculating the weight and the height. Premium is placed on BMI by health specialists to determine obesity. 61 million adults in America are considered as obese, based on current statistics. The percentage of youth and children that are overweight is put at 15 while those that are at risk of being overweight are also 15 percent. Obesity among youth is growing at an alarming rate in the US and this has become a concern of the nation. This situation has grown worse to the point that diseases associated with adulthood are now becoming pronounced among youth (Petterson, 2011). According to Connie (2011), BMI could be determined according to the following:

BMI formula;

BMI chart; and

BMI calculator.

Each of these methods would yield similar BMI result. Having determined BMI number, interpretation could be made. For adults, standard weight measurement that is suitable for both male and female could be used.

Teens as well as men could use the BMI chart for women. The division of a subject weight in kilograms by height in meters squared ($BMI=kg/m^2$) is the mathematical formula to arrive at BMI of an individual. The mathematical formula considers the stature and body mass of the participants, excluding gender. The BMI chart has predicted several age variations and keyed them in the chart to ensure ease of calculation. The chart does not discriminate as it could be used by anybody.

The height and frame are essential in calculating the percentage of the body fat and weight. A male should have body fat of 2-4% on the average while that of female should be 10-

12%. However, for athletic women, the body fat should be 14-20% while that of male should be 14-20%. If a female weighs up to 32% or more, such is considered obese while a male is considered obese on 25% or more (Shorts, 2002).

Whithers (2004) observed that accurate result may not be generated when body fat weight scales are used. Waist, hip and wrist size that a major parts considered in determining the body fat percentage are impossible to measure using bathroom body fat weight scales. It is also impossible for the scale to measure muscle. Between muscle and fat, which weighs more? This is recommended for further study. There are divergent opinions on this. While some experts maintain that muscle and fat have equal weight, others opine that muscle has higher weight than fat as muscle is made up of heavy tissues and has 70% of water.

Reducing body fat and weight has been found to be a difficult task. A major element of human body is body fat. It facilitates the normal functioning of the body in conjunction with water, muscle, bones and organs. Maintaining the required percentage for body fat is also essential for proper cushioning of the body. Energy is stored in the body fat which is also known as "essential fat'' and maintains the temperature of the body. Reducing excess fat requires reduction in the quantity of fatty foods and engagement in certain exercises to ensure high level of energy released and % lower of consumption. This will ensure burning of calories. In summary, eating less and exercising more ensures faster reduction of calories (*WHO, 2004*).

The soaring record of obesity all over the world has propelled the *WHO* (2002) and the *National Institute of Health (NIH)* (2009) to adopt a standardized measurement for obesity and overweight (Tates, 2001). Adjusted body mass for stature is BMI in kg/m^2. Practitioners have adopted these measurements as standards in determining patients that are obese and overweight. The major postulation of body mass is adjusted for stature squared. A dichotomy has also been established between overweight and overfat individuals. Body builders could have higher weight but their BMI could remain within the normal range. It has however been observed that these special class of people are not many compared to the entire population of overweight persons who do not have BMI within the acceptable range. However, evaluating these set of individuals in terms of body fatness might be confusing.

There is a want of literature on how body fat leads to sickness and death. More empirical studies are needed to substantiate this observation. There is also no consensus on the ranges for fat in the body; there are also limitations to ranges that are said to be empirically. Jackson and Pollock (1999) in their explanation noted that the chart for body fat has the age column at the left side and the percentages/ colours depict lean, ideal, average, and above average ranges. The ideal percentage for body fat of a 30 year old man should be between 10% and 16%. When it is on the average, it should be between 18% and 22% (*Appendix 3*). Increase in age is also usually accompanied by considerable body fat. Three types of fat have been identified: subcutaneous fat, visceral fat and intramuscular around the body muscle. During growth the visceral and intramuscular increase but subcutaneous does not.

Cardiorespiratory Response to Aerobic Dance Exercise

The amounts of oxygen intake maximally have several benefits which is accomplished between 50% and 80% of the heart rate in aerobic exercise. It has been affirmed that part of the all-inclusive treatment program for overweight and obesity is the aerobic dance activity. Aerobic dance could therefore be recommended as part of contributors to reduction of abdominal fat, boosting of cardiorespiratory fitness, and regulating body mass loss and obese. The popularity of step aerobics dance exercises has soared high in fitness and weight loss programmes (Loss, 2002). Several cardiovascular problems have been correlated with body fat as Blair (1993) affirmed the possibility of aggravating chronic diseases resulting from strains which the excess fat has placed on the body. One of them is high blood pressure disturbing the normal heartbeat.

There are several health benefits that individuals could derive from aerobic dance exercises. With aerobic dance as discribed by the analysis of American College of Sports Medicine (2000), cardiorespiratory health could be improved; decrease in high blood pressure could be achieved with metabolic variables such as weight management. An individual body can also improve in muscle strength, coordination, flexibility and balance through aerobic dance. With aerobic dance exercise, mental health could also be improved. Self-esteem, less stress and confidence are some of the mental health benefits accruable from a healthy body achieved through aerobic dance exercise.

Increased blood pressure develops from fat accumulated around the arterial blood vessels because of its predisposition. When there is a rise in the pressure of blood around the arteries beyond the expected pressure results to arterial hypertension due to high blood pressure.

As at present, millimeter of mercury (mmHg) is being used as the current unit of blood pressure. However, the need to review it is being considered by the European Medical Commission (Fahey, Insel and Roth, 2000).

Strokes and heart attacks could easily develop among persons with high blood pressure. The difficulty experienced by blood in penetrating the arteries as a result of accumulated fat in the vessel, leads to the rise in the pressure applied by the heart, thereby forcing the heart to apply more pressure than expected. Engaging in several aerobic exercises could drastically reduce high blood pressure, although persons suffering from hypertension usually depend on several medications to control it. It has been recommended that engaging in aerobic fitness movement for 30 minutes, five days in a week would drastically reduce high blood pressure (*The American Heart Association, 2000*).

Influence of age on cardiorespiratory fitness

Age and complexion contributes significantly to high blood pressure developing risks factors. Persons that are beyond the age of 55 could develop in high blood pressure. This establishes that obesity alone should not be seen as the only cause of high blood pressure. This has been affirmed by Fahey, Insel and Roth (2000) who noted that old age predisposes individuals to high blood pressure. Moreover, they also established the fact that black persons have higher risk of being hypertensive compared to other complexions. This assertion has however not been concluded as recent studies are still trying to differentiate the difference between black people who are in Africa and those that have never been on the African continent. Studies also have established that men have higher risk of hypertension compared to women whether at old age or at young age (Winnicki, 2006). The risk of high blood pressure could also be lined to family history. As such persons with such history have higher risk compared to persons without it.

The heart could become weak when individuals do not engage in exercise; when persons cannot endure long exercise and when persons are obese. Food intake has also been seen as a major factor that could result to high blood pressure risks. Canned foods and high content of salt in food are also seen as dietary factors that could lead to hypertension. The intake of imbalanced diet leads to obesity and overweight which could significantly predict high blood pressure

(Fejerman, 2006). In developing countries, owing to transition being experience in nutrition, there is an increasing number of cases of obesity and overweight is such countries (Cheong, Kandiah, Chinna and Saad, 2010).

Aerobic exercise is needed by both healthy individuals and those that are suffering from either obesity or overweight as the exercise could significantly improve the respiratory organs thereby helping the heart to function well (Solda and Davey, 2009). Oxygen needed to keep the heart in good working condition is inhaled at considerable level during aerobic exercise, thereby forcing carbondioxide out of the body. The aerobic exercise allows for increase in pulmonary ventilation and brings oxygen diffusion into the lungs (Lancaster, Halson, Kha, Drysdele and Jeulkkendrum, 2003). Pulmonary diffusion is the process through which oxygen circulates from the lungs into the blood stream. When blood is enabled by oxygen, it passes along side of the blood stream to the muscles, where it diffuses from the capillaries in a process known as capillary diffusion carbon dioxide from the muscle follow the reverse pathway (Gannon, Rhind, Shek, and Shepard, 2002). Exercise increases diffusion of the pulmonary system, or exchange of gases inside the lung, during sub maximal exercise. However diffusion of pulmonary increase at maximal exercise.

The flow of blood to the lungs is propelled through aerobic training, encouraging gas exchange. The major benefits of aerobic activity is maximum inhale of oxygen into the blood streams and aids the weak heart to work effectively among people suffering with cardiovascular disease.

These variations can also help individuals with damaged left ventricular function, in whom most adaptation to exercise drill seem to be marginal and could happen with low-intensity exercise (Belardineli, G eorgius, Scoco, Barstow and Purcaro, 1995). Exercise training results in reduced myocardial oxygen stresses for same level of external works performed, as demonstrated by a decreased in the product heart rate and systolic blood pressure (Traps & Clause, 1991; King Haskell, Young Oka &Stefanick, 1995).

Cardiorespiratory Response to Circuit Training

Circuit exercise is effective and efficient types of conditioning programme that develops strength, endurance (both aerobic and anaerobic), flexibility and coordinating all in one exercise session. It is one of the few forms of fitness training, which has been shown to be effective to both power and cardiovascular ability development in the similar exercise session.

In the opinion of Mackenzie (2007), the modalities adopted for the training instead of the real art of type of exercise done, is referred to as "circuit training". This type of exercise is continuous for the period allotted for it without much time for relaxation. With circuit training, there is autonomy for the athlete to include and invent several forms of workout. Circuit training is an outstanding method currently used to increase movement and endurance. Exercises lined for the circuit training could be between 6 to 10 forms being taken subsequently. Periods are allotted to each exercise, specifying the sequence of activities. A very minute period is usually set apart at the transition period to other exercises. Several levels of trainings are usually incorporated into the sessions as they are usually categorized based on their levels (starter, midway and progressive). Withers (2004) reported that, though circuit routines are alike to intermission exercise procedures, there are nearly key variances. He further specified that circuits integrate a huge diversity of trainings of smaller period in one term. Interim exercise inclines to concentrate on one sole workout (characteristically a stamina workout, like running, cycling, swimming, rowing, and others.) throughout a period based on the physical activity intensity throughout the workout period.

The benefit of a well-coordinated exercise is the impact it has on the muscle and the increase on the capacity of the cardiovascular tissues to endure. Much more, it could also be used to readjust the imbalance in the muscle has been the result challenges encountered by athletes that focus on a single kind of sport. Calories could be easily burned through this form of exercise as individuals are subjected to rigorous exercise. Circuit is applicable at every level as it could accommodate the professionals as much as the beginners. It could be adjusted to fit the scale of individuals as athletes. In addition, it is embedded with fun while maintaining its effectiveness despite the fact that it is usually very fast.

The impact of circuit is said to be reflected in the muscular and cardiorespiratory fitness. This assertion is based on investigation that focused on a circuit display presented by children in an extracurricular circuit training program (Annesi, Westcott, Faigenbaum, and Unruh, 2005; Ignico and Mahon, 2005). This study however focuses on athletic activities in school environment as aforementioned in this work. In the same vein, owing to the absence of required machineries in a Physical Education, locations were engaged to substitute the precise equipment for exercise (Doherty and Westcott, 2002).

Keeping the children active and alive during school hours constitutes one of the main reasons teachers engage children in exercises during Physical Education classes. Through the circuit technique, the pupils can effortlessly attain the expected motor engagement time (Lozano, 2009) and they could concurrently perform several exercises. This could help teachers to judiciously engage the students and also maximize the time to achieve more objectives (Faigenbaum and Mediate, 2008).

The findings of Dorgo (2009) also confirmed the fact that there could be a very significant development of some vital body organs resulting from circuit training. The capacity of the cardiovascular tissues to endure would be increased and muscles of the body would be strengthened. It has also been observed that if maintenance exercise could be done once a week in four weeks of the month, the result yielded in the course of the exercise would be maintained. However the results earlier achieved could be reverted if the athlete declines to exercise for the period of eight weeks, thereby becoming indolent or inactive (Tsolakis, Vagenas and Dessypris 2004). A study carried out on basket players by Dorgo (2009) also confirmed that consistency in exercise maintains the retention of the strength gained.

The study Lozano, (2009) however did not support this as the pre-pubescent children did not retain the strength gained though they engaged in once-in-a-week exercise designed to maintain the gains. The study that also confirmed that youth maintained their strength based on once-in-a-week exercise programme has not been sufficiently documented in empirical format. It should also be noted that earlier researches that bothered on maintenance of the strength after the exercise were not carried out as real classes in Physical Education but as curriculum activities. It is also worthy of note that most of these early studies did not create rooms for long intervals between the exercises and the maintenance period. However, the maintenance exercise after an interval occasioned by inconsistent school holiday calendar, need to teach other aspects of Physical Education and other academic subjects that needed to be taught. This study has therefore put all the aforementioned into consideration to plan the exercise by allowing for intervals before the commencement of maintenance program.

In conclussion, there is the possibility of maintaining cardiovascular and muscle endurance level by engaging a short-term training in a Physical Education setting, while ensuring that it does not affect the normal schedule of other curricular activities. This propels Physical Education teachers to come up with preservation programmes that would encourage the maintenance of the strength and vigor acquired in the process of the exercise.

Peak expiratory flow rate assessment in obese youths

Evaluating the respiratory health of an individual is premised on pulmonary function tests. Measured in this test are the rates of air flow, volumes of the lungs and its capacity for gas transmission across the alveolar of the capillary membrane. There is variance in the functional of pulmonary tests values based on age, sex, height, weight, body mass index, chest circumference and the habit of smoking. In obese persons and those that are not, PEFR is a measure of bronchial in hyper responsiveness and good parameter of lung physiology.

When there is pulmonary function impairment there is high tendency for emergence of obesity. Although there is no concrete evidence to support the level of PEFR in persons said to be obese, yet obesity could be correlated with other factors such as genetic, metabolism, behavior, lifestyle, environment factors based on culture and socioeconomic status. The pulmonary functions could be affected by central obesity which has the capacity to limit expansion of the lungs (Williams, 2009).

The muscular expiratory strengths that generate the contraction forces and recoil of elastic of the lungs pressure and the airway size in PEFR. The functioning of the lungs could be affected by several factors which include body size, age, exercise, environmental condition and ethnicity (Vijayan, Kuppurao, Venkatesan, Sankaran, Prabhakar, 1990). Among young persons that are obese, PEFR fall was discovered to be 13% while it has increased to 29% in adults that were obese. Percentage of body fat has been identified by Anuradha, Ratan, Singh and Joshi (2008) among persons that are young and exclusive study was done on male regarding the body fat percentage. Among young persons, a correlation of percentage in body fat and pulmonary functions was established while the exclusive study on male regarding body fat reflected a negative correlation.

Among obese persons, a strong relationship has been observed by King, Brown and Diba (2005) amid BMI and respiratory volume with airway calibers. The implication of this is that as the body mass increases, the narrower the airwaves consequent to reduction in lung volume. This suggests either of functional or structural change in the airways. Dhungel, Parthasarathy, Dipali (2008) did a comparative study of the PEFR values between Farida and Nepalese males and found higher PEFR values in the latter compared to the former. Eman, Abdelaziz, Amal,Terez, and Fahmy (2009) also conducted a research on females that are obese and found that female children showed had higher rate of chest symptoms than the control group. In another study, it was found by Saxena, Purwar and Upmanyu (2011 that body fat distribution affects PFER independently and the most preferable predictor of expiratory flow was the waist-hip ratio instead of weight or BMI.

Effect of Aerobic Dance Step Exercise through Resistance Training on Body Fat Percent and Organic compound Profiles in Sedentary Females

The effect of exercise usually reflects on the body fat percentage and the profile of serum lipid. However, there has not been concrete evidence of empirical findings on the effects of diverse categories of grouping physical activitieson body fat. A ten-year study conducted by Conroy (2007) revealed that there was a direct relationship of participating in sport on the prevention of cardiorespiratory diseases variables risk factor.

There are studies on aerobic exercises, power and parallel of resistance training on body composition, physical fitness and health related metabolic factors such as blood lipids levels among women. This was resulted on decrease values of fat in the body among the aerobic groups significantly, but body fat percent changes in response to parallel and power training groups. On the other hand, circumference of the waist only decreased significantly in resistance and parallel training groups. Additionally, there was a response of intervention on low density lipoprotein cholesterol, total cholesterol levels in all groups. In another study, training in aerobic, power and parallel training (combined) resulted in positive effects on fitness, body fat percent and lipids profiles as related to cardiorespiratory variables in females obese (Akdur, Sozen, Yigty, Balota, Guven, 2007).

Aerobic step exercise is another method that improves cardiorespiratory fitness, physical health and body composition profiles. In another study conducted by Hallage,, Krause, Haile (2010) in which aerobic step exercises combined with resistance training programme were launch in 80-90% of maximum heart rate which significantly decreased in body fat percent, sub skin folds fat, lipids profiles and health profiles of obese female youths.

According to Cornelissen (2005) combined aerobic dance training significantly improved cardiorespiratory fitness, reduced %bf, waist circumference and sub skin folds fat. A recent study reported that combination of training; aerobic dance and circuit training results responses based on cardiorespiratory fitness, aerobic fitness and body composition. This attracts attention and soft for women compared to other sports and exercise training methods. Based on these analyses there has been no studies executed considering the uses of aerobic dance exercise in circuit training effects on cardiorespiratory and body composition of college students.

Appraisal of literature reviewed

The review of related literature in this study examined the prevalence causes and management of youth obesity. It also looked into the definition and overview of aerobic dance exercise and circuit training exercise.

The health implications of obesity, management and prevention of obesity were also looked into. Literature on the various global high rate of obesity as it is related to the uses of aerobic dance exercise and circuit training programme, for its prevention and management were also reviewed as the exercise intensity, the duration, frequency and sample of the participants involved in the study. Possible effects of aerobic dance exercise and circuit training were also discussed.

Literature on the various cardiorespiratory variables used in this study were also discussed such as, VO_2max, inspiratory reserved volume, peak expiratory flow rate, heart rate reserved, resting pressure of the blood and mean arterial blood pressure. They were related to the training effect on obesity.

CHAPTER THREE

METHODOLOGY

The methods and procedures adopted for this research were converse under the following headings:

1. Research design
2. Population
3. Sample and sampling techniques
4. Research instruments
5. Validity of the instruments
6. Reliability of the instruments
7. Pilot study
8. Ethical Consideration
9. Procedure for data collection
10. Procedure for data analysis

Research design

The research design for this study was a pretest-posttest control group quasi experimental design using 2x2x4 factorial matrix. The design ensured that the initial differences in the outcome measured on the participants were obtained using the pretest scores. The initial difference was removed in the final posttest analysis. The design is schematically presented as

O_1 X_1 O_3..................................Experimental group

O_2 X_2 O_4................................Control group

Where O_1 and O_2 are pretest observation for the experimental and control groups respectively. O_3 and O_4 are the posttest observation for the experimental and the control groups respectively. X is the experimental treatment of aerobic dance circuit training. X_2 is the control group given Lifestyle Education In the design, the control group participants was not exposed to the main treatment but placed on placebo. The selected body composition and cardiorespiratory variables of the two groups were measured as pretest and posttest.

Variables in the study

Independent variable

Aerobic Dance Circuit Training (Experimental Group)

Lifestyle Education (Control Group)

Moderating variables

1. Age
2. Class of obesity

Dependent variables

1. Body composition variables *[Percent body fat (%bf), Waist-to-hip ratio (WHR) and Waist-to-height ratio (WHtR)]*
2. Cardiorespiratory variables *[(Diastolic Blood Pressure (DBP), Systolic Blood Pressure (SBP), Mean Arterial Blood Pressure (P_{mean}), Vital Capacity (VC), Inspiratory Reserved Volume (IRV), Peak Expiratory Flow Rate (PEFR), Heart Rate Reserved (HRR) and Maximal Oxygen Uptakes (*VO_2max*)]*.

Population

The population for this study was apparently entire obese female college students in Oyo State, Nigeria.

Sample and sampling technique

Seventy (70) obese female youths took part in this study. Purposive sampling technique was used to select the participants for the study; because of the peculiar characteristics required BMI ≥25.0 as the yardstick to qualify. Purposive sampling technique was used to select two institutions in Oyo town; Emmanuel Alayande College of Education, Oyo and Federal College of Education (Special), Oyo. This restriction helped to minimize to the bearest minimum the effect of nutrition on body composition variables in this study. The participants were randomly assigned into two (2) groups (35 participants per group), experimental group and control group. Experimental group went through the 12 weeks aerobic dance circuit training session while control group was placed on placebo (12 weeks lesson of lifestyle education).

Inclusion Criteria

The following inclusion criteria were for the study:

1. Obese female students in colleges of education (NCE) in Oyo town.
2. Participants who had no medical reports contra-indicating exercise participation.
3. Participants who were not engaged in any aerobic exercise programme four weeks before, during and after the recruitment for this study.

4. Obese female youth with BMI ≥ 25.0 to determine the level of obesity.

Exclusion Criteria

The following participants were excluded in the study:

1. Participants with cardiorespiratory disease and other metabolic conditions.
2. Participants with heart rate suddenly rose above 100 bpm-pretest.
3. Participants with tendency towards fainting or dizziness.

Research instruments

The instruments used for data collection includes:

i. **Bathroom weighing scale**: The portable Hanson weighing scale made in Ireland; modelB1801A was used to measure body weight to nearest 0.1 kilogram.

ii. **Non-Elastic Measuring tape**: A non-elastic tape measure made in china (Model Butterfly) calibrated in centimeter from 0 centimeter to 160 centimeter was used to measure waist and hip circumference of participants.

iii. **Skinfold caliper**: Ponderax skinfold caliper Servier Laboratories Ltd. Harrow Middlesex was used to measure percent body fat at the following sites: abdominal, suprailliac, and triceps.

iv. **Digital Sphygmomanometer**: Omron Intellisense M6 Comfort made in Japan. This was used to measure blood pressure both systolic and diastolic.

v. **Spirometer**: Portable spirometer made by Wedge Bellows, England was used to measure the vital capacity and Inspiratory Reserved volume in millimeters.

vi. **Spirometer Mouthpiece:** Vitalography spirometer mouth piece made in United Kingdom was used by participants while assessing their vital capacity and Inspiratory Reserved volume.

vii. **Peak Flow Meter:** Mini Wright Peak Flow Meter PFM20 made in Omron Healthcare Europe B.V. scorpius 33. Neitherlands made in UK, Model PFM20 was used to measure Peak Expiratory Flow Rate (PEFR) in millimeters.

viii. **Stopwatch**: Sport timer alarm stop-watch made in United Kingdom was used to time the rhythmic aerobic activities.

ix. **Musical sound box:** Pacific DVD player musical instrument manufactured by Shenzhen Jiayuxiang Hi-fi electronic co. Ltd (Japan) was used to provide the variety of aerobic dance music.
x. **Cone:** a plastic cone was used to demarcate each exercise station.
xi. **Metronome:** Dr beat digital metronome. Model DB-90 made in Roland Corporation US was used to detremine increatment on the variety tempo of the aerobic dance music.
xii. **Heart Rate wrist monitor:** Polar Rs800 heart rate monitors made in Polar Electro, Kempele, Finland was used to monitor exercise intensity.

Validity of the instrument

The research instruments used were scientifically proved to be standardized ones. However, the researcher and supervisor cross checked the calibration to ensure that they were in proper working conditions before usage.

Reliability of instruments

In order to be sure that the research instruments used yielded consistently the same results over repeated testing period. Instrument like digital skinfold caliper and blood pressure monitor have high reliability coefficient (0.94) (Ellis, 2001). Jackson and Pollock (1999) reported r=0.90 for 3 sites skinfold for females. Freedman, Zuguo, Srinivasan, Berenson, and Dietz (2007) reported r=0.95 for weight and height measuring devices indices. Bourbonnais (1998) also found strong r=0.97 for sphygmomanometer for blood pressure measurement.

Pilot study

The field testing was carried out at Federal College of Education (SP), Oyo before the main study in which twelve (12) volunteered obese female college students participated in the study. The researcher was able to identify basic problems that arose during the training programme; and well acquainted with the instruments for the detection of unforeseen constraints during the main study. It also provided ample opportunities to train the research assistants on the procedure that were used in the data collection.

Ethical Consideration

The study was subjected to ethical consideration and subsequent approval was given from the Social Science and Humanities Research Ethics Committee (SSHREC) of the University of Ibadan. Both electronic and hard copies of the research proposal indicated the participants' dossier and introductory letter from Head; Human Kinetics and Health Education Department, University of Ibadan were submitted to the Chairman of SSHREC for consideration and approval. Only participants that filled informed consent form for this study were used. Confidentiality of the participants was assured without making reference to their names and other personal data. Similarly, participants on request were given permission to take water, visit the rest room, to pick towel to clean up the swept on their bodies.

Procedure for Data Collection

The participants were asked to sign the informed consent form showing their interest to be part of this research work and their readiness to cooperate with the researcher after which the following data (information) were collected before (pre) and after (post) training programmes. The following measurements were taken by the researcher and research assistants.

Age: The participant's age as at last birthday was recorded in years to the nearest birthday.

Body Mass Index: This was used to determine the level of obesity of the participant, it was calculated by dividing the participant's weight (in kilograms) by the square of height (in meters) [Weight (kg)/height^2 (meters)].

Weight: Hanson scale portable type was used to measure the participants' weight to the nearest kilogram with participant's wearing very light sport wear and no shoes, arm relaxed by the side, measurement were recorded to the nearest 0.1kg. (*Appendix 12*)

Height: The participants' heights were measured while standing erect looking straight ahead and bare footed against the modified stadio-meter. A ruler was rested on the head of each participant horizontally. Their heights then read to the nearest centimeter. (*Appendix 12*)

Percent body fat (%bf): All skinfold values were taken from the participant's right side of the body. The participant stood in a relaxed position; the appropriate anatomical landmarks were carefully located and mark with a marker. The skinfold at the various sites were picked between the index finger and the thumb of the left hand in other to ensure that, the two layers of the skin and underlying fat were included. The calliper was held with the right hand and gently applied perpendicular to the skinfold about 1cm from the gripping fingers to clamp the skinfold. Skinfold measure was read off on the calliper's meters, one to two seconds after clamping, to the nearest 0.5mm. Three measures per site were taken as the average computed. The 3-sites are abdominal, suprailliac and triceps. Hockey (1993) skinfold techniques was followed with the following procedure:

Purpose: To estimate a person's percent body fat.

Objective**:** To provide a field method of accurately estimating anthropometric characteristics.

Equipment**:** skinfold calliper.

Instructions**:** Skinfold at the abdominal skinfold site, suprailliac skinfold site and triceps skinfold sited one was measured based on the following procedures for each site:

Abdominal Skinfold**: -**The researcher grasped a vertical skinfold 2cm to the left of and 1cm above the umbilicus. Place the jaws of the calliper 1cm below and perpendicular to the vertical fold. (Appendix 12)

Suprailiac: **-**The researcher grasped the skinfold just above the iliac crest at the level of the anterior axillary line along the natural cleavage of the skinfold (running diagonally down the crest toward the umbilicus). Place the jaws of the calliper 1cm (0.4 in.) distal and perpendicular to the diagonal fold. (Appendix 12)

Triceps**: -** The researcher pinched a site 1cm above the midpoint between the shoulder (acromion process of the scapula) and the tip of the elbow (inferior portion of the olecranon process of the ulna) on the posterior aspect of the triceps. Place the jaws of the caliper 1cm below and perpendicular to the vertical fold. (Appendix 12).

Scoring**:** Converted the skinfold measure to percent body fat. Jackson, Pollock and Ward (1980) equation for estimation %body fat was used:

%fat = (0.41563 x sum of skinfolds) – (0.00112 x square of the sum of skinfolds) + (0.03661 x age) + 4.03653.

Reliability = 0.825

Procedure:

Step 1: The participant's skinfolds was lift two times before placing the skinfold caliper and taking a measurement.

Step 2: Place the caliper below the thumb and fingers and perpendicular to the fold so that the dial can be easily read.

Step 3: Release the caliper grip completely; and read the dial 1to 2 second later

Step 4: Repeat the process three times.

Table 2: percent body fat norms

Female rating	18-25 years	26-35 years
Very lean	13-17	13-18
Lean	18-20	19-21
Leaner than average	21-23	22-23
Average	24-25	24-26
Fatter than average	26-28	27-30
Fat	29-31	31-35
Overfat	33-43	36-48

Adapted from Golding, Myers and Sinning (1989)

Waist-to-hip ratio: Participant's circumference of the waist to that of the hip were compared and used as an indicator of body fat distribution.

Purpose: To determine the ratio of waist circumference to the hip circumference.

Objective**:** To provide a field method of accurately estimated body composition characteristics.

Equipment**:** Non-elastic flexible measuring tape.

Procedure:

Step 1: From the anatomical position, participant's waist circumference was taken around the smallest area from the anterior side of the waist with the used of non-elastic flexible measuring tape.

Step 2: The hip circumference was taken around the largest area of the buttocks (with minimal clothing).

Step 3: Repeat the process three times.

Step 4: The WHR was calculated as the waist circumference (cm)/hip circumference (cm).

Scoring: the circumference was recorded to the nearest centimeters, and divide the waist girth by hip girth (WHR = Gw/Gh).

Table 3: Waist-to-hip norms table

Women	Age	Low	Moderate	High	Very High
	19-29	<0.71	0.71-0.77	0.78-0.82	>0.82
	30-39	<0.72	0.72-0.78	0.79-0.84	>0.84

Adapted from Heyward (2010).

Waist-to-height ratio: Participant's circumference of the waist to that of the hip were compared and used as an indicator of body fat distribution.

Purpose: To determine the ratio of waist circumference to the height.

Objective**:** To provide a field method of accurately estimated body composition characteristics.

Equipment**:** Non-elastic flexible measuring tape and modified stadio-meter.

Procedure:

Step 1: Participant stood in good posture and relaxed.

Step 2: Waist circumference was measured with the use of flexible tape, taken around the smallest area of the waist.

Step 3: Participant's heights were measured while standing erect looking straight ahead and bare footed against the modified stadio-meter.

Step 4: A ruler was placed horizontally rested on the head of the participant. The height then read to the nearest centimeter. (*Appendix 12*).

Scoring: Waist to height ratio was calculated by dividing waist size (cm) by height (cm). If the waist measurement is higher than half the height, it is a risk for obesity-related disease (WHtR = w (cm)/h (cm).

Resting Blood Pressure (Systolic and Diastolic): blood pressure is the force the blood exerts against the walls of the vessels in which it is contained. The blood pressure was determined using digital sphygmomanometer in a sitting position. Each participant was allowed to rest for 5 minutes on arrival at the venue of study and thereafter, the cuff was applied to the left arm of the participant in a sitting position and 2 readings were taken consecutively at 2 minutes interval and the last reading was used as the appropriate measurement This recorded in mmHg (millimetre of mercury) systolic over diastolic pressure before and after the training programme as recommended by Hockey (1993). (*Appendix 12*).

Purpose: To observe the blood pressure responses to exercise training

Objective: To provide a field method of accurately estimating cardiorespiratory characteristics.

Equipment**:** Digital sphygmomanometer,

Scoring: The measurement was read and recorded in mmHg.

Mean arterial pressure (P_{mean}): this was determined by the formula**:**

P_{mean}= 2/3(DP) +1/3(SP)

Resting Heart Rate: The resting heart rate of the participants were measured before and after the training programmes using the palpation method, the participant was comfortably seated, fully rested and free from any form of excitement.

Purpose: To observe the resting heart rate response to exercise training.

Objective: To provide a field method of accurately estimating cardiorespiratory characteristics.

Equipment**:** Stopwatch

The following procedure of American College of Sports Medicine (2000) heart rate by palpation was used:

Instructions**:** The following steps were taken by the researcher:

Step 1: The tip of the middle and index fingers was used to produce an accurate count.

Step 2: The stopwatch simultaneously start with the pulse beat counting the first beat as zero, then for ten (10) seconds which was later multiplied by six.

Scoring: The beats were recorded in number of beats per minute (b/m). The result was also used to determined VO_2max and Reserved Heart rate with the formula below:

Estimated VO_2max **= *HRmax X 15 ÷ HRrest***

Reserved Heart Rate (RHR) = *HRmax - HRrest*

Performance Heart Rate: To determine whether heart rate recovery and reserved heart rate is a roboust measure of the training programme and wether changes reflected in the performance and training overload.

Purpose: To observe the overloading principle of the ADCT

Objective: To examine exercise intensity and music tempo

Equipment: metronome wrist heart rate monitor.

Procedure:

Step 1: Each participant was allowed to wear the sensor watches while exercising.

Step 2: The tap of the metronome set determined the tempo of the music

Step 3: Metronome was set up for the slow tempo at 40% MaxHR, medium tempo for 50%-55% MaxHR and highest tempo for 60%-65%MaxHR.

Interpretation: slow tempo – 40%MaxHR

Medium tempo – 50%-55% MaxHR

Highest tempo – 60% - 65% MaxHR (*Appendix 15*)

Vital Capacity: This is the maximum volume of air the participants could expired sequel to maximum aspiratory effort (*Appendix 12*).

Purpose: To observe the inspiratory capacity of the participant's response to exercise training.

Objective: To provide a field method of accurately estimating cardiorespiratory characteristics.

***Equipment*:** portable spirometer and spirometer mouth piece

Procedure: The following steps were taken by the researcher:

Step 1: From the anatomical position, the participant held the dry pocket spirometer with the mouth piece in place

Step 2: Make a maximal inspiratory effort with lips tightly closed around the mouthpiece of the portable spirometer.

Step 3: Exhaled forcefully and continuously through the mouthpiece into the spirometer.

Step 4: This was repeated three different times

Scoring: The best three trials was recorded to the 0.1Lliters

Inspiratory Reserved Volume (IRV): This is the volume of air that the participants maximally inspired above the volume inspired tidally. The value of the IVR was read through the side displayed of the portable spirometer (*Spirometer and Flow Volume Measurement Standards and Guidelines 1998). (Appendix 12).*

Purpose: To observe the maximal inspiratory reserved volume capacity of the participant's response to exercise training.

Objective: To provide a field method of accurately estimating cardiorespiratory characteristics.

***Equipment*:** portable spirometer and spirometer mouth piece

Procedure: The following steps were taken by the researcher:

Step 1: From the anatomical position, the participant was required to make a maximal expiratory effort with lips tightly closed around the mouthpiece of the portable spirometer

Step 2: Inhale forcefully and continuously at the end of a normal inspiration, through the mouthpiece into the spirometer.

Step 3: The value of the IVR was then read through the side displayed of the portable spirometer

Step 4: This was repeated three different times

Scoring: The best three trials was recorded to the 0.1Llitres. Average measure for women 2400ml.

Peak Expiratory Flow Rate (PEFR): This was participant's maximum flow (speed) of expiration during the maximally forced expiration initiated at full inspiration. This was repeated three different times and recorded in liters/minutes or seconds (*Appendix 12*).

Purpose: To observe the maximal speed of expiration of the participant's response to exercise training.

Objective: To provide a field method of accurately estimating cardiorespiratory characteristics.

***Equipment*:** Mini wright peak flow meter

Procedure: The following steps were taken by the researcher:

Step 1: From the anatomical position, the participant was required held the peak flow meter in her hand.

Step 2: Blew out forcefully into the mini-wright peak flow meter.

Step 3: The value of the PEFR was then read through the side displayed of the peak flow meter

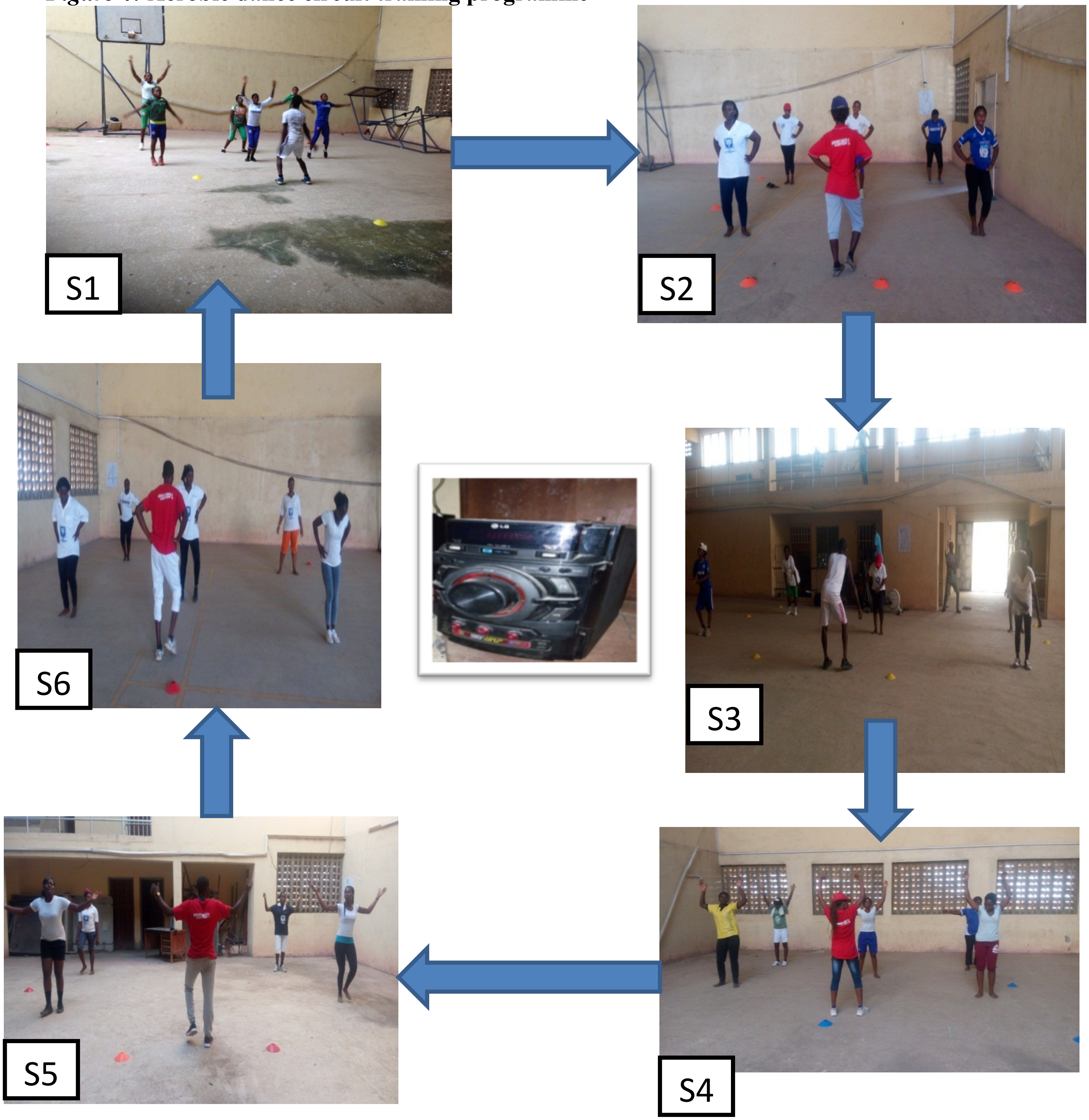
Step 4: This was repeated three different times

Scoring: The best three trials was recorded in liters per minutes (l/min)

Training programme

Treatment group: This aerobic dance circuit training (ADCT) consisted of series of exercises inter spaced and performed at each station with minimal 60 seconds rest in between. Exercises were performed at a safe level of moderate intensity between 40% (week 1) and 70% (week 12) of age predicted MaxHR. Aerobic dance circuit training programme was performed by all participants for the entire twelve (12) weeks period. The instructors lead the exercise at each station. The body movements were simplified and made easy to involve the use of both upper and lower extremities and the back. The participants were distributed to six stations. The frequency was 3 times/week for twelve weeks; each session consisted of three minutes warm up, three minutes cool down and 30-60 minutes of aerobic dance with brief rest periods to move from one station to the next station. The choreography exercise consisted of arm, leg, waist-hip and progressive step-aerobic movements; performed with music. The order of training programme for treatment group is shown in *Appendix 9*.

Figure 4: **Aerobic dance circuit training programme**



Keys:

S1: Jumping jacks
S2: Marching on the spot
S3: Waist twitch
S4: Trunk swings
S5: Arm swing leg aside
S6: Lateral legs aside bend

Control (Lifestyle Education) Group: The control group participants were placed on placebo of teaching them lifestyle education which consisted of series of activities such as, nutrition and health education, concept of obesity, healthy lifestyles, importance of exercise, importance of physical fitness activities and body composition. The training objectives were to identify factors influencing attitudes and practices of obese regarding diet, causes of obesity, concept of HELP (Health, Everyone, Lifetime and Personal philosophy), to examine the importance of engaging in physical activities and how to measure body mass index (BMI). The lectures were done 20 minutes contact/3 times in a week lesson (Monday, Wednesday and Friday). The training programme for control group is in *appendix 10.*

Procedure for data analysis

Descriptive statistics of means, range, standard deviation, frequency, percentage, pie chart, bar chart analysis were used to for the physical characteristics of the participants and research questions. Cochran Q test and Analysis of covariance (ANCOVA) were used to analyze hypotheses obtained at 0.05 alpha levels to determine the acceptance and rejection of the stated hypotheses. Adjusted marginal means was used to show the direction of differences in variables measured.

CHAPTER FOUR

RESULTS AND DISCUSSION

The research work was carried out to find out the effect of aerobic dance circuit training programme on body composition and cardiorespiratory variables of obese female college students in Oyo Town. Data were collected through pretest and posttest performance of the participants following the exposure of the participants to the aerobic dance circuit training treatment.

Results

The demographic variables of the participants were presented as shown below:

Demographic Variables

Table 4.1: Distribution of participants based on groups

Groups	Frequency	Percent
Experimental	35	50.0
Control	35	50.0
Total	**70**	**100**

Table 4.1 shows the frequency distribution chart of participants with 35(50.0%) of the experimental group (ADCT) and 35(50.0%) control groups (Lifestyle Education).

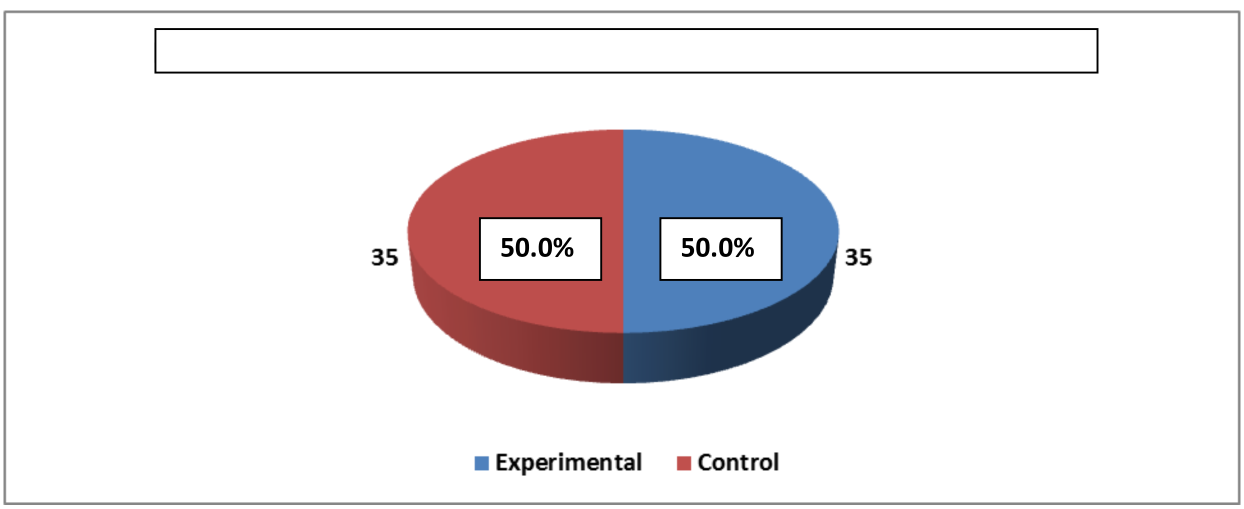


Figure 4.1: Frequency distribution of participants based on Group

Table 4.2: Age range of participants

Variable	Frequency	Percent	Valid Percent	Cumulative Percent
19-24yrs	44	62.9	62.9	50.00
25-30yrs	26	37.1	37.1	100.00
Total	70	100	100	

Table 4.2 shows the descriptive statistics of the age of participants. 44(62.9%) of the participants are aged 19-24 years and 26(37.1%) are aged 25-30 years. It means that high degree of the participants were in the age range of 25-30 years.

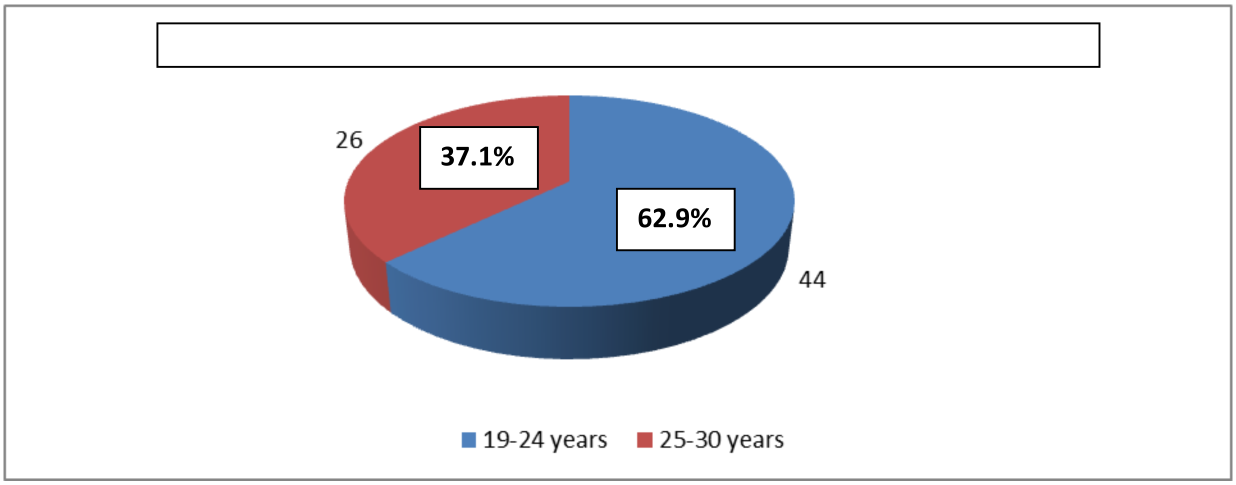


Figure 5.1: Frequency distribution of participants based on age

Research Question 1: What are the physical characteristics of participants?

Table 5.1: Weight (kg) of the participants

Weight (kg)	Frequency	Percent
61-70	9	12.9
71-80	30	42.9
81-90	30	42.9
90+	1	1.3
Total	**70**	**100**

Table 5.1 shows that 9(12.9%) of the participants weighed 61-70Kg, 30(42.9%) weighed 71-80Kg, 30(42.9%) weighed 81-90Kg and 1(1.3%) weighed 90Kg and above. The above data was the pre treatment measurements of all the participants.

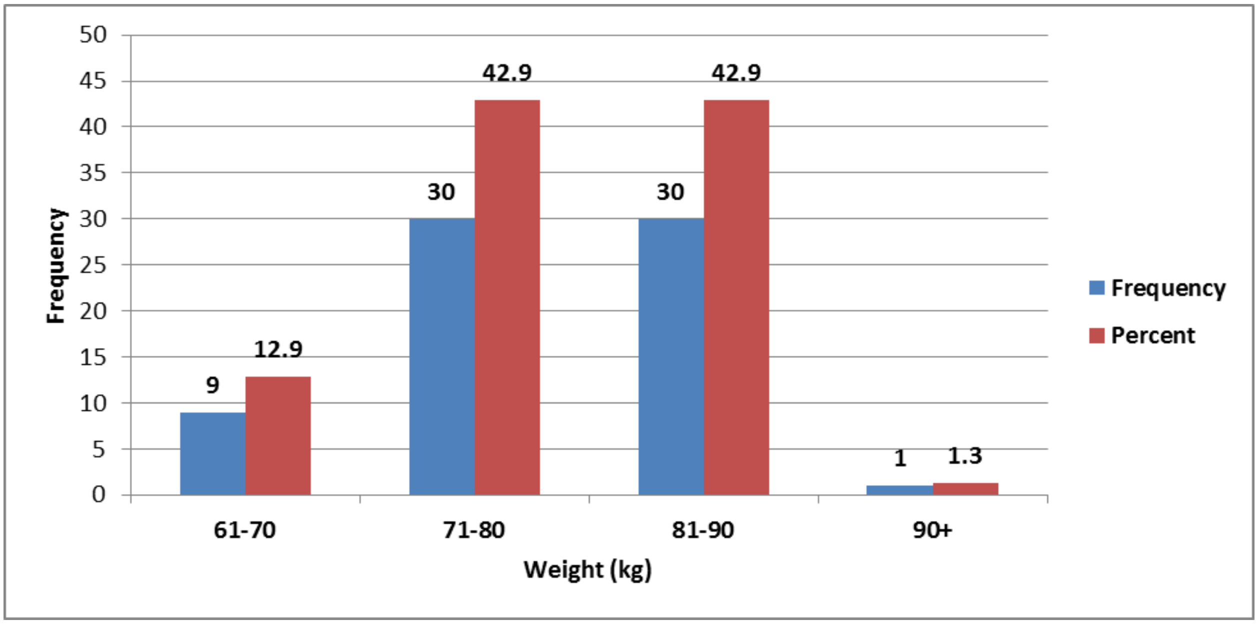


Figure 6.1: Frequency distribution of participants based on weight (kg)

Table 5.2: Height (cm) of the participants

Height (cm)	**Frequency**	**Percent**
145-155	13	18.6
156-165	45	64.3
166+	12	17.1
Total	**70**	**100**

Table 5.2 shows that 13(18.6%) of the participants had 145-155 cm, 45(64.3%) had 156-165 and 12(17.1%) had 166 cm and more.

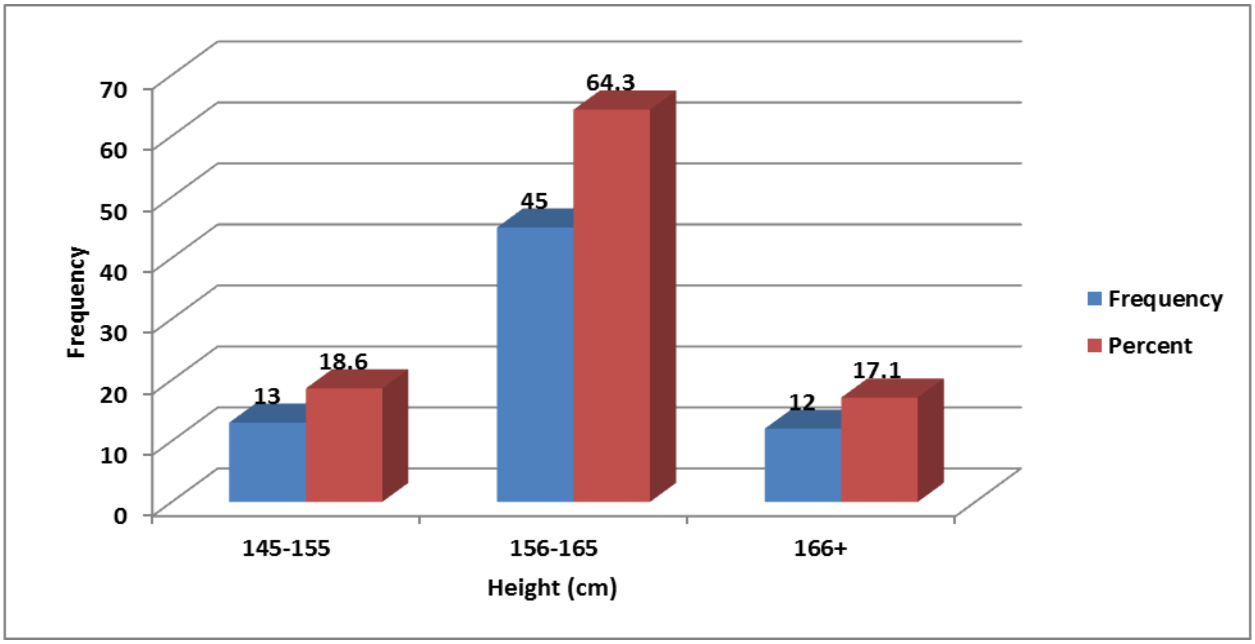


Figure 7.1: Frequency distribution of participants based on height (cm)

Research Questions 2: Obesity classifications of the participants

Table 5.3: Distribution of the participants by Class of obesity

Class of obesity	Frequency	Percentage	Norms	Interpretations
Class 1 obesity	15	21.4	25.0-30.0	Average
Class 2 obesity	42	60.0	30.0-35.0	Fatter than average
Class 3 obesity	12	17.1	35.0-40.0	Fat
Class 4 obesity	1	1.4	40.0-above	Overfat
Total	**70**	**100.0**		

Using the classification of Japan (2013), Table 5.3 shows that 15(21.4%) of the participants were class 1 obesity which were at average level compared to the norms, 42(60.0%) class 2 obesity were fatter than average level, 12(17.1%) class 3 obesity are fat compared to the standard norms while 1(1.4%) class 4 obesity is categorized as overfat as described above. The above table revealed that all the participants were above the recommended normal height and weight expected of their age *(Appendix 2)***.**

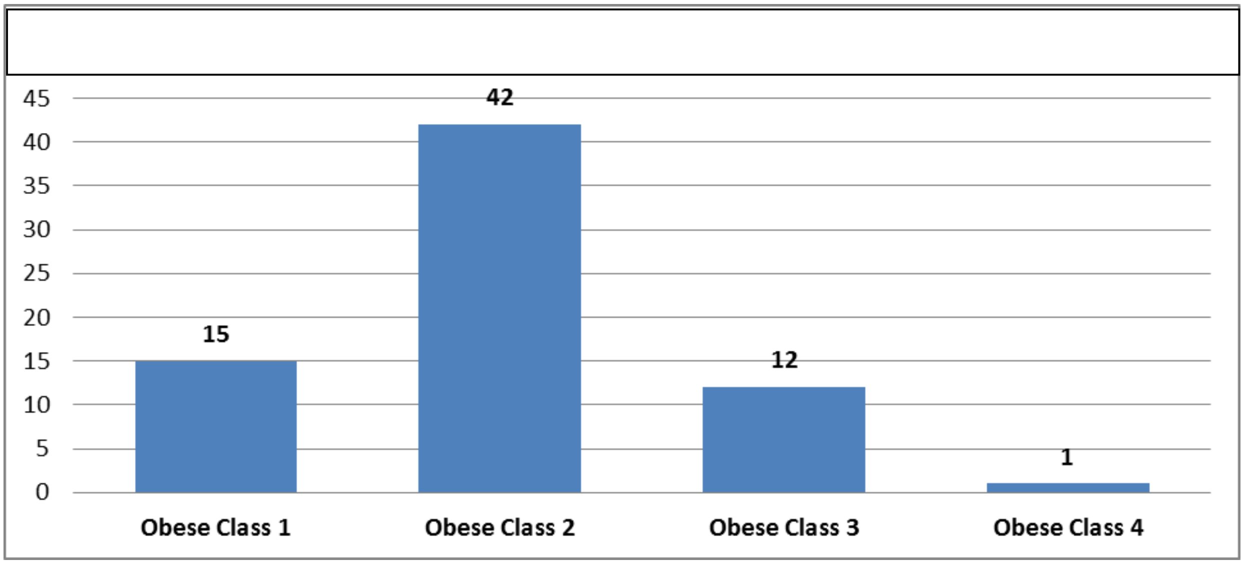


Figure 8.1: Frequency distribution of participants based on obesity classification (BMI)

HYPOTHESES TESTING

Results

Hypothesis 1 (ai): There will be no significant main effect of treatment on %bf

Table 6.1: ANCOVA showing the main effect and interaction effects of Treatment, Age and Class of obesity on % BF

Source	Sum of Squares	df	Mean Square	F	Sig.	Eta. Sq
Corrected Model	893.328	13	68.718	11.623	.000	.362
Main Effect:						
Treatment Group	183.615	1	183.615	31.057	.000	.105
Age	68.514	1	68.514	11.589	.001	.042
Class of obesity	26.396	3	8.799	1.488	.218	.017
2-way Interactions:						
Treatment x Age	22.678	1	22.678	3.836	.051	.014
Treatment x Class of obesity	9.550	3	3.183	.538	.656	.006
Age x Class of obesity	6.109	2	3.054	.517	.597	.004
3-way Interactions:						
Treatment x Age x Class of obesity	20.714	2	10.357	1.752	.175	.013
Error	1572.651	57	27.5904			
Total	2465.979	69				

Table 6.1 shows significant effect of treatment on %bf (F1, 57=31.057, P<0.05, η^2=.105). The Eta Square of .105 shows that about 11% of the variation in participants scores were attributed to the treatment. Therefore, the null hypothesis is rejected.

Table 6.2: Estimated Marginal Means of Treatment Groups on %bf

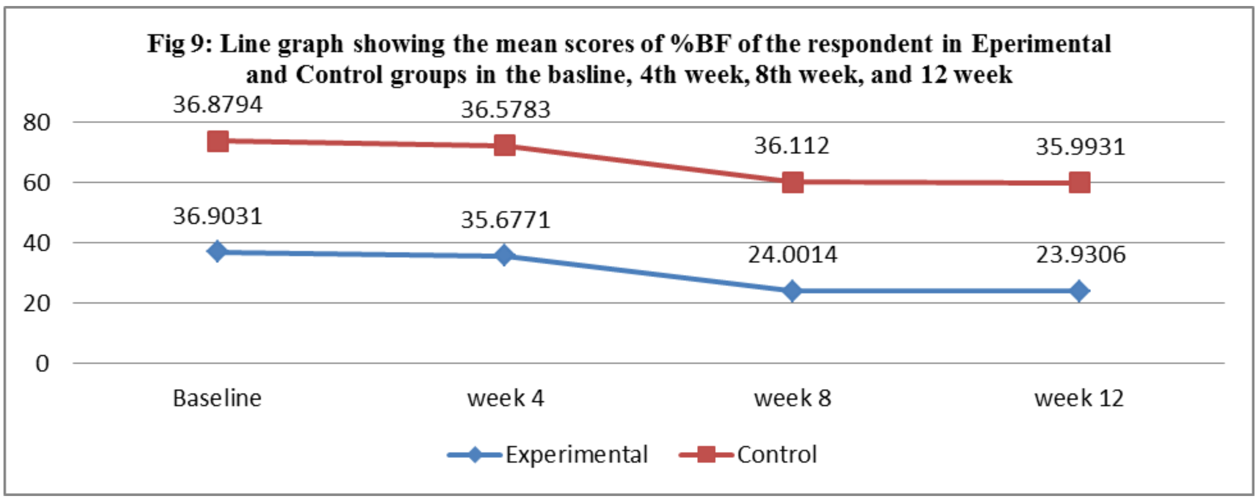
Treatment	Mean	Std Error
Experimental Group	24.475	0.421
Control Group	38.030	0.340

Table 6.2 reveals that participants in experimental group had a lower estimated mean score of 24.475 while participants in control group had a mean score of 38. 030. This shows that participants in experimental group perform better than those in control group.

Table 6.3: The average %bf of obese female college students per week

%bf	**Baseline**	**week 4**	**week 8**	**week 12**
Experimental	36.9031	35.6771	24.0014	23.9306
Control	36.8794	36.5783	36.112	35.9931

The time series design in Table 6.3 shows the mean values of %bf of both experimental and control group taken at interval of four weeks. The value shows that experimental group %bf decrease gradually throughout week 12 of aerobic dance circuit training.



From the figure, the line graph indicates that the treatment was effective between the week 4, week 8 and week 12 but there was no significant effect between the baseline and the week 4. This may be as a result of principle of exercise conditioning.

Hypothesis 1 (aii): There will be no significant main effects of treatment on WHR

Table 7.1: ANCOVA showing the main effect and interaction effects of Treatment, Age and Class of obesity on WHR

Source	Sum of Squares	df	Mean Square	F	Sig.	Eta. Sq
Corrected Model	.144	13	1.105E-02	2.683	.001	.116
Main Effect:						
Treatment Group	1.637E-02	1	1.637E-02	3.975	.047	.015
Age	1.924E-03	1	1.924E-03	.467	.495	.002
Class of obesity	1.804E-02	3	6.012E-03	1.460	.226	.016
2-way Interactions:						
Treatment x Age	1.692E-02	1	1.692E-03	.413	.521	.002
Treatment x Class of obesity	1.583E-02	3	5.276E-03	1.281	.281	.014
Age x Class of obesity	1.304E-02	2	6.519E-04	.158	.854	.001
3-way Interactions:						
Treatment x Age x Class of obesity	2.115E-02	2	1.058E-02	2.568	.079	.019
Error	1.096	57	4.119E-03			
Total	1.239	69				

Table 7.1 shows that there was significant effect of treatment on WHR ($F_{1,57}=3.975$, $P<0.05$, $\eta^2=.015$). The Eta Square of .015 shows that about 2% of the variation in participants scores were attributed to the treatment. Therefore, the null hypothesis is rejected.

Table 7.2: Estimated Marginal Means of Treatment Groups on WHR

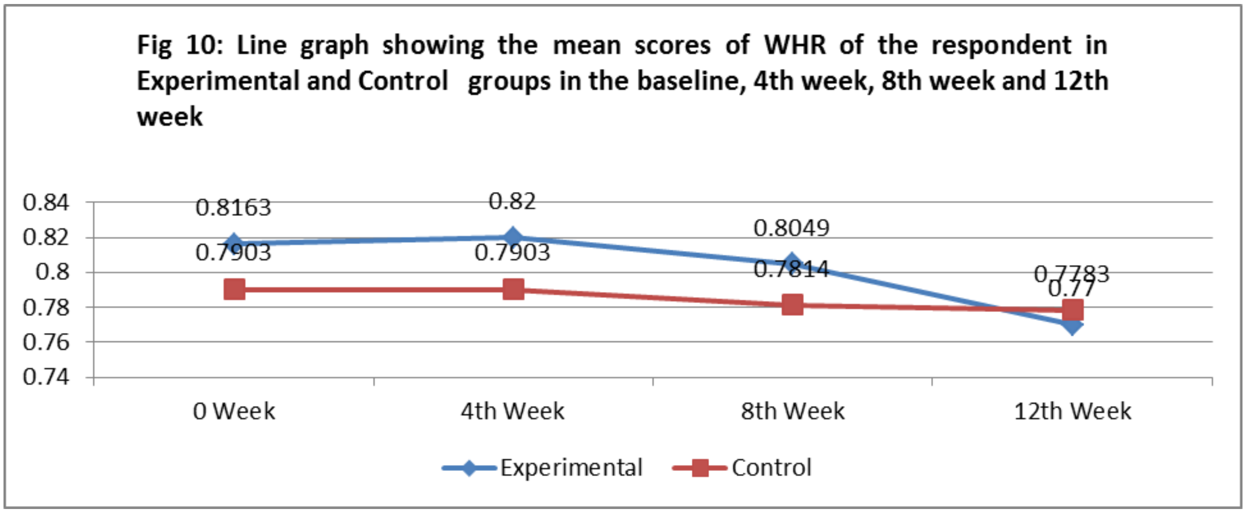
Treatment	Mean	Std Error
Experimental Group	.789	0.011
Control Group	.826	0.009

Table 7.2 reveals that participants in experimental group had a lower mean score of 0.789 while participants in control group had a mean score of 0.826. This shows that participants in experimental group perform better than those in control group.

Table 7.3: The average WHR of obese female college students per week

WHR	**Baseline**	**week 4**	**week 8**	**week 12**
Experimental	0.8163	0.82	0.8049	0.7741
Control	0.7903	0.7903	0.7814	0.7783

Table 7.3 shows the average WHR of both experimental and control group participant taken per week. The value shows that experimental group WHR decreases from the Baseline to the week 12 of aerobic dance circuit training.



From the figure, the line graph indicates that the treatment was effective between the week 4, week 8 and week 12 but there was no effect between the baseline and the week 4.

Hypothesis 1 (aiii): There will be no significant main effects of Treatment on WHtR

Table 8.1: ANCOVA showing the main effect and interaction effects of Treatment Group, Age and Class of obesity on WHtR

Source	Sum of Squares	df	Mean Square	F	Sig.	Eta. Sq
Corrected Model	.305	13	2344E-02	11.828	.000	.366
Main Effect:						
Treatment Group	2.050E-02	1	2.050E-02	10.345	.001	.037
Age	1.898E-04	1	1.898E-02	.096	.757	.000
Class of obesity	9.242E-02	3	3.081E-02	15.544	.000	.149
2-way Interactions:						
Treatment x Age	1.061E-03	1	1.061E-02	.536	.465	.002
Treatment x Class of obesity	3.927E-02	3	1.309E-02	6.606	.000	.069
Age x Class of obesity	2.555E-02	2	1.278E-02	6.447	.002	.046
3-way Interactions:						
Treatment x Age x Class of obesity	3.407E-03	2	1.694E-03	.860	.425	.006
Error	.527	57	1.982E-03			
Total	.832	69				

Table 8.1 shows that there was significant effect of treatment on WHtR ($F(1,57) = 10.345$, $p<.05, \eta^2=.037$).The Eta Square of .037 shows that about 40% of the variation in participants scores were attributed to the treatment. Therefore, the null hypothesis is rejected.

Table 8.2: Estimated Marginal Means of Treatment Groups on WHtR

Treatment	Mean	Std Error
Experimental Group	0.511	0.008
Control Group	0.553	0.006

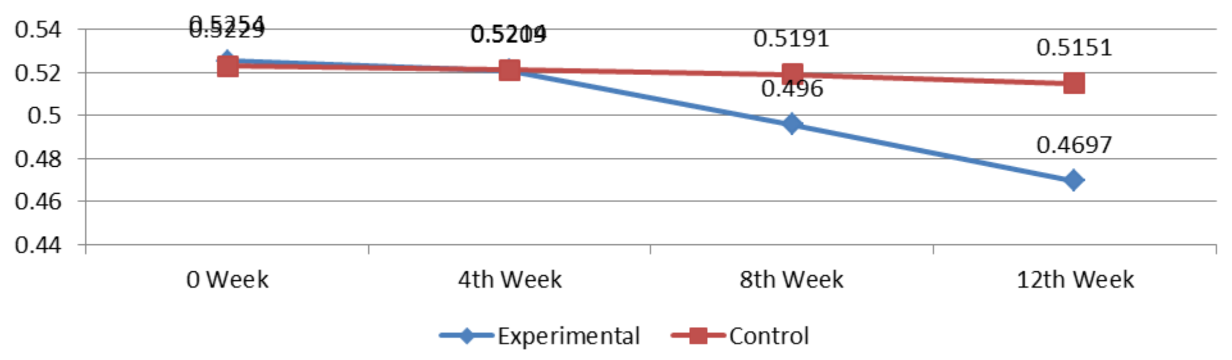
Table above reveals that participants in experimental group had a lower mean score of 0.511 while participants in control group had a mean score of 0.553. This shows that participants in experimental group perform better than those in control group.

Table 8.3: The average WHtR of obese female college students per week

WHtR	Baseline	week 4	week 8	week 12
Experimental	0.5254	0.5209	0.4961	0.4697
Control	0.5229	0.5214	0.5191	0.5151

Table 8.3 shows the average WHtR of both experimental and control group participant taken per week. The value shows that experimental participants WHtR decrease from the Baseline to the week 12 of aerobic dance circuit training

Fig 11: Line graph showing the mean scores of WHtR of the respondent in Experimental and Control groups in the baseline, 4th week, 8th week and 12th week



From the figure, the line graph indicates that the treatment was effective from week 4 through the week 12 among the experimental group.

Table 8.4: Estimated marginal means of treatment groups on Body composition (%bf, WHR and WHtR)

Treatment	Means
Experimental group	5.258
Control group	6.469

Table 8.4 reveals that participants in experimental group had a lower estimated mean score of 5.258 while participants in control group had an estimated means score of 6.469. This shows that the treatment favour participants in experimental group more than those in controls group.

Table 8.5: Paired Sample Test showing the Pretest and Posttest scores of body composition variables (%bf, WHR and WHtR)

Variable		N	Mean	Std. Dev.	Crit-t	Cal-t.	df	P
% BF	Pretest	70	36.8913	4.0993	2.00	3.648	69	0.001
	Posttest	70	24.9619	3.6993				
WHR	Pretest	70	0.8033	6.717E-02	2.00	4.807	69	0.000
	Posttest	70	0.7741	5.570E-02				
WHtR	Pretest	70	0.5241	5.625E-02	2.00	7.669	69	0.000
	Posttest	70	0.4924	5.539E-02				

Table 8.5 shows the results of the significant difference between the pretest and posttest scores of Body Composition (% Body Fat (%bf), Waist- to-Hip Ratio (WHR) and Waist-to-height ratio (WHtR)) in obese female College of Education Students, viz:

- % BF (Crit-t = 2.00, Cal.t = 3.648, df = 69,p<.05). The hypothesis is rejected;
- WHR (Crit-t = 2.00, Cal.t = 4.807, df = 69,p<.05). The hypothesis is rejected and
- WTHR (Crit-t = 2.00, Cal.t = 7.669, df = 69,p<.05). The hypothesis is rejected.

Table 8.6: Summary of the Body Composition variables of the participants at Baseline and Post-intervention (N=70)

Variables	Mean±SD Baseline	Mean±SD Week 4	Mean±SD Week 8	Mean±SD Post
%bf	36.8913±1.62	36.1277±1.45	30.0567±1.66	29.9617±0.09
WHR	0.8033±8.15	0.8052±4.73	0.7932±2.14	0.7742±1.23
WHtR	0.5242±1.45	0.5212±0.28	0.5076±0.83	0.4924±0.86

From Table 8.6, the mean of obese participants on body compostion variables of the participants for %bf at the baseline was 36.8913±1.62, at the 4th week was 36.1277±1.45, 8th week was 30.0567±1.66 and at the post intervention was 29.9617±0.09, while that of WHR ranges frrom the baseline 0.8033±8.15, 4th week was 0.8052±4.73, at the 8th week was 0.7932±2.14 and at the post intervention was 0.7742±1.23, while that of WHtR at the baseline was 0.5242±1.45, 4th week was 0.5212±0.28, 8th week 0.5076±0.83 and post intervention recorded 0.4924±0.86

Hypothesis 1 (bi): There will be no significant main effects of Treatment on DBP

Table 9.1: ANCOVA showing the main effect and interaction effects of Treatment, Age and Class of obesity on DBP

Source	Sum of Squares	df	Mean Square	F	Sig.	Eta. Sq.
Corrected Model	17281.913	13	1329.378	8.076	.000	0.283
Main Effect:						
Treatment Group	2297.090	1	2297.090	13.954	.000	0.050
Age	98.620	1	98.620	.599	.440	0.002
Class of obesity	722.505	3	240.835	1.463	.225	0.016
2-way Interactions:						
Treatment x Age	254.811	1	254.811	1.548	.215	0.006
Treatment x Class of obesity	163.755	3	54.858	.332	.803	0.004
Age x Class of obesity	137.567	2	68.783	.418	. 659	0.003
3-way Interactions:						
Treatment x Age x Class of obesity	633.809	2	316.904	1.925	.148	0.014
Error	43788.430	57	768.2181			
Total	61069.343	69				

Table 9.1 shows that there was significant effect of treatment on DBP. ($F(1,278) = 13.954$, $p<.05, \eta^2=.050$)The Eta Square of .050 shows that about 50% of the variation in participants scores were attributed to the treatment. Therefore, the null hypothesis is rejected.

Table 9.2: Estimated Marginal Means of Treatment Groups on DBP

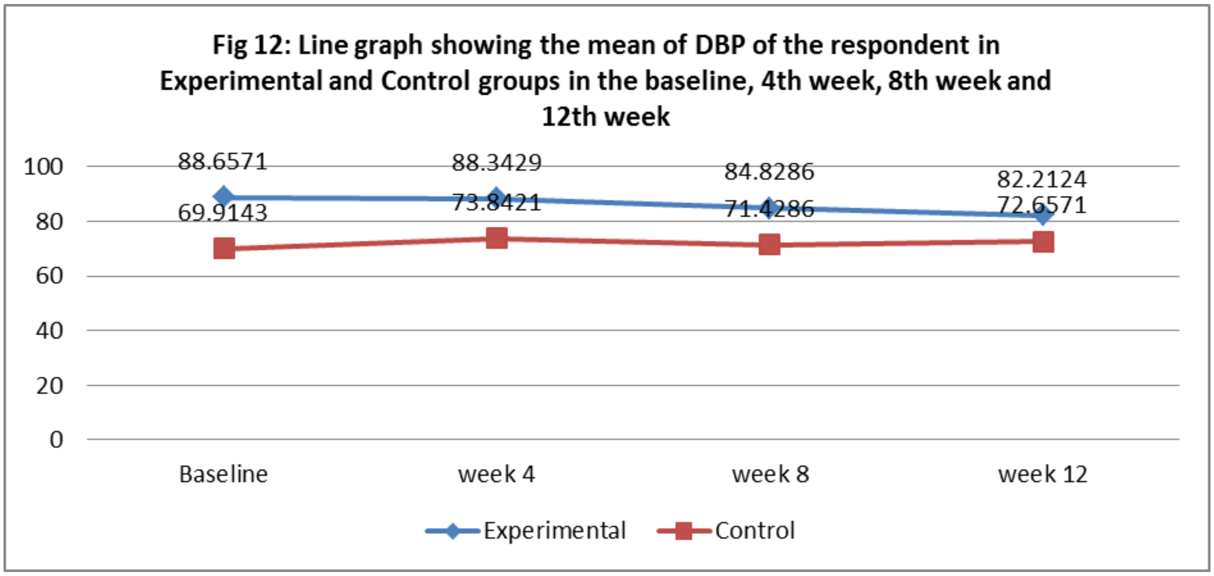
Treatment	Mean	Std. Error
Experimental Group	71.259	2.222
Control Group	84.540	1.793

Table 9.2 reveals that participants in experimental group had a lower mean score of 71.259 while participants in control group had a mean score of 84.540. This shows that participants in experimental group perform better than those in control group.

Table 9.3: The average DBP of obese female college students per week

DPB	**Baseline**	**week 4**	**week 8**	**week 12**
Experimental	88.6571	88.3429	84.8286	82.2124
Control	69.9143	73.8421	71.4286	72.6571

Table 9.3 shows the average DBP of both experimental and control group participant taken per week. The value shows that experimental group DBP decreases from the week 4 to the week 12 of aerobic dance circuit training. Control group values are better especially after week 4.



From the figure, the line graph reveals that there was slightly significant effect of treatment between the baseline, week 4, week 8 and week 12 of experimental group.

Hypothesis 1 (bii): There will be no significant main effects of Treatment on SBP

Table 10.1: ANCOVA showing the main effect and interaction effects of Treatment, Age and Class of obesity on SBP

Source	Sum of Squares	df	Mean Square	F	Sig.	Eta. Sq.
Corrected Model	11376.225	13	875.094	6.259	.000	.234
Main Effect:						
Treatment Group	619.172	1	619.172	4.428	.036	.016
Age	1079.358	1	1079.172	7.720	.006	.028
Class of obesity	205.977	3	68.659	.491	.689	.006
2-way Interactions:						
Treatment x Age	469.690	1	469.690	3.366	.068	.012
Treatment x Class of obesity	2454.867	3	818.289	5.852	.001	.062
Age x Class of obesity	194.756	2	97.378	.696	.499	.005
3-way Interactions:						
Treatment x Age x Class of obesity	991.889	2	495.945	3.547	.030	.026
Error	37192.346	57	652.4973			
Total	48568.571	69				

Table 10.1 shows that there was significant effect of treatment on SBP. ($F(1,57) = 4.428$, $p<.05, \eta^2=.016$). The Eta Square of .016 shows that about 5% of the variation in participants scores were attributed to the treatment. Therefore, the null hypothesis is rejected.

Table 10.2: Estimated Marginal Means of Treatment Groups on SBP

Treatment	Mean	Std Error
Experimental Group	134.475	0.421
Control Group	138.030	0.340

Table 10.2 reveals that participants in experimental group had a lower mean score of 134.475 while participants in control group had a mean score of 138.030. This shows that participants in experimental group perform better than those in control group.

Table 10.3: The average SBP of obese female college students per week

SPB	**Baseline**	**week 4**	**week 8**	**week 12**
Experimental	136.4857	136.1143	132.5429	131.6571
Control	130.8156	130.2286	129.8286	130.5617

Table 10.3 shows the average SBP of both experimental and control group participant taken per week. The value shows that experimental participants SBP decrease from the week 4 to the week 12 of aerobic dance circuit training.

Fig 13: Line graph showing the mean scores of SBP of the respondent in Experimental and Control groups in the baseline, 4th week, 8th week and 12th week

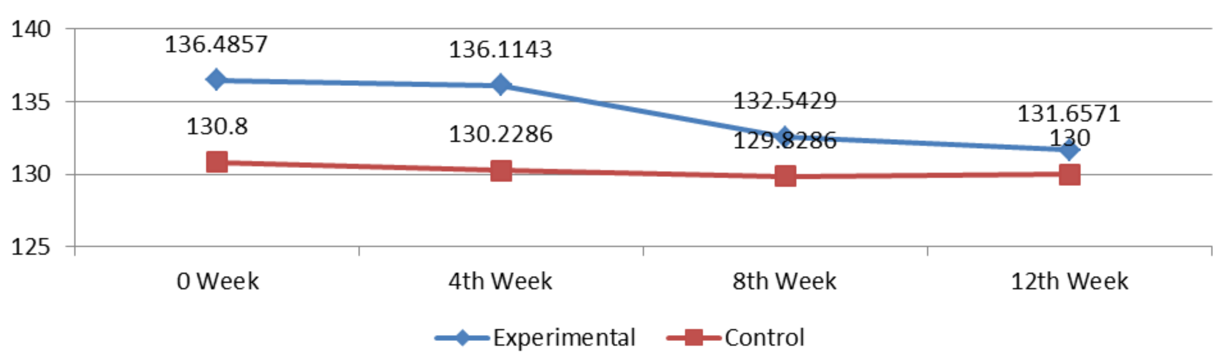


Figure shows the line graph of the SBP. This indicates that there was a reduction in experimental SBP participants between the week 4 and week 8 following the treatment.

Hypothesis 1 (biii): There will be no significant main effects of Treatment on P_{mean}

Table 11.1: ANCOVA showing the main effect and interaction effects of Treatment, Age and Class of obesity on the P_{mean}

Source	Sum of Squares	df	Mean Square	F	Sig.	Eta. Sq
Corrected Model	10333.551	13	794.889	5.525	.000	.213
Main Effect:						
Treatment Group	875.136	1	875.136	6.082	.014	.022
Age	63.120	1	63.120	.439	.508	.002
Class of obesity	198.683	3	66.228	.460	.710	.005
2-way Interactions:						
Treatment x Age	587.363	1	587.363	4.082	.044	.015
Treatment x Class of obesity	495.343	3	165.114	1.148	.330	.013
Age x Class of obesity	82.733	2	41.366	.287	.750	.002
3-way Interactions:						
Treatment x Age x Class of obesity	.331	2	.166	.001	.999	.001
Error	38273.063	57	671.4572			
Total	48606.613	69				

Table 11.1 shows that there was significant effect of treatment on P_{mean}. ($F(1,57) = 6.082$, $p<.05, \eta^2=.022$). The Eta Square of .022 shows that about 2% of the variation in participants scores were attributed to the treatment. Therefore, the null hypothesis is rejected.

Table 11.2: Estimated Marginal Means on Treatment Groups on P_{mean}

Treatment	Mean	Std. Error
Experimental Group	91.990	2.078
Control Group	100.241	1.677

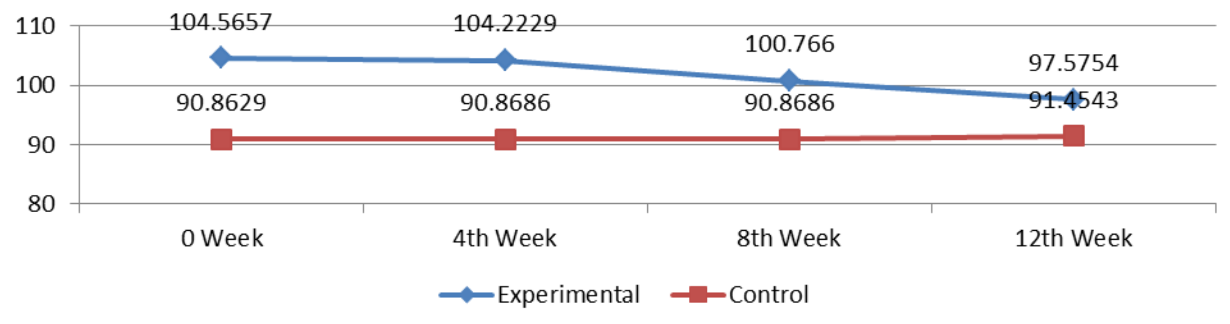
Table 11.2 reveals that participants in experimental group had a lower mean score of 91.990 while participants in control group had a mean score of 100.241. This shows that participants in experimental group perform better than those in control group.

Table 11.3: The average P_{mean} of obese female college students per week

P_{mean}	**Baseline**	**week 4**	**week 8**	**week 12**
Experimental	104.5657	104.2229	100.766	97.5754
Control	90.8629	90.8686	90.8686	91.4543

Table 11.3 shows the average P_{mean} of both experimental and control group participant taken per week. The value shows that experimental participants P_{mean} decrease from the week 4 to the week 12 of aerobic dance circuit training.

Fig 14: Line graph showing the mean scores of MAP of the respondent in Experimental and Control groups in the baseline, 4th week, 8th week and 12th week



From the figure, the line graph reveals that there was significant effect of treatment between week 4, week 8 and week 12 following the treatment.

Hypothesis 1 (biv): There will be no significant main effects of Treatment on VC

Table 12.1: ANCOVA showing the main effect and interaction effects of Treatment, Age and Class of obesity on Vital Capacity

Source	Sum of Squares	df	Mean Square	F	Sig.	Eta. Sq
Corrected Model	21688513.818	13	16668347.217	10.607	.000	.341
Main Effect:						
Treatment Group	2816719.166	1	2816719.166	17.908	.000	.063
Age	146419.432	1	146419.432	.931	.336	.003
Class of obesity	1082579.806	3	360859.935	2.294	.078	.025
2-way Interactions:						
Treatment x Age	64837.257	1	64837.257	.412	.521	.002
Treatment x Class of obesity	1241255.895	3	413751.965	2.631	.051	.029
Age x Class of obesity	65577.192	2	32788.896	.208	.812	.002
3-way Interactions:						
Treatment x Age x Class of obesity	65817.093	2	32908.547	.209	.811	.002
Error	41838450.468	57	734007.9030			
Total	63526964.286	69				

Table 12.1 shows that there was significant effect of treatment on VC. ($F(1,57) = 17.908$, $p<.05, \eta^2=.063$). The Eta Square of .063 shows that about 60% of the variation in participants scores were attributed to the treatment. Therefore, the null hypothesis is rejected.

Table 12.2: Estimated Marginal Means of Treatment Groups on VC

Treatment	Mean	Std. Error
Experimental Group	2361.029	68.699
Control Group	1906.958	55.434

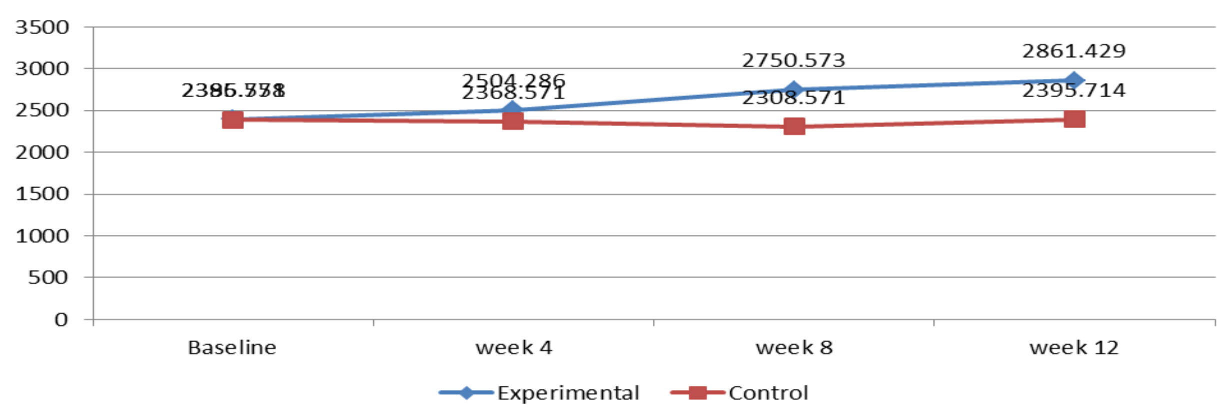
Table 12.2 reveals that participants in experimental group had a greater mean score of 2361.029 while participants in control group had a mean score of 1906.958. This shows that participants in experimental group perform better than those in control group.

Table 12.3: The average VC of obese female college students per week

VC	Baseline	week 4	week 8	week 12
Experimental	2395.758	2504.286	2750.573	2861.429
Control	2386.571	2368.571	2308.571	2395.714

Table 12.3 shows the average VC of experimental and control group participant taken per week. The value shows that experimental participants VC increase from the Baseline to the week 12 following aerobic dance circuit training.

Fig 15: Line grapgh showing the mean scores of VC of the respondent in Experimental and Control groups in the baseline, 4th week, 8th week and 12th week



From the figure, the line graph reveals that there was slightly significant effect of treatment on experimental group VC from the baseline to week 4 and pick up more from week 8 to week 12.

Hypothesis 1 (bv): There will be no significant main effects of Treatment on IRV

Table 13.1: ANCOVA showing the main effect and interaction effects of Treatment, Age and Class of obesity on Inspiratory reserved volume

Source	Sum of Squares	df	Mean Square	F	Sig.	Eta. Sq
Corrected Model	46081602.775	13	3544738.675	13.119	.000	.391
Main Effect:						
Treatment Group	3140169.633	1	3140169.633	11.621	.001	.042
Age	535850.686	1	535850.686	1.983	.160	.007
Class of obesity	1459891.802	3	486630.601	1.801	.147	.020
2-way Interactions:						
Treatment x Age	1340078.365	1	1340078.365	4.959	.027	.018
Treatment x Class of obesity	635181.247	3	211727.082	.784	.504	.009
Age x Class of obesity	151231.631	2	757615.815	2.804	.062	.021
3-way Interactions:						
Treatment x Age x Class of obesity	523179.144	2	261589.572	.968	.381	.007
Error	71875504.368	57	1260973.761			
Total	117957107.1	69				

Table 13.1 shows that there was significant effect of treatment on IRV ($F(1,57) = 11.621$, $p<.05, \eta^2=.042$). The Eta Square of .063 shows that about 60% of the variation in participants scores were attributed to the treatment. Therefore, the null hypothesis is rejected.

Table 13.2: Estimated Marginal Means on Treatment Groups on IRV

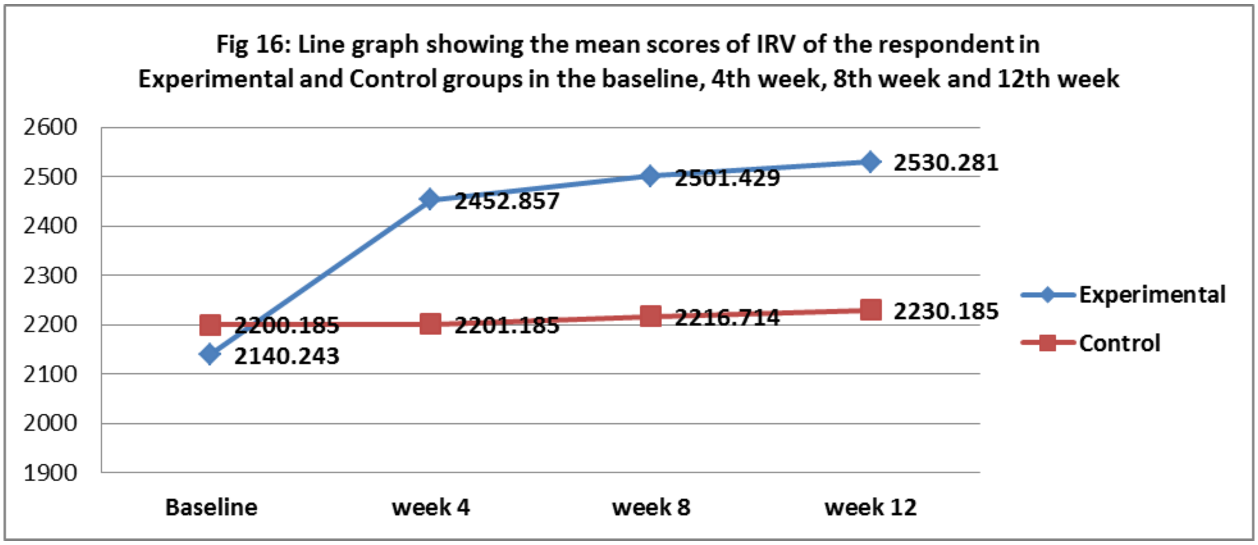
Treatment	Mean	Std Error
Experimental Group	2369.390	90.043
Control Group	1834.419	72.658

Table 13.2 reveals that participants in experimental group had a greater mean score of 2369.390 while participants in control group had a mean score of 1834.419. This shows that participants in experimental group perform better than those in control group.

Table 13.3: The average IRV of obese female college students per week

IRV	**Baseline**	**week 4**	**week 8**	**week 12**
Experimental	2140.2430	2452.8570	2501.4290	2530.2810
Control	2200.1850	2201.1850	2216.7140	2230.1850

Table 13.3 shows the average IRV of experimental and control group participant taken per week. The value shows that experimental participants IRV increase from the Baseline to the week 12 of aerobic dance circuit training.



From the figure, the line graph shows that there was no significant improvement in IRV between the base line and the week 4. The trend however shows that there was a significant effect of treatment sharply from the baseline and week 4 than 4th week to 8th week and week 12 among the experimental group.

Hypothesis 1 (bvi): There will be no significant main effects of Treatment on PEFR

Table 14.1: ANCOVA showing the main effect and interaction effects of Treatment, Age and Class of obesity on PEFR.

Source	Sum of Squares	df	Mean Square	F	Sig.	Eta. Sq
Corrected Model	1064212.460	13	81862.497	30.691	.000	.600
Main Effect:						
Treatment Group	162351.731	1	162351.731	60.867	.000	.186
Age	53042.107	1	53042.107	19.886	.000	.069
Class of obesity	12818.434	3	4272.811	1.602	.189	.018
2-way Interactions:						
Treatment x Age	2985.717	1	2985.717	1.119	.291	.004
Treatment x Class of obesity	18174.501	3	6058.167	2.271	.081	.025
Age x Class of obesity	4178.094	2	2089.047	.783	.458	.006
3-way Interactions:						
Treatment x Age x Class of obesity	13674.049	2	6837.024	2.563	.079	.019
Error	699501.825	57	12271.962			
Total	1773714.286	69				

Table 14.1 shows that there was significant effect of treatment on PEFR ($F(1,57) = 60.867, p<.05, \eta^2=.186$). The Eta Square of .186 shows that about 90% of the variation in participants scores were attributed to the treatment. Therefore, the null hypothesis is rejected.

Table 14.2: Estimated Marginal Means of Treatment Groups on PEFR

Treatment	Mean	Std Error
Experimental Group	343.185	8.946
Control Group	233.947	7.219

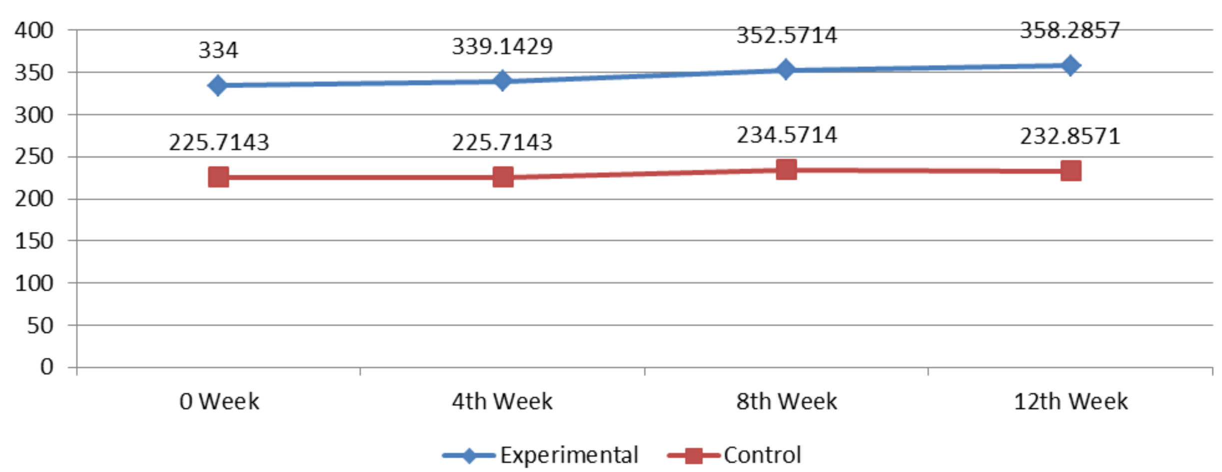
Table 14.2 reveals that participants in experimental group had a greater mean score of 343.185 while participants in control group had a mean score of 233.947. This shows that participants in experimental group perform better than those in control group.

Table 14.3: The average PEFR of obese female college students per week

PEFR	Baseline	week 4	week 8	week 12
Experimental	334.0000	339.1429	352.5714	358.2857
Control	225.7143	225.7143	234.5714	232.8571

Table 14.3 shows the average PEFR of experimental and control group participant taken per week. The value shows that experimental participants PEFR increase from the Baseline to the week 12 of aerobic dance circuit training

Fig 17: Line graph showing the mean scores of PEFR of the respondent in Experimental and Control groups in the baseline, 4th week, 8th week and 12th week



The figure reveals that there was an improvement in PEFR of the experimental group between the baseline, week 4, week 8 and week 12 following the treatment.

Hypothesis 1 (bvii): There will be no significant main effects of Treatment on HRR

Table 15.1: ANCOVA showing the main effect and interaction effects of Treatment, Age and Class of obesity on HRR

Source	Sum of Squares	df	Mean Square	F	Sig.	Eta. Sq
Corrected Model	31581.148	13	2429.319	7.121	.000	.258
Main Effect:						
Treatment Group	5334.964	1	5334.964	15.638	.000	.056
Age	.274	1	.274	.001	.977	.000
Class of obesity	482.049	3	160.683	.471	.693	.005
2-way Interactions:						
Treatment x Age	.913	1	.913	.003	.959	.000
Treatment x Class of obesity	669.222	3	223.074	.654	.581	.007
Age x Class of obesity	791.119	2	395.560	1.159	.315	.009
3-way Interactions:						
Treatment x Age x Class of obesity	516.420	2	258.210	.757	.469	.006
Error	90749.423	57	1592.095			
Total	122330.571	69				

Table 15.1 shows that there was significant effect of treatment on HRR ($F(1,57) = 15.638$, $p<.05, \eta^2=.056$). The Eta Square of .056 shows that about 60% of the variation in participants scores were attributed to the treatment. Therefore, the null hypothesis is rejected.

Table 15.2: Estimated Marginal Means of Treatment Groups on HRR.

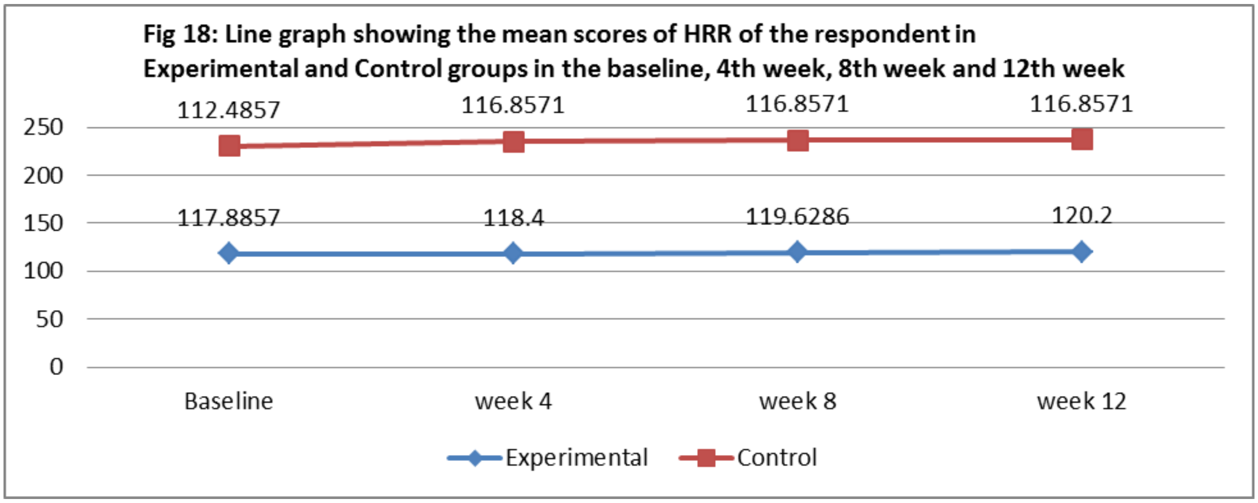
Treatment	Mean	Std Error
Experimental Group	136.098	3.200
Control Group	116.491	2.582

Table 15.2 reveals that participants in experimental group had a greater mean score of 136.098 while participants in control group had a mean score of 116.491. This shows that participants in experimental group perform better than those in control group.

Table 15.3: The average HRR of obese female college students per week

HRR	**Baseline**	**week 4**	**week 8**	**week 12**
Experimental	117.8857	118.4000	119.6286	120.2000
Control	112.4857	116.8571	116.8571	116.8571

Table 15.3 shows the average HRR of both experimental and control group participant taken per week. The value shows that experimental participants HRR increase from the 0^{th} week to the week 4, from week 4 to week 8 and to the week 12 of aerobic dance circuit training.



The figure reveals that the treatment was more effective between the baseline, week 4, week 8 and week 12 among the experimental group than the control group.

Hypothesis 1 (bviii): There will be no significant main effects of Treatment on VO_2max

Table 16.1: ANCOVA showing the main effect and interaction effects of Treatment, Age and Class of obesity on VO_2max

Source	Sum of Squares	df	Mean Square	F	Sig.	Eta. Sq
Corrected Model	2322.988	13	178.691	6.138	.000	.231
<u>Main Effect:</u>						
Treatment Group	319.845	1	319.845	10.987	.001	.040
Age	3.6743	1	3.673	.126	.723	.000
Class of obesity	97.176	3	32.392	1.113	.344	.012
<u>2-way Interactions:</u>						
Treatment x Age	118.239	1	118.239	4.062	.045	.015
Treatment x Class of obesity	185.865	3	61.955	2.128	.097	.023
Age x Class of obesity	34.409	2	17.204	.591	.554	.004
<u>3-way Interactions:</u>						
Treatment x Age x Class of obesity	234.181	2	117.090	4.022	.019	.029
Error	7743.368	57	135.849			
Total	10066.355	69				

Table 16.1 shows that there was significant effect of treatment on VO_2max ($F(1,57) = 10.987$, $p<.05, \eta^2=.040$). The Eta Square of .040 shows that about 40% of the variation in participants scores were attributed to the treatment. Therefore, the null hypothesis is rejected.

Table 16.2: Estimated Marginal Means of Treatment Groups on VO_2max

Treatment	Mean	Std Error
Experimental Group	41.669	.935
Control Group	36.868	.754

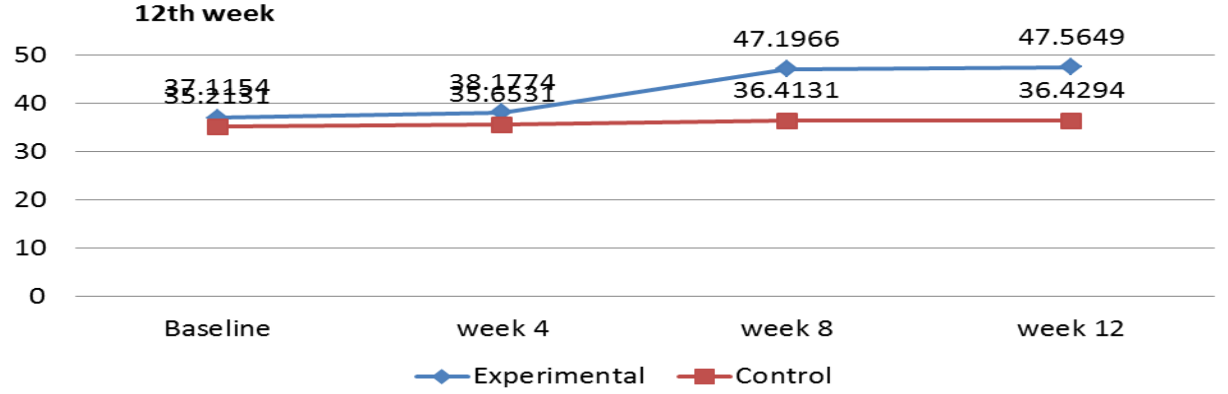
Table 16.2 reveals that participants in experimental group had a greater mean score of 41.669 while participants in control group had a mean score of 36.868. This shows that participants in experimental group perform better than those in control group.

Table 16.3: The average VO_2max of obese female college students per week

$V0_2$max	**Baseline**	**week 4**	**week 8**	**week 12**
Experimental	37.1154	38.1774	47.1966	47.5649
Control	35.2131	35.6531	36.4131	36.4294

Table 16.3 shows the average VO_2max of both experimental and control group participant taken per week. The value shows that experimental participants VO_2max slightly increase from 0^{th} week to week 4 and increased more from week 4 to the week 12 following aerobic dance circuit training intervention.

Fig 19: Line graph showing the mean of VO2 Max of the respondent in Experimental and Control groups in the baseline, 4th week, 8th week and 12th week



Form the figure, the line graph reveals that there was a rise in VO_2max between the baseline and the week 4 while the treatment was effective between the week 4, week 8 and 12 week among the experimental group as a results of exercise conditioning.

Table 16.4: Estimated marginal means of treatment groups on Cardiorespiratory variables (DBP, SBP, VC, IRV, PEFR and P_{mean}, HRR and VO_2max**].**

Treatment	**Means**
Experimental group	678.76
Control group	541.44

Table 15.4 reveals that participants in experimental group had a higher estimated mean score of 678.76 while participants in control group had an estimated means score of 541.44. This shows that the treatment favour participants in experimental group than those in control group.

Table 16.5: Paired Sample Test showing the Pretest and Posttest scores of cardiorespiratory variables

Variable		N	Mean	Std. Dev.	Crit-t	Cal-t.	df	P
Systolic BP	Pretest	70	133.6429	13.9461	2.00	3.026	69	.003
	Posttest	70	130.8286	9.2470				
Diastolic BP	Pretest	70	79.7857	17.0820	2.00	1.437	69	.155
	Posttest	70	77.4286	10.5865				
Reserved Heart Rate	Pretest	70	116.0571	16.9209	2.00	0.723	69	.472
	Posttest	70	117.6286	10.0075				
Peak Expiratory Flow Rate	Pretest	70	279.8571	77.1502	2.00	8.943	69	.000
	Posttest	70	295.5714	82.3502				
Vital Capacity	Pretest	70	2084.2857	476.6689	2.00	4.602	69	.000
	Posttest	70	2178.5714	478.9460				
$V0_2max$	Pretest	70	36.1643	4.9823	2.00	1.220	69	.227
	Posttest	70	36.9971	5.1729				
Inspiratory Reserved Volume	Pretest	70	2140.0000	621.4522	2.00	4.615	69	.000
	Posttest	70	2330.0000	695.0863				
P_{mean}	Pretest	70	97.7143	14.5806	2.00	1.786	69	.078
	Posttest	70	94.5149	13.6008				

Below are the results of the significant difference between the pretest and posttest scores of Cardiorespiratory (Systolic BP (SBP), Diastolic BP (DBP), Heart Rate Reserved, Peak

Expiratory Flow Rate, Vital Capacity, $V0_2$max, Inspiratory Reserved Volume and Mean Arterial Blood Pressure) in obese female College of Education Students

- Systolic BP (Crit-t = 2.00, Cal.t = 3.026, df = 69,p<.05). The hypothesis is rejected;
- Diastolic BP (Crit-t = 2.00, Cal.t = 1.437, df = 69,p>.05). The hypothesis is accepted;
- Heart Rate Reserved (Crit-t = 2.00, Cal.t = -.723, df = 69,p>.05). The hypothesis is accepted;
- Peak Expiratory Flow Rate (Crit-t = 2.00, Cal.t = 8.943, df = 69,p<.05). The hypothesis is rejected;
- Vital Capacity (Crit-t = 2.00, Cal.t = 4.602, df = 69,p<.05).The hypothesis is rejected;
- $V0_2$max (Crit-t = 2.00, Cal.t = 1.220, df = 69,p>.05). The hypothesis is accepted;
- Inspiratory Reserved Volume (Crit-t = 2.00, Cal.t = 4.615, df = 69,p<.05). The hypothesis is rejected and
- P_{mean} (Crit-t = 2.00, Cal.t = 1.786, df = 69,p>.05). The hypothesis is accepted;

Hypothesis 2(ai): There will be no significant main effect of Age on %bf

From table 6.1 there was significant main effect of age on %bf (F (1,57) = 11.589, $p<.05,\eta^2=.042$). The Eta Square value of .042 shows that about 5% of the participants' scores were accounted for by Age. Therefore, the null hypothesis is rejected.

Table 17.1: Estimated Marginal Means of Age on %bf

Age	Mean	Std Error
19-24years	36.582	.406
25-30years	25.813	.325

Table 17.1 shows the estimated marginal means scores of the effects of age on %bf. It reveals that participants within the age bracket of 25-30 years had lower means scores of 25.813 while participants within the age bracket of 19-24 years had means scores of 36.582. This shows that participants within the age bracket of 25-30 years responded to treatment than the participants within the age of 19-24 years.

Table 17.2: The average %bf of obese female college students 19 and 24 years per week

%bf	Baseline	week 4	week 8	week 12
Experimental	37.0800	36.3623	24.6200	24.4973
Control	37.2355	36.5327	36.8318	36.2091

Table 17.2 shows the average %bf of experimental and control group participant ages 19 and 24 years taken per week. The value shows that experimental participants %bf decrease from the Baseline to the week 12 of aerobic dance circuit training.

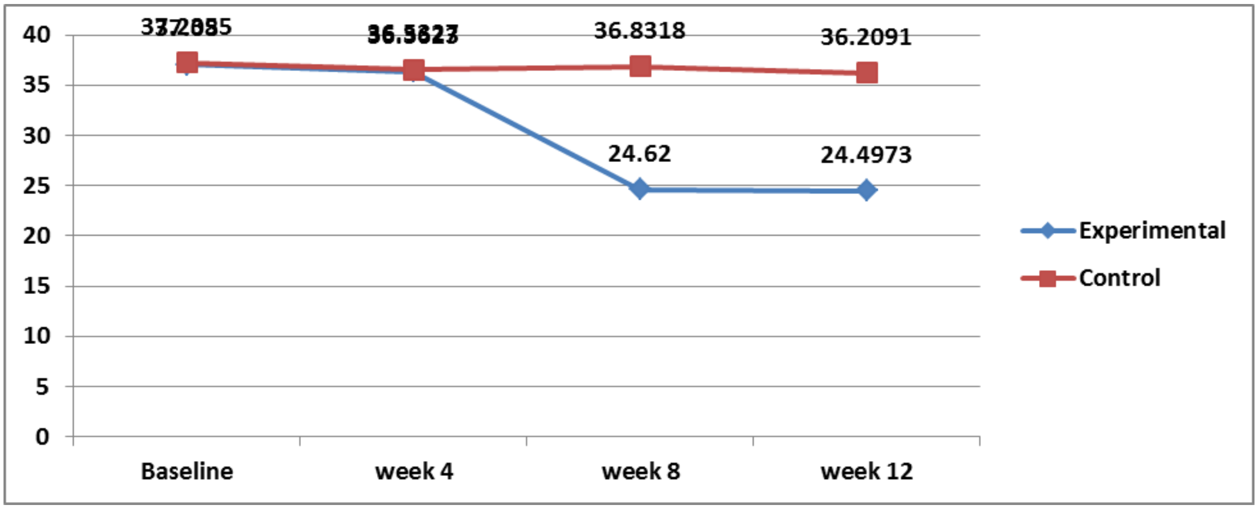
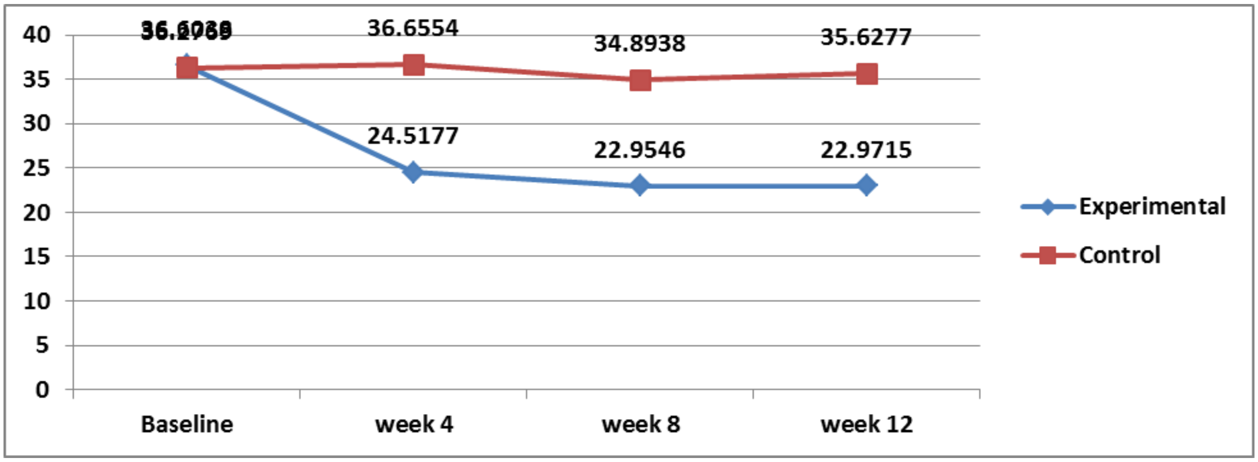


Table 17.3: The average %bf of obese female college students 25 and 30 years per week

%bf	Baseline	week 4	week 8	week 12
Experimental	36.6038	24.5177	22.9546	22.9715
Control	36.2769	36.6554	34.8938	35.6277

Table 17.3 shows the average %bf of experimental and control group participant ages 25 and 30 years taken per week. The value shows that experimental participants %bf decrease from the Baseline to the week 12 of aerobic dance circuit training.



From the figures, the line graphs reveal that the treatment was more effective in ages 19-24years than 25-30 years. It was also reveals that in ages 19-24 years there was significant effect of treatment between 4^{th} and week 8 up to the week 12 among the experimental group.

Hypothesis 2(aii): There will be no significant main effect of Age on WHR

From Table 7.1 there was no significant main effect of age on WHR (F (1,57) = .467, p>05,η^2=.002). The Eta Square value of .002 shows that about 20% of the participants' scores were accounted for by Age. Therefore, the null hypothesis is accepted.

Table 18.1: Estimated Marginal Means of Age on WHR

Age	Mean	Std Error
19-24years	0.812	0.011
25-30years	0.803	0.009

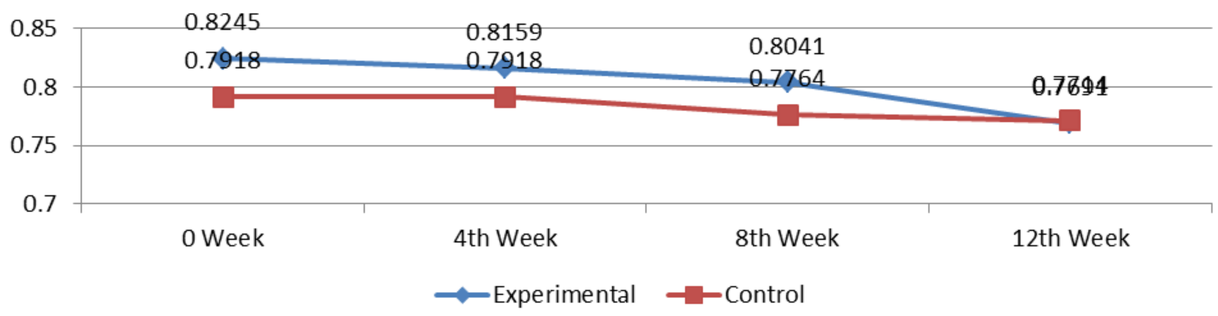
Table 18.1 shows the estimated marginal means scores of the effects of age on WHR. It reveals that participants within the age bracket of 25-30 years had lower means scores of 0.803 while participants within the age bracket of 19-24 years had higher means scores of 0.812. This shows that participants within the age bracket of 25-30 years responded to treatment than the participants within the age of 19-24 years.

Table 18.2: The average WHR of obese female college students 19 and 24 years per week

WHR	**Baseline**	**week 4**	**week 8**	**week 12**
Experimental	0.8245	0.8159	0.8041	0.7691
Control	0.7918	0.7918	0.7764	0.7714

Table 18.2 shows the average WHR of experimental and control group participant ages 19 and 24 years taken per week. The value shows that experimental participants WHR decrease from the Baseline to the week 12 of aerobic dance circuit training.

Fig. 22 : Line graph showing the mean scores of WHR of the respondents in Experimental and Control groups for paticipants of age 19-24 in the baseline, 4th week, 8th week and 12th week



The line graph reveals that the treatment was more effective between 8th to week 12s among the experimental group.

Table 18.3: The average WHR of obese female college students 25 and 30 years per week

WHR	Baseline	week 4	week 8	week 12
Experimental	0.8023	0.8269	0.8062	0.7715
Control	0.7877	0.7877	0.7900	0.7900

Table 18.3 shows the average WHR of experimental and control group participant ages 25 and 30 years taken per week. The value shows that experimental participants WHR increase from the Baseline to the week 4 and decrease from week 4 to the week 12 of aerobic dance circuit training.

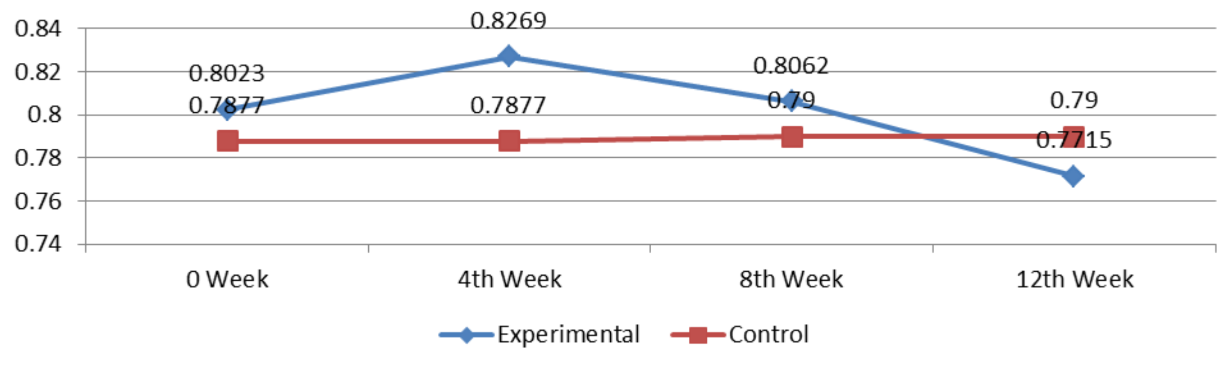


Fig.23: Line graph showing the mean scores of WHR of the respondents in Experimental and Control groups for paticipants of age 25-30 in the baseline, 4th week, 8th week and 12th week

The figure reveals that there was significant effect of treatment between 4th and week 8 up to the week 12 among the experimental group.

Hypothesis 2(aiii): There will be no significant main effect of Age on WHtR

From table 8.1 above there was significant main effect of age on WHtR (F (1,57) = 0.096, p>05,η^2=.000). The Eta Square value of .000 shows that about 1% of the participants' scores were accounted for by Age. Therefore, the null hypothesis is accepted.

Table 19.1: Estimated Marginal Means of Age on WHtR

Age	Mean	Std Error
19-24years	0.535	0.007
25-30years	0.528	0.006

Table 19.1 shows the estimated marginal means scores of the effects of age on WHtR. It reveals that participants within the age bracket of 25-30 years had lower means scores of 0.528 while participants within the age bracket of 19-24 years had higher means scores of 0.535. This shows that participants within the age bracket of 25-30 years responded to treatment than the participants within the age of 19-24 years.

Table 19.2: The average WHtR of obese female college students per week

WTHR	**Baseline**	**week 4**	**week 8**	**week 12**
Experimental	0.5236	0.5191	0.4936	0.4677
Control	0.5291	0.5268	0.5232	0.5177

Table 19.2 shows the average WHtR of experimental and control group participant ages 19 and 24 years taken per week. The value shows that experimental participants WHtR decrease from the Baseline to the week 12 of aerobic dance circuit training.

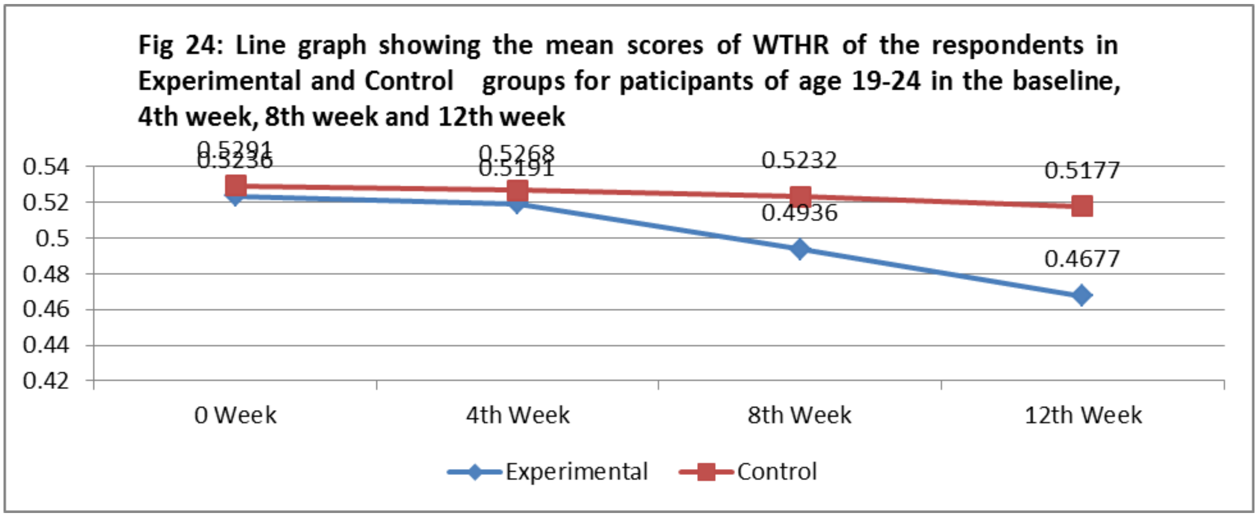
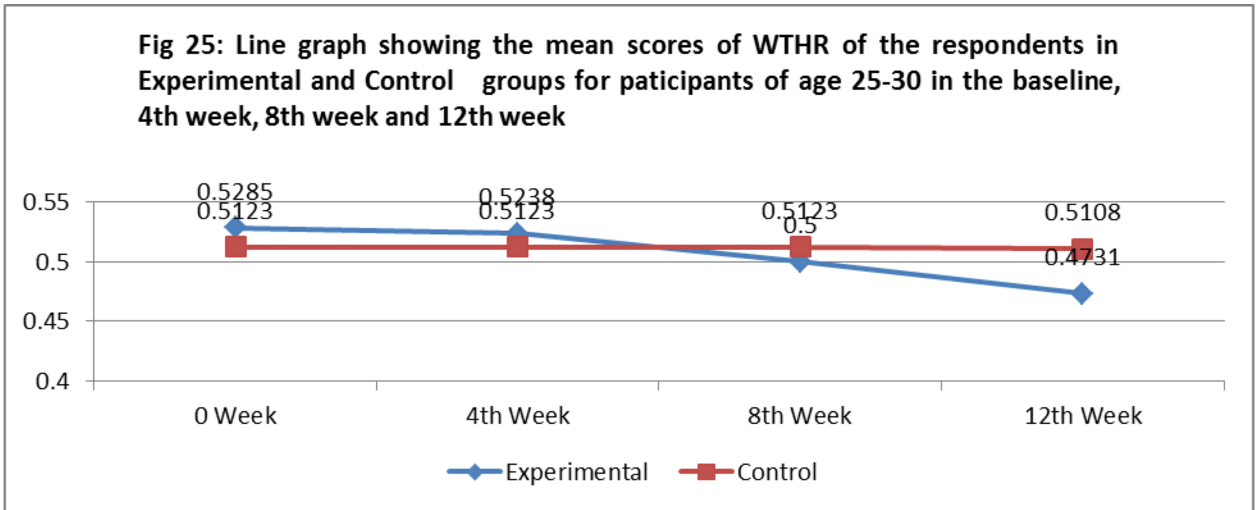


Table 19.3: The average WHtR of obese female college students per week

WHtR	Baseline	week 4	week 8	week 12
Experimental	0.5285	0.5238	0.5012	0.4731
Control	0.5123	0.5123	0.5123	0.5108

Table 19.3 shows the average WHtR of experimental and control group participant ages 25 and 30 years taken per week. The value shows that experimental participants WHtR decrease from the week 4 to the week 12 of aerobic dance circuit training.



The line graph reveals that the treatment was more effective between 4th and week 8 up to the week 12 among the experimental group.in ages 19-24years than 25-30 years.

Hypothesis 2(bi): There will be no significant main effect of Age on DBP

From Table 9.1 there was no significant main effect of age on DBP (F (1,57) = .599, p>05,η^2=.002). The Eta Square value of .002 shows that about 2% of the participants' scores were accounted for by Age. Therefore, the null hypothesis is accepted.

Table 20.1: Estimated Marginal Means of Age on DBP

Age	Mean	Std. Error
19-24years	75.846	2.143
25-30years	80.639	1.713

Table 20.1 shows the estimated marginal means scores of the effects of age on DBP. It reveals that participants within the age bracket of 19-24 years had lower means scores of 75.846 while participants within the age bracket of 25-30 years had higher means scores of 80.639. This shows that participants within the age bracket of 19-24 years responded to treatment than the participants within the age of 25-30 years.

Table 20.2: The average DBP of obese female college students per week

DPB	**Baseline**	**week 4**	**week 8**	**week 12**
Experimental	90.2273	89.9545	85.4091	82.8636
Control	72.2727	74.2273	71.0455	71.2727

Table 20.2 shows the average DBP of experimental and control group participant ages 19 and 24 years taken per week. The value shows that experimental participants DBP decrease from the Baseline to the week 12 of aerobic dance circuit training.

Fig 26: Line graph showing the mean score of DBP of the respondents in experimental and Control groups for participants age 19-24 in the baseline, 4th week, 8th week and 12th week

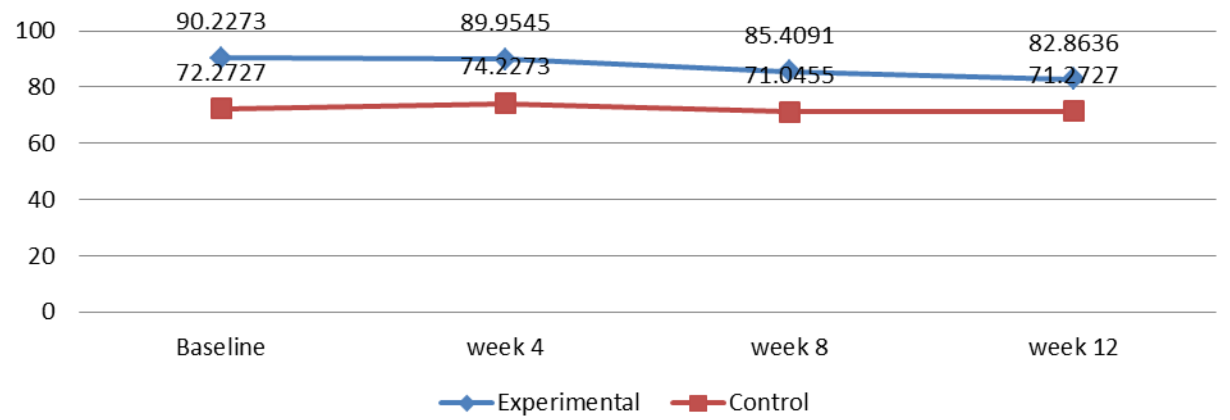
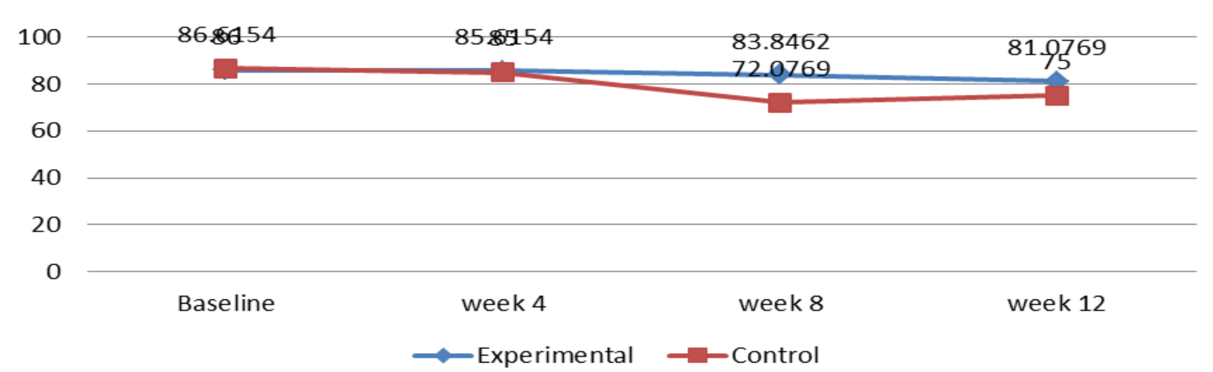


Table 20.3: The average DBP of obese female college students per week ages 25-30 years

DPB	Baseline	week 4	week 8	week 12
Experimental	86.0000	85.6154	83.8462	81.0769
Control	86.6154	85.0000	72.0769	75.0000

Table 20.3 shows the average DBP of experimental and control group participant ages 25 and 30 years taken per week. The value shows that experimental participants DBP decrease from the Baseline to the week 12 of aerobic dance circuit training

Fig 27: Line graph showing the mean score of DBP of the respondents in experimental and Control groups for participants age 25-30 in the baseline, 4th week, 8th week and 12th week



From the figure, line graph reveals that the treatment was not effective from the baseline to 4th, week 8 and week 12 among the experimental group.in ages 19-24years and 25-30 years.

Hypothesis 2(bii): There will be no significant main effect of Age on SBP

From Table 10.1 above there was significant main effect of age on SBP (F (1,57) = 7.720, p>05,η^2=.028). The Eta Square value of .028 shows that about 30% of the participants' scores were accounted for by Age. Therefore, the null hypothesis is rejected

Table 21.1: Estimated Marginal Means of Age on SBP

Age	Mean	Std Error
19-24years	116.582	0.406
25-30years	115.813	0.325

Table 21.1 shows the estimated marginal means scores of the effects of age on SBP. It reveals that participants within the age bracket of 19-24 years had higher means scores of 16.582 while participants within the age bracket of 25-30 years had lower means scores of 15.813. This shows that participants within the age bracket of 25-30 years responded to treatment than the participants within the age of 19-24 years.

Table 21.2: The average SBP of obese female college students per week

SPB	Baseline	week 4	week 8	week 12
Experimental	135.4545	135.0455	131.6818	130.6364
Control	134.2273	133.2273	132.5909	132.7273

Table 21.2 shows the average SBP of experimental and control group participant ages 19 and 24 years taken per week. The value shows that experimental participants SBP decrease from the week 4 to the week 12 of aerobic dance circuit training.

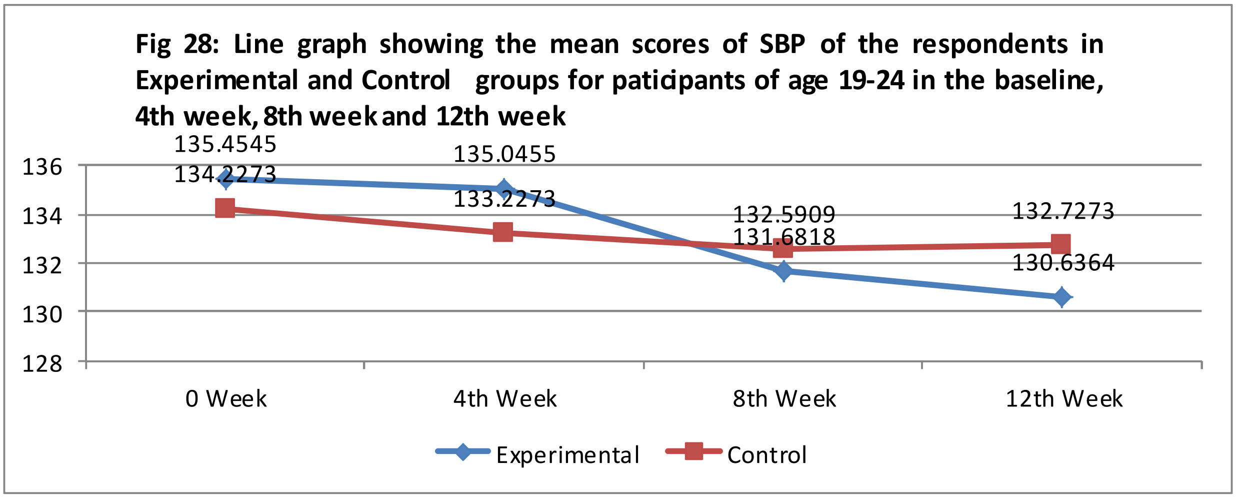
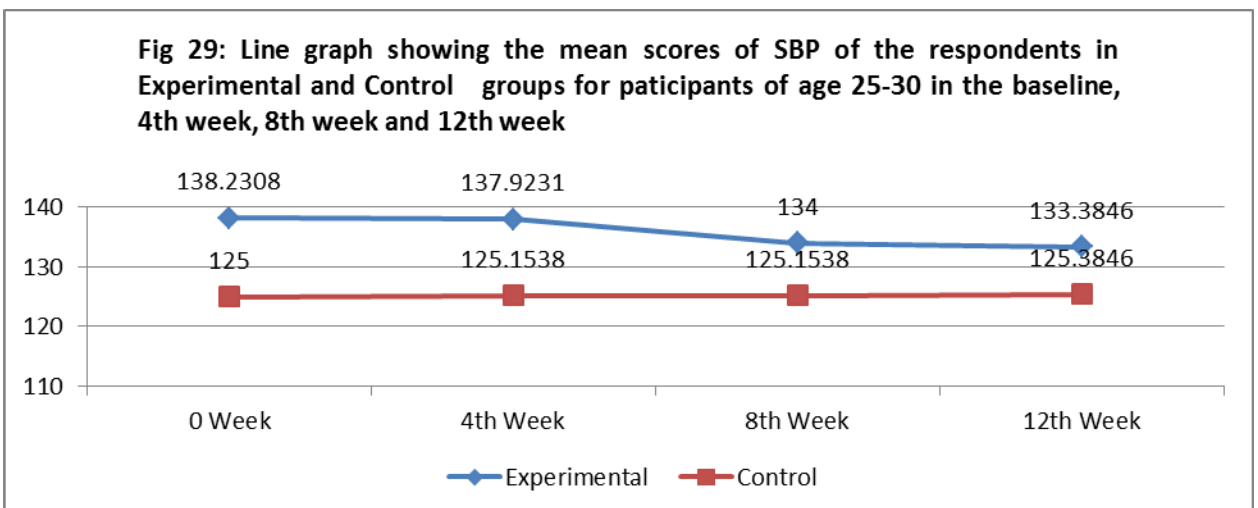


Table 21.3: The average SBP of obese female college students per week

SPB	Baseline	week 4	week 8	week 12
Experimental	138.2308	137.9231	134.0000	133.3846
Control	125.0000	125.1538	125.1538	125.3846

Table 21.3 shows the average SBP of experimental and control group participant ages 25 and 30 years taken per week. The value shows that experimental participants SBP decrease from the Baseline to the week 12 of aerobic dance circuit training



From the figure, the line graph reveals that the treatment was more effective between 4th and week 8 up to the week 12 among the experimental group.in ages 19-24 years than 25-30 years.

Hypothesis 2(biii): There will be no significant main effect of Age on P_{mean}

From table 10a above there was no significant main effect of age on P_{mean} (F (1,57) = .439, p>05,η^2=.002). The Eta Square value of .002 shows that about 2% of the participants' scores were accounted for by Age. Therefore, the null hypothesis is accepted.

Table 22.1: Estimated Marginal Means of Age on P_{mean}

Age	Mean	Std. Error
19-24years	96.110	2.004
25-30years	96.122	1.601

Table 22.1 shows the estimated marginal means scores of the effects of age on P_{mean}. It reveals that participants within the age bracket of 19-24 years had lower means scores of 96.110 while participants within the age bracket of 25-30 years had higher means scores of 96.122. This shows that participants within the age bracket of 25-30 years responded to treatment than the participants within the age of 19-24 years.

Table 22.2: The average P_{mean} of obese female college students per week

P_{mean}	Baseline	week 4	week 8	week 12
Experimental	105.2682	104.9318	100.9032	96.0909
Control	92.9818	93.0909	93.0909	93.0091

Table 22.2 shows the average P_{mean} of experimental and control group participant ages 19 and 24 years taken per week. The value shows that experimental participants P_{mean} decrease from the Baseline to the week 12 of aerobic dance circuit training.

Fig. 30: Line graph showing the mean scores of Pmean of the respondents in Experimental and Control groups for paticipants of age 19-24 in the baseline, 4th week, 8th week and 12th week

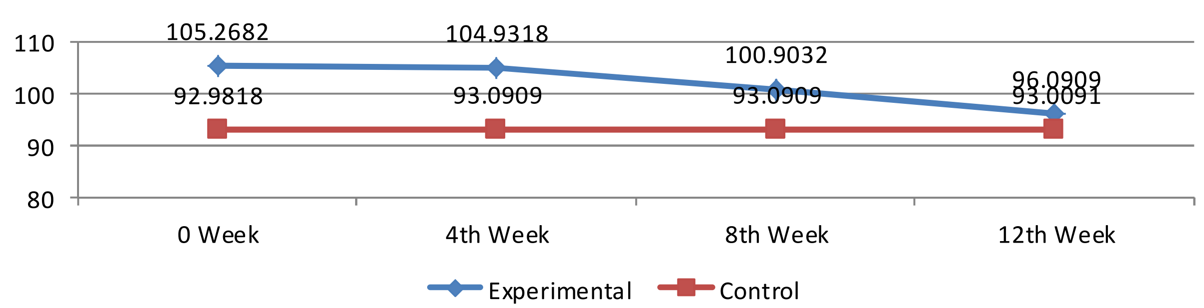
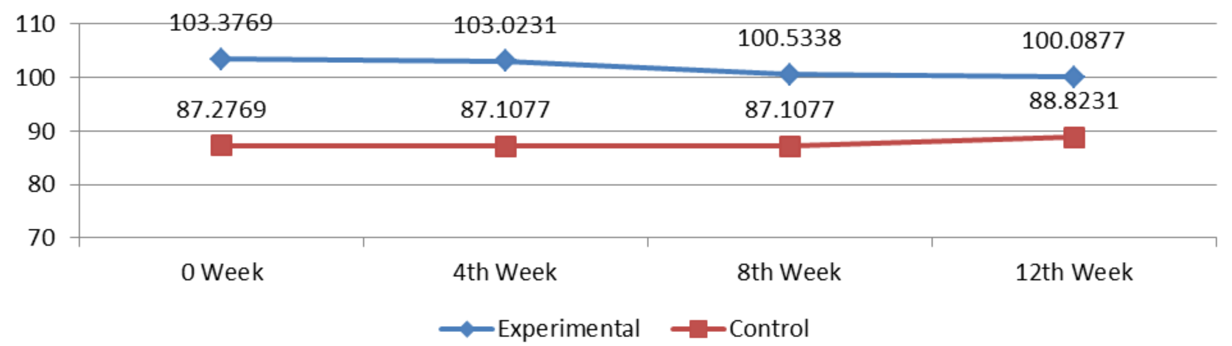


Table 22.3: The average P_{mean} of obese female college students per week

P_{mean}	Baseline	week 4	week 8	week 12
Experimental	103.3769	103.0231	100.5338	100.0877
Control	87.2769	87.1077	87.1077	88.8231

Table 22.3 shows the average P_{mean} of experimental and control group participant ages 25 and 30 years taken per week. The value shows that experimental participants P_{mean} decrease from the week 4 to the week 12 of aerobic dance circuit training

Fig. 31: Line graph showing the mean scores of Pmean of the respondents in Experimental and Control groups for paticipants of age 25-30 in the baseline, 4th week, 8th week and 12th week



From the figures above the line graphs reveals that the treatment was more effective between 4th and week 8 up to the week 12 among the experimental group.in ages 19-24years than 25-30 years.

Hypothesis 2(biv): There will be no significant main effect of Age on VC

From Table 12.1 above there was no significant main effect of age on VC (F (1,57) = .931, p>05,η^2=.003). The Eta Square value of .003 shows that about 3% of the participants' scores were accounted for by Age. Therefore, the null hypothesis is accepted.

Table 23.1: Estimated Marginal Means of Age on VC

Age	Mean	Std. Error
19-24years	2177.778	66.255
25-30years	2075.614	52.938

Table 23.1 shows the estimated marginal means scores of the effects of age on VC. It reveals that participants within the age bracket of 19-24 years had higher means scores of 2177.778 while

participants within the age bracket of 25-30 years had lower means scores of 2075.614. This shows that participants within the age bracket of 19-24 years responded to treatment than the participants within the age of 25-30 years.

Table 23.2: The average VC of obese female college students per week

VC	Baseline	week 4	week 8	week 12
Experimental	2286.364	2406.818	2447.727	2479.546
Control	1831.818	1831.818	1872.727	1861.364

Table 23.2 shows the average VC of experimental and control group participant ages 19 and 24 years taken per week. The value shows that experimental participants VC increase from the Baseline to the week 12 of aerobic dance circuit training.

Fig 32: Line graph showing the mean scores of VC of the respondents in Experimental and Control groups for paticipants of age 19-24 in the baseline, 4th week, 8th week and 12th week

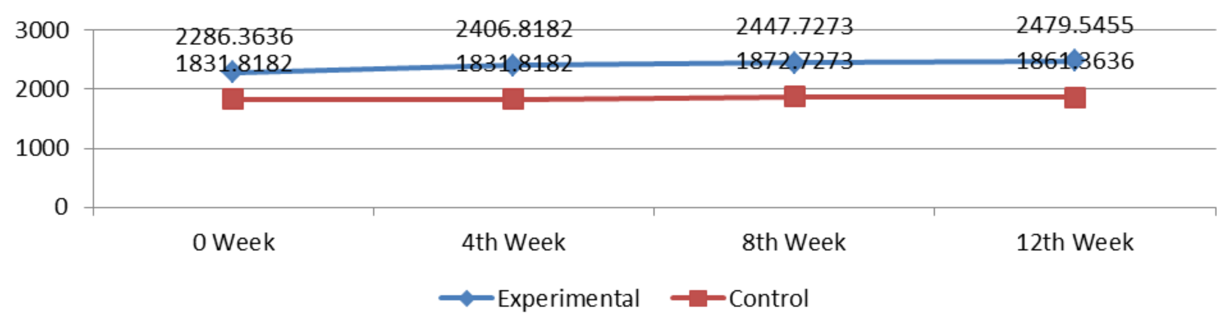
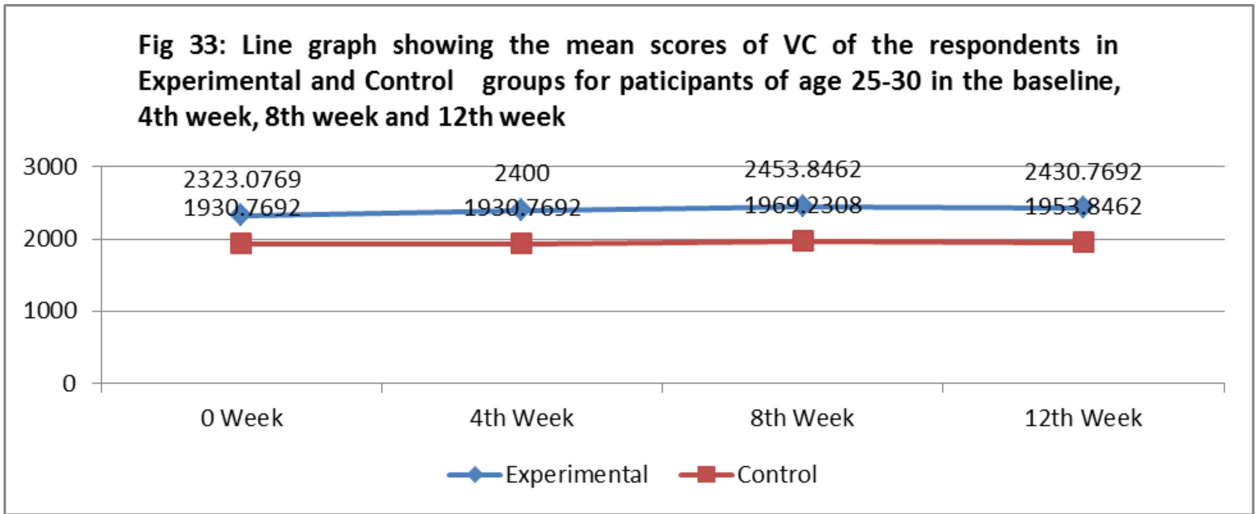


Table 23.3: The average VC of obese female college students per week

VC	Baseline	week 4	week 8	week 12
Experimental	2323.077	2400.000	2453.846	2430.769
Control	1930.769	1930.769	1969.231	1953.846

Table 23.3 shows the average VC of experimental and control group participant ages 25 and 30 years taken per week. The value shows that experimental participants VC slightly increase from the Baseline to the week 12 of aerobic dance circuit training



From the figure, the line graphs reveal that the treatment was more effective between 4th and week 8 up to the week 12 among the experimental group in all age brackets.

Hypothesis 2(bv): There will be no significant main effect of Age on IRV

From table 13.1 above there was no significant main effect of age on IRV (F (1,57) = 1.983, p>05,η^2=.007). The Eta Square value of .007 shows that about 7% of the participants' scores were accounted for by Age. Therefore, the null hypothesis is accepted.

Table 24.1: Estimated Marginal Means of Age on IRV

Age	Mean	Std Error
19-24years	1986.165	86.841
25-30years	2257.391	69.385

Table 24.1 shows the estimated marginal means scores of the effects of age on IRV. It reveals that participants within the age bracket of 19-24 years had lower means scores of 1986.165 while participants within the age bracket of 25-30 years had higher means scores of 2257.391. This shows that participants within the age bracket of 25-30 years responded to treatment than the participants within the age of 19-24 years.

Table 24.2: The average IRV of obese female college students per week

IRV	**Baseline**	**week 4**	**week 8**	**week 12**
Experimental	2522.727	2495.455	2718.182	2854.546
Control	1979.546	1979.546	1984.091	1979.546

Table 24.2 shows the average IRV of experimental and control group participant ages 19 and 24 years taken per week. The value shows that experimental participants IRV decrease from the Baseline to the week 4 and increase from week 4 to the week 12 of aerobic dance circuit training.

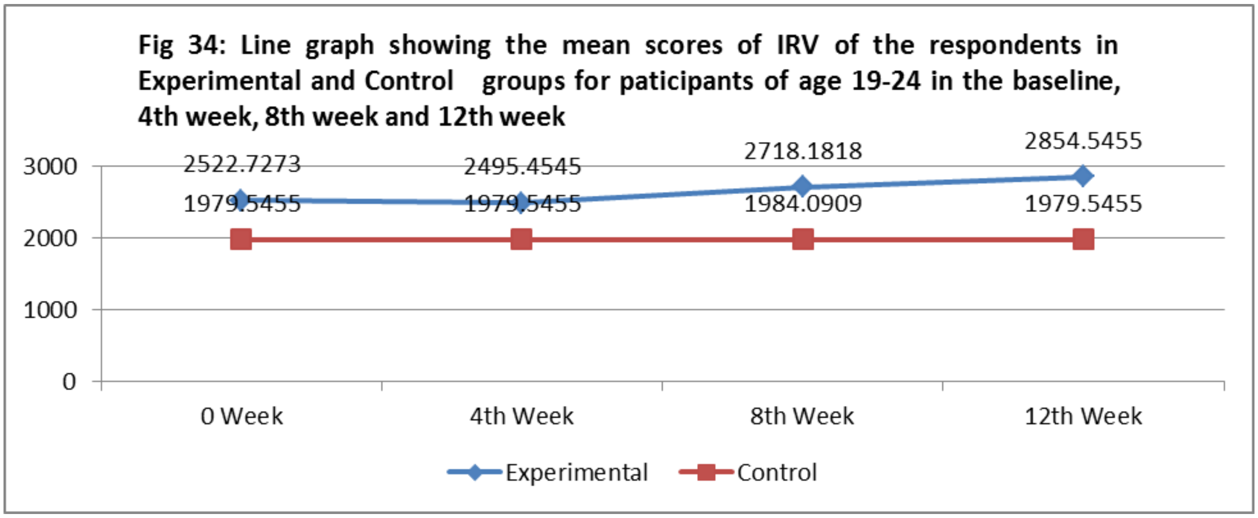
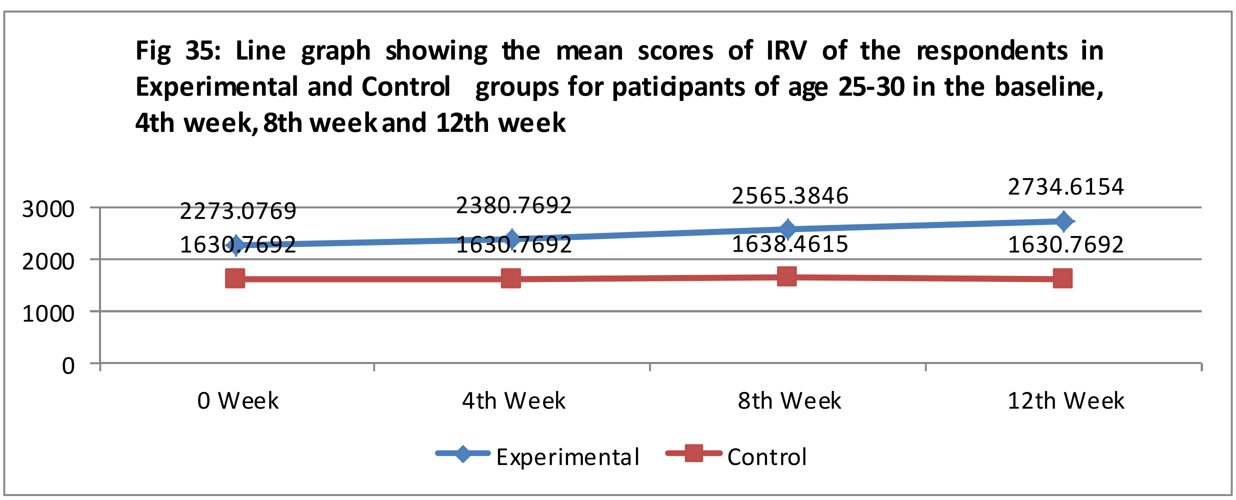


Table 24.3: The average IRV of obese female college students per week

IRV	Baseline	week 4	week 8	week 12
Experimental	2273.077	2380.769	2565.385	2734.615
Control	1630.769	1630.769	1638.462	1630.769

Table 24.3 shows the average IRV of experimental and control group participant ages 24 and 30 years taken per week. The value shows that experimental participants IRV increase from the Baseline to the week 12 of aerobic dance circuit training



From the figures above the line graphs reveals that the treatment was effective between 4th and week 8 up to the week 12 among the experimental group.in ages 19-24years but more effective in 25-30 years.

Hypothesis 2(bvi): There will be no significant main effect of Age on PEFR

From table 14.1 there was significant main effect of age on PEFR (F (1,57) = 19.886, p>05,η^2=.069). The Eta Square value of .069 shows that about 69% of the participants' scores were accounted for by Age. Therefore, the null hypothesis is rejected.

Table 25.1: Estimated Marginal Means of Age on PEFR

Age	Mean	Std Error
19-24years	273.632	8.628
25-30years	308.478	8.894

Table 25.1 shows the estimated marginal means scores of the effects of age on PEFR. It reveals that participants within the age bracket of 19-24 years had lower means scores of 1986.165 while participants within the age bracket of 25-30 years had higher means scores of 2257.391. This shows that participants within the age bracket of 25-30 years responded to treatment than the participants within the age of 19-24 years.

Table 25.2: The average PEFR of obese female college students per week

PEFR	**Baseline**	**week 4**	**week 8**	**week 12**
Experimental	326.8182	331.8182	346.3636	352.2727
Control	230.9091	230.9091	240.4545	238.6364

Table 25.2 shows the average PEFR of experimental and control group participant ages 19 and 23 years taken per week. The value shows that experimental participants PEFR increase from the Baseline to the week 12 of aerobic dance circuit training.

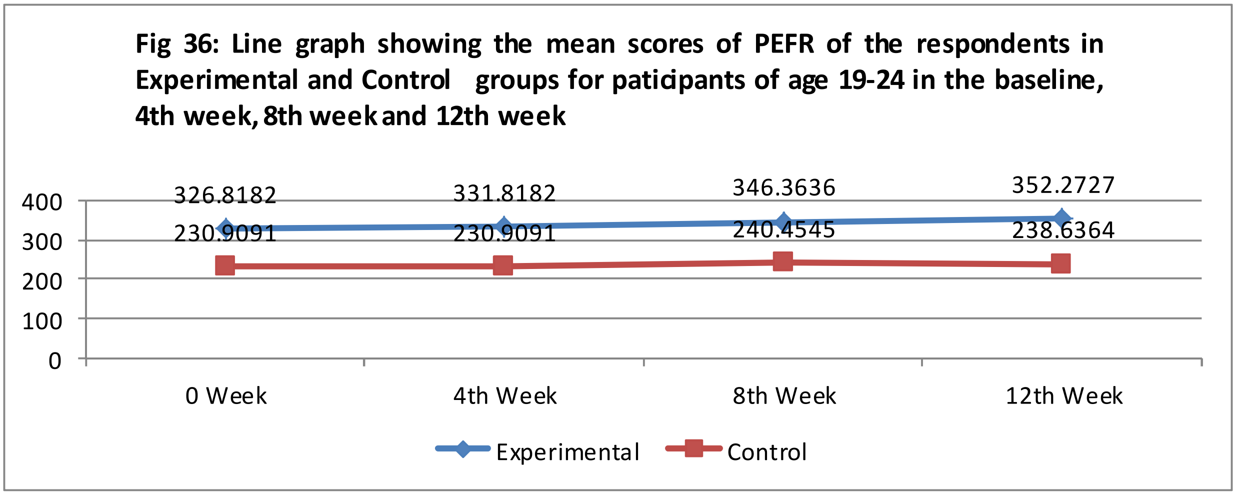
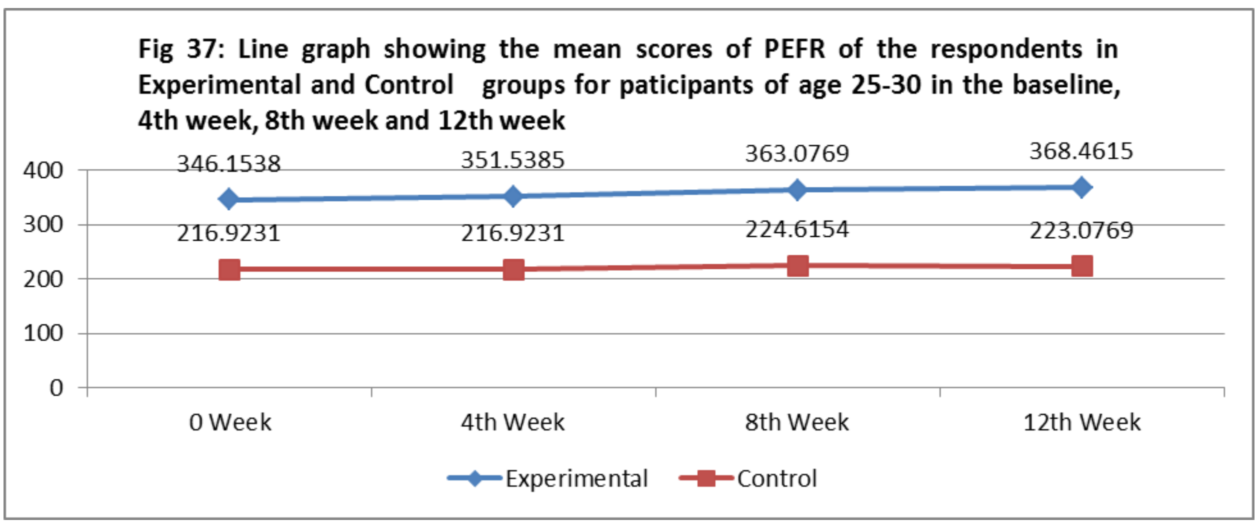


Table 25.3: The average PEFR of obese female college students per week

PEFR	Baseline	week 4	week 8	week 12
Experimental	346.1538	351.5385	363.0769	368.4615
Control	216.9231	216.9231	224.6154	223.0769

Table 25.3 shows the average PEFR of experimental and control group participant ages 25 and 30 years taken per week. The value shows that experimental participants PEFR increase from the Baseline to the week 12 of aerobic dance circuit training



From the figure, the line graph reveals that there was an effect of treatment from the baseline, but was more effective between the week 4, week 8 and week 12 among the experimental group.in ages 19-24years than 25-30 years.

Hypothesis 2(bvii): There will be no significant main effect of Age on HRR

From table 15.1 there was no significant main effect of age on HRR (F (1,57) = .977, p>05,η^2=.000). The Eta Square value of .000 shows that about 1% of the participants' scores were accounted for by Age. Therefore, the null hypothesis is accepted.

Table 26.1: Estimated Marginal Means of Age on HRR

Age	Mean	Std Error
19-24years	127.289	3.086
25-30years	124.969	2.465

Table 26.1 shows the estimated marginal means scores of the effects of age on HRR. It reveals that participants within the age bracket of 19-24 years had higher means scores of 127.289 while participants within the age bracket of 25-30 years had lower means scores of 124.969. This shows that participants within the age bracket of 25-30 years responded to treatment than the participants within the age of 19-24 years.

Table 26.2: The average HRR of obese female college students per week

HRR	Baseline	week 4	week 8	week 12
Experimental	114.5455	115.0909	119.6818	120.2727
Control	111.7273	115.6364	115.6364	115.6364

Table 26.2 shows the average HRR of experimental and control group participant ages 19 and 24 years taken per week. The value shows that experimental participants HRR increase from the Baseline to the week 12 of aerobic dance circuit training.

Fig 38: Line graph showing the mean scores of HRR of the respondents in Experimental and Control groups for paticipants of age 19-24 in the baseline, 4th week, 8th week and 12th week

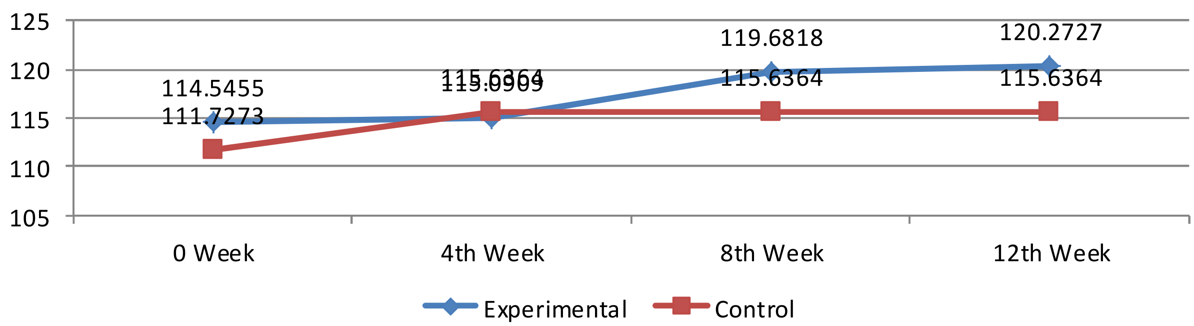
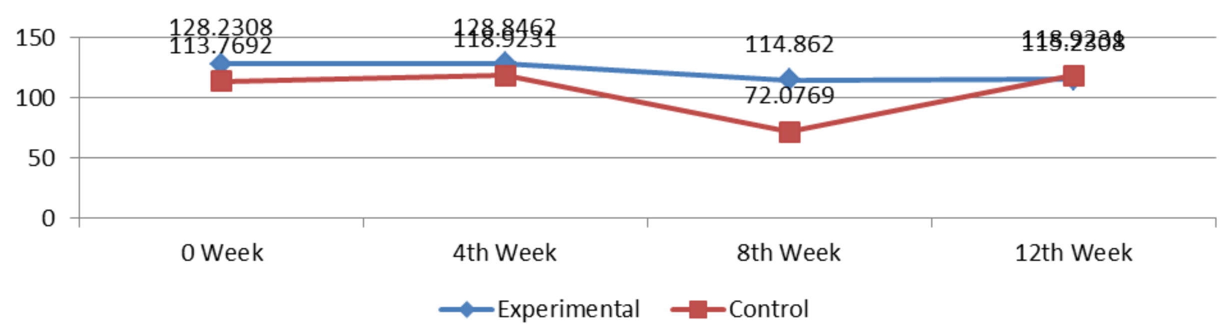


Table 26.3: The average HRR of obese female college students per week

HRR	Baseline	week 4	week 8	week 12
Experimental	128.2308	128.8462	115.2308	114.8620
Control	113.7692	118.9231	72.0769	118.9231

Table 26.3 shows the average HRR of experimental and control group participant ages 24 and 30 years taken per week. The value shows that experimental participants HRR decrease from the week 4 to the week 12 of aerobic dance circuit training

Fig 39: Line graph showing the mean scores of HRR of the respondents in Experimental and Control groups for paticipants of age 25-30 in the baseline, 4th week, 8th week and 12th week



From the figure, the line graph reveals that the treatment was not effective from the baseline, 4^{th}, 8^{th} and week 12 among the experimental group.in ages 19-24years, but it was effective in 25-30 years from week 4 to week 12.

Hypothesis 2(bviii): There will be no significant main effect of Age on VO_2max

From table 16.1 above there was no significant main effect of age on VO_2max (F (1,57) = .126, p>05,η^2=.000). The Eta Square value of .000 shows that about 1% of the participants' scores were accounted for by Age. Therefore, the null hypothesis is accepted.

Table 27.1: Estimated Marginal Means of Age on VO_2max

Age	Mean	Std Error
19-24years	39.388	0.901
25-30years	39.110	0.720

Table 27.1 shows the estimated marginal means scores of the effects of age on VO_2max. It reveals that participants within the age bracket of 19-24 years had higher means scores of 39.388

while participants within the age bracket of 25-30 years had lower means scores of 39.110. This shows that participants within the age bracket of 19-24 years responded to treatment than the participants within the age of 25-30 years.

Table 27.2: The average VO_2max of obese female college students per week

$V0_2$max	Baseline	week 4	week 8	week 12
Experimental	35.6964	36.9568	37.5909	37.8123
Control	34.8355	35.5423	36.3809	36.4009

Table 27.2 shows the average VO_2max of experimental and control group participant ages 19 and 23 years taken per week. The value shows that experimental participants VO_2max increase from the Baseline to the week 12 of aerobic dance circuit training.

Fig. 40: Line graph showing the mean scores of V02MAX of the respondents in Experimental and Control groups for paticipants of age 19-24 in the baseline, 4th week, 8th week and 12th week

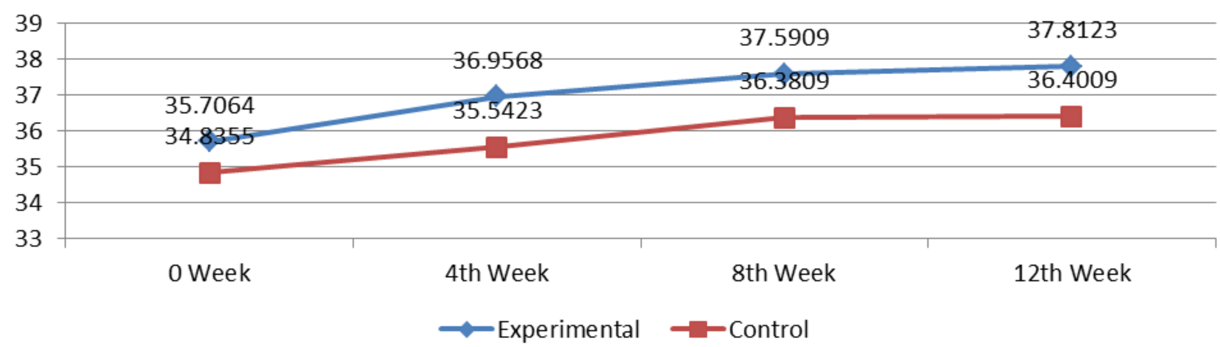
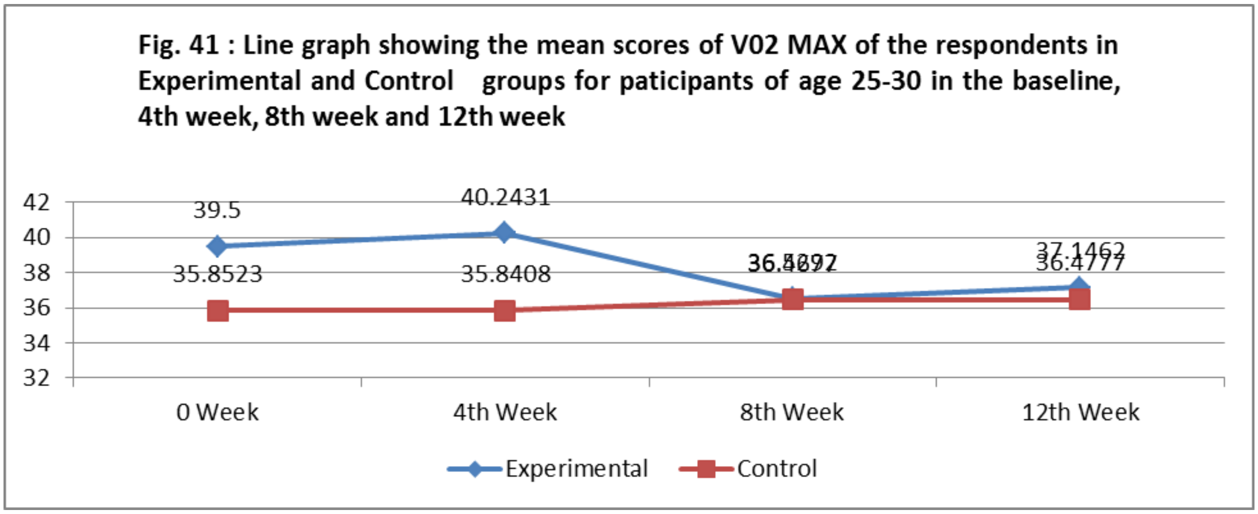


Table 27.3: The average VO_2max **of obese female college students per week**

$V0_2$max	Baseline	week 4	week 8	week 12
Experimental	39.5000	40.2431	36.5292	37.1462
Control	35.8523	35.8408	36.4677	36.4777

Table 27.3 shows the average VO_2max of experimental and control group participant ages 25 and 30 years taken per week. The value shows that experimental participants VO_2max decrease from the Baseline to the week 12 of aerobic dance circuit training



From the figure, the line graph reveals that the treatment was more effective from the baseline week 4, week 8 and week 12 in ages 19-24years than 25-30 years among the experimental group.

Hypothesis 3 (ai): There will be no significant main effect of class of obesity on %bf

From table 6.1, it shows that there was significant main effect of class of obesity on %bf (F (3,57) = 1.488, $p<.05, \eta^2=.017$). The Eta Square value of .017 shows that about 2% of the participants' scores were accounted for by class of obesity. Therefore, the null hypothesis is accepted

Table 28.1: Estimated Marginal Means on Class of obesity

Class of obesity	Mean	Std Error
Class 1 obesity	36.092	.291
Class 2 obesity	36.563	.201
Class 3 obesity	36.776	.467
Class 4 obesity	34.905	1.489

Table 28.1 shows the Estimated Marginal Mean Scores of main effect of class of obesity on %bf. This indicates that class 1 obesity had lower means scores of 36.092, follow by class 2 obesity (36.563), class 3 obesity (36.776), while class 4 obesity had the higher means score of 34.905. This shows that class 1 obesity, class 2 and class 3 responded to the treatment than class 4 obesity.

Table 28.2: The average %bf of class 1 obesity female college students per week

%bf	Baseline	week 4	week 8	week 12
Experimental	35.8567	24.2333	22.9067	22.6200
Control	36.9744	36.2978	36.4867	36.1278

Table 28.2 shows the average %bf of experimental and control group class 1 obesity participant taken per week. The value shows that experimental participants %bf decrease from the Baseline to the week 8 of aerobic dance circuit training

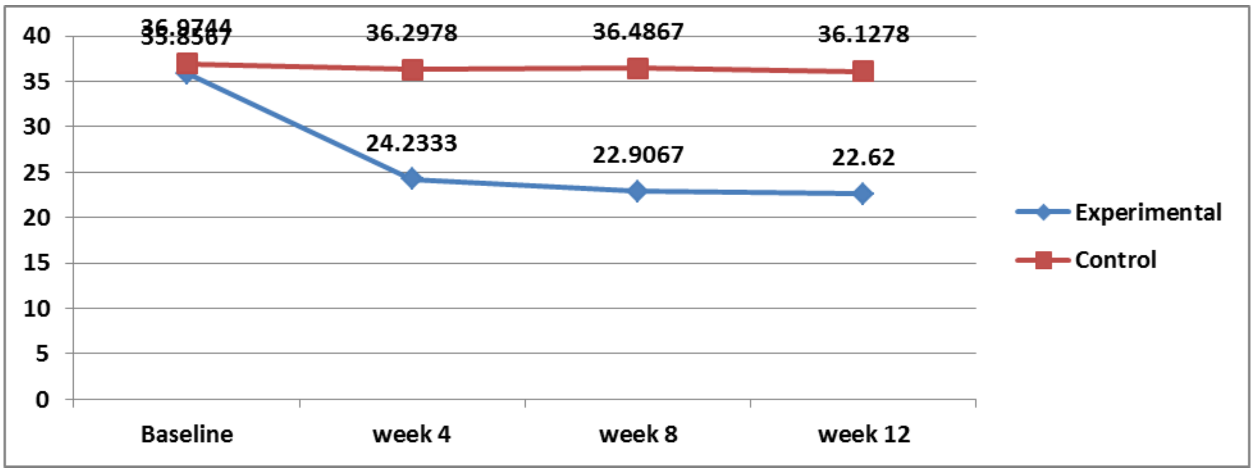


Table 28.3: The average %bf of class 2 obesity female college students per week

%bf	Baseline	week 4	week 8	week 12
Experimental	37.064	26.6465	24.3845	24.227
Control	35.7827	26.0727	25.2068	25.2645

Table 28.3 shows the average %bf of experimental and control group class 2 obesity participants taken per week. The value shows that experimental participants %bf decrease from the week 4 to the week 12 of aerobic dance circuit training

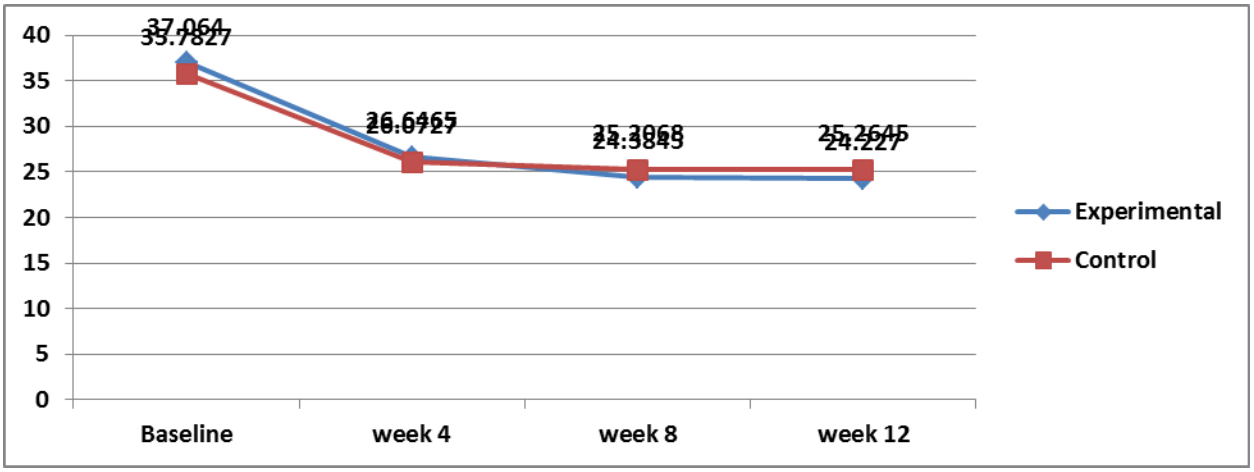
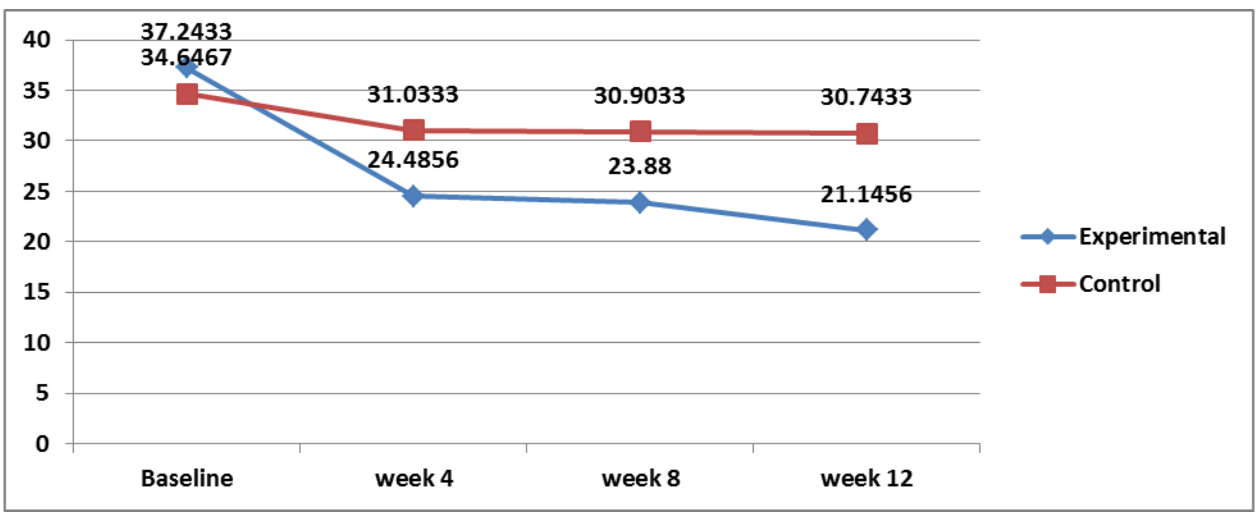


Table 28.4: The average %bf of class 3 obesity female college students per week

%bf	Baseline	week 4	week 8	week 12
Experimental	37.2433	24.4856	23.88	21.1456
Control	34.6467	31.0333	30.9033	30.7433

Table 28.4 shows the average %bf of experimental and control group class 3 obesity participants taken per week. The value shows that experimental participants %bf decrease from Baseline to the week 12 of aerobic dance circuit training.



From the line graph, it reveals that the treatment was more effective between 4th and week 8 up to the week 12 among the class 2 obesity participants than class 1 obesity and class 3 obesity in experimental group.

Hypothesis 3(aii): There will be no significant main effect of class of obesity on WHR

From table 7.1, it shows that there was significant main effect of class of obesity on WHR (F (3,57) = 1.460, $p<.05, \eta^2=.016$). The Eta Square value of .016 shows that about 6% of the participants' scores were accounted for by class of obesity. Therefore, the null hypothesis is accepted

Table 29.1: Estimated Marginal Means on Class of obesity

Class of obesity	Mean	Std Error
Class 1 obesity	0.804	0.008
Class 2 obesity	0.807	0.005
Class 3 obesity	0.788	0.012
Class 4 obesity	0.857	0.039

Table 29.1 shows the Estimated Marginal Mean Scores, across the obese classes on WHR. From the above result, it shows that class 3 obesity had the lowest means score of 0.788 compared to class 1 obesity (0.804), 2(0.807) and 4(0.857). This reveals that, the treatment was more effective in class 3 obesity.

Table 29.2: The average WHR of class 1 obesity female college students per week

WHR	**Baseline**	**week 4**	**week 8**	**week 12**
Experimental	0.8400	0.8400	0.7000	0.7933
Control	0.7689	0.7689	0.7489	0.7400

Table 29.2 shows the average WHR of experimental and control group class 1 obesity participant taken per week. The value shows that experimental participants WHR decrease from the week 4 to the week 12 of aerobic dance circuit training

Fig 45: Line graph showing the mean scores of WHR of the respondents in Experimental and Control groups for paticipants of the Obese class 1 in the baseline, 4th week, 8th week and 12th week

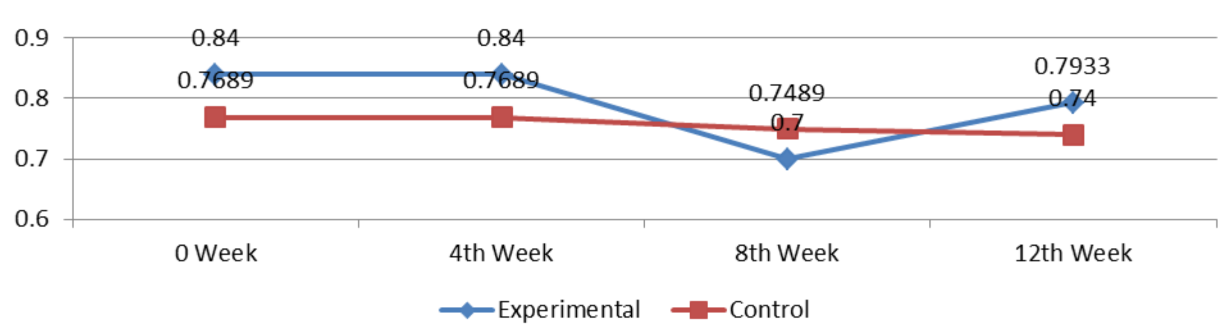


Table 29.3: The average WHR of class 2 obesity female college students per week

WHR	Baseline	week 4	week 8	week 12
Experimental	0.822	0.8185	0.8105	0.7700
Control	0.7945	0.7945	0.7895	0.7891

Table 29.3 shows the average WHR of experimental and control group class 2 obesity participants taken per week. The value shows that experimental participants WHR decrease from the Baseline to the week 12 of aerobic dance circuit training

Fig 46: Line graph showing the mean scores of WHR of the respondents in Experimental and Control groups for paticipants of the Obese class 2 in the baseline, 4th week, 8th week and 12th week

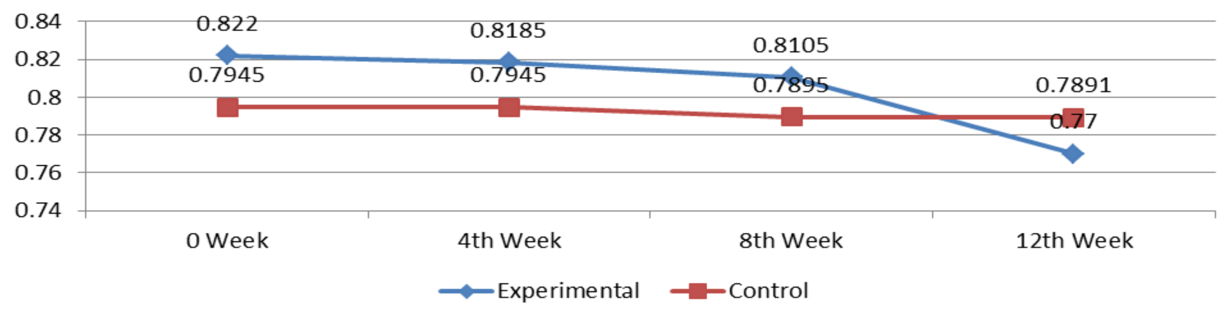
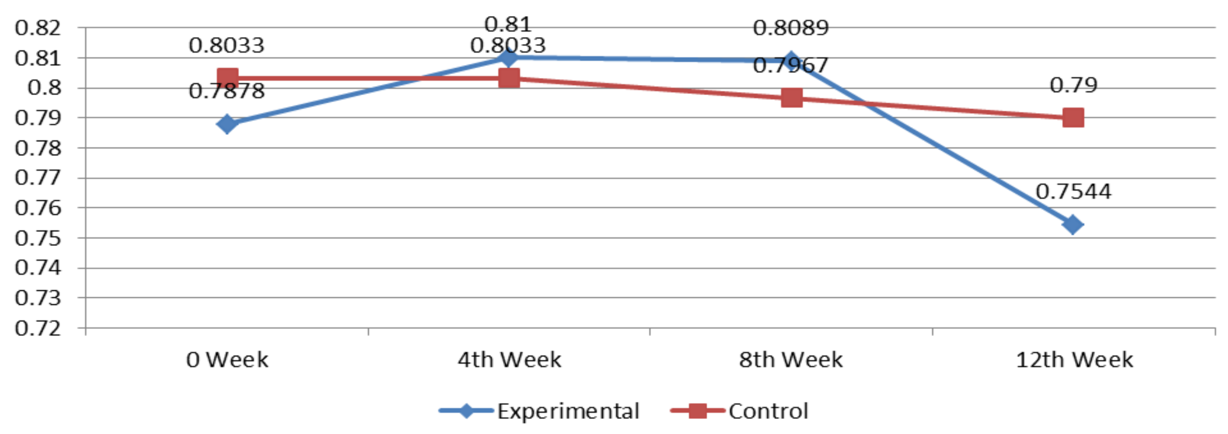


Table 29.4: The average WHR of class 3 obesity female college students per week

WHR	Baseline	week 4	week 8	week 12
Experimental	0.7878	0.8100	0.8089	0.7544
Control	0.8033	0.8033	0.7967	0.7900

Table 29.4 shows the average WHR of experimental and control group class 3 obesity participants taken per week. The value shows that experimental participants WHR decrease from Baseline to the week 12 of aerobic dance circuit training.

Fig 47: Line graph showing the mean scores of WHR of the respondents in Experimental and Control groups for paticipants of the Obese class 3 in the baseline, 4th week, 8th week and 12th week



From the figures, the line graph reveals that the treatment was effective between 4th and week 8 in class 2 obesity, between 8th and week 12 in class 2 obesity and more effective in class 3 obesity in experimental group.

Hypothesis 3(aiii): There will be no significant main effect of class of obesity on WHtR

From table 8.1, it is shown that there was significant main effect of class of obesity on WHtR ($F (3,57) = 15.544, p<.05, \eta^2=.149$). The Eta Square value of .149 shows that about 15% of the participants' scores were accounted for by class of obesity. Therefore, the null hypothesis is rejected.

Table 30.1: Estimated Marginal Means on Class of obesity on WHtR

Class of obesity	Mean	Std Error
Class 1 obesity	0.498	0.005
Class 2 obesity	0.537	0.004
Class 3 obesity	0.552	0.009
Class 4 obesity	0.550	0.027

Table 30.1 shows the Estimated Marginal Mean Scores, across the obese classes on WHtR. From the above result, it shows that class 1 obesity had the lowest means score of 0.498 compared to class 2 obesity (.537), class 3 obesity(.552) and class 4 obesity(0.550). This reveals that, the treatment was more effective in class 1 obesity.

Table 30.2: The average WHtR of class 1 obesity female college students per week

WHtR	Baseline	week 4	week 8	week 12
Experimental	0.4900	0.4900	0.4667	0.4417
Control	0.5178	0.5178	0.5056	0.4967

Table 30.2 shows the average WHtR of experimental and control group class 1 participant taken per week. The value shows that experimental participants WHtR decrease from the week 4 to the week 12 of aerobic dance circuit training

Fig 48: Line graph showing the mean scores of WHtR of the respondents in Experimental and Control groups for paticipants of the Obese class 1 in the baseline, 4th week, 8th week and 12th week

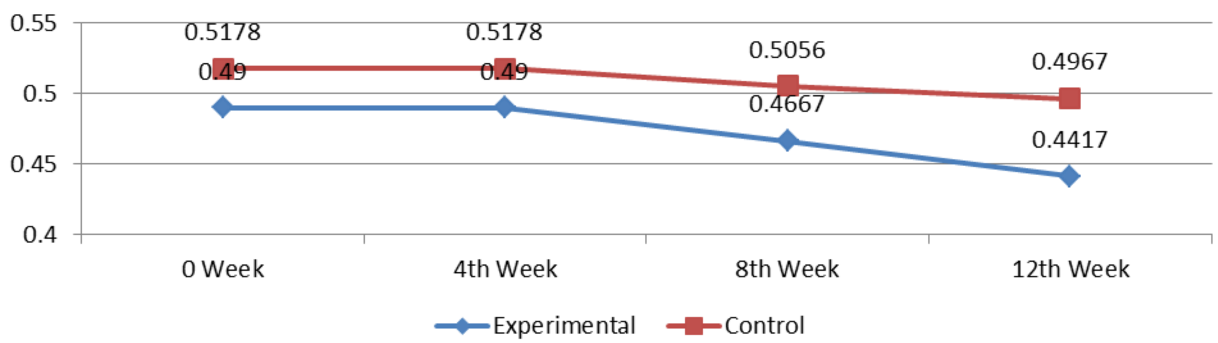


Table 30.3: The average WHtR of class 2 obesity female college students per week

WHtR	Baseline	week 4	week 8	week 12
Experimental	0.4900	0.4900	0.4667	0.4417
Control	0.5178	0.5178	0.5056	0.4967

Table 30.3 shows the average WHtR of experimental and control group class 2 obesity participants taken per week. The value shows that experimental participants WHtR decrease from the week 4 to the week 12 of aerobic dance circuit training

Fig 49: Line graph showing the mean scores of WHtR of the respondents in Experimental and Control groups for paticipants of the Obese class 2 in the baseline, 4th week, 8th week and 12th week

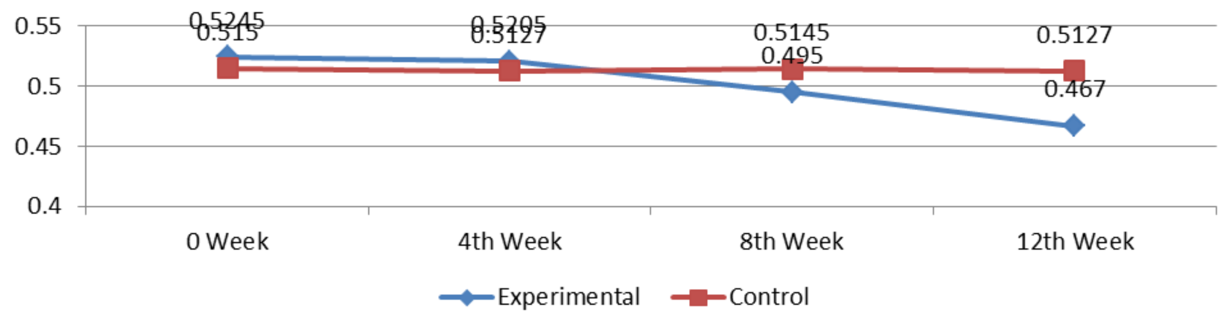
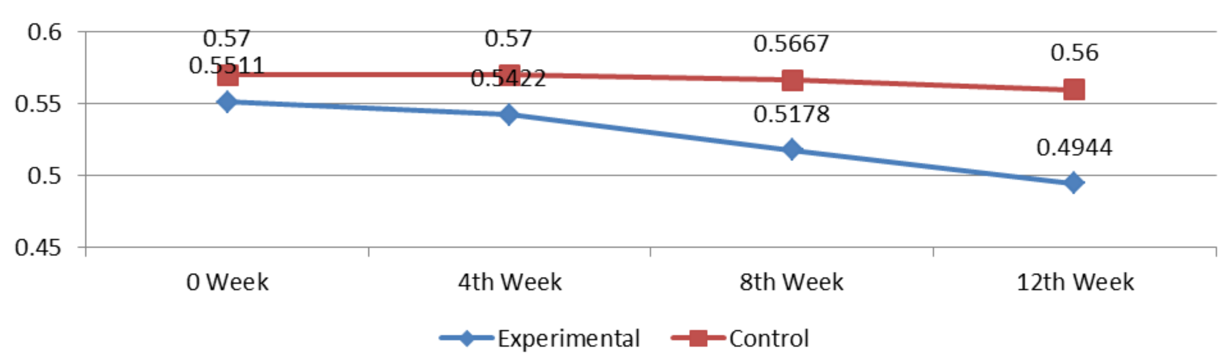


Table 30.4: The average WHtR of class 3 obesity female college students per week

WHtR	Baseline	week 4	week 8	week 12
Experimental	0.5511	0.5422	0.5178	0.4944
Control	0.5700	0.5700	0.5667	0.5600

Table 30.4 shows the average WHtR of experimental and control group class 3 obesity participants taken per week. The value shows that experimental participants WHtR decrease from Baseline to the week 12 of aerobic dance circuit training.

Fig 50 Line graph showing the mean scores of WHtR of the respondents in Experimental and Control groups for paticipants of the Obese class 3 in the baseline, 4th week, 8th week and 12th week



From the figure, the line graphs reveals that the treatment was more effective from the week 4 up to the week 12 among the experimental group class 1 obesity, class 2 obesity and class 3 obesity.

Hypothesis 3(bi): There will be no significant main effect of Class of obesity on DBP

From table 9.1, it is shown that there was significant main effect of class of obesity on DBP (F (3,57) = 1.463,p<.05,η^2=.016). The Eta Square value of .016 shows that about 20% of the participants' scores were accounted for by class of obesity. Therefore, the null hypothesis is accepted.

Table 31.1: Estimated Marginal Means of Class of obesity on DBP

Class of obesity	Mean	Std. Error
Class 1 obesity	78.625	1.536
Class 2 obesity	78.620	1.059
Class 3 obesity	82.280	2.462
Class 4 obesity	66.250	7.857

Table 31.1 shows the Estimated Marginal Mean Scores, across the obese classes on DBP. From the above result, it shows that class 4 obesity had the lowest means score of 66.250 compared to class 1 obesity(78.625), class 2 obesity(78.620) and class 3 obesity(82.280). This reveals that, the treatment was more effective in class 4 obesity.

Table 31.2: The average DBP of class 1 obesity female college students per week

DPB	Baseline	week 4	week 8	week 12
Experimental	92.0000	91.6667	85.8333	85.3333
Control	74.3333	73.2222	71.8889	71.8889

Table 31.2 shows the average DBP of experimental and control group class 1 obesity participant taken per week. The value shows that experimental participants DBP decrease from the Baseline to the week 8 of aerobic dance circuit training

Fig 51: Line graph showing the mean score of DBP of the respondents in experimental and Control groups for participants of the Obese class 1 in the baseline, 4th week, 8th week and 12th week

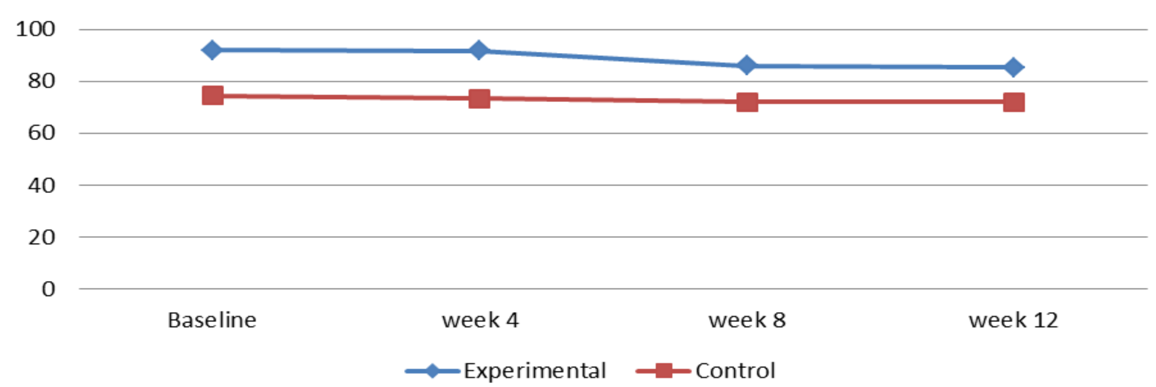


Table 31.3: The average DBP of class 2 obesity female college students per week

DPB	Baseline	week 4	week 8	week 12
Experimental	89.7500	89.4500	84.000	81.1500
Control	69.7273	70.1300	71.6364	73.3636

Table 31.3 shows the average DBP of experimental and control group class 2 obesity participants taken per week. The value shows that experimental participants DBP decrease from the week 4 to the week 12 of aerobic dance circuit training

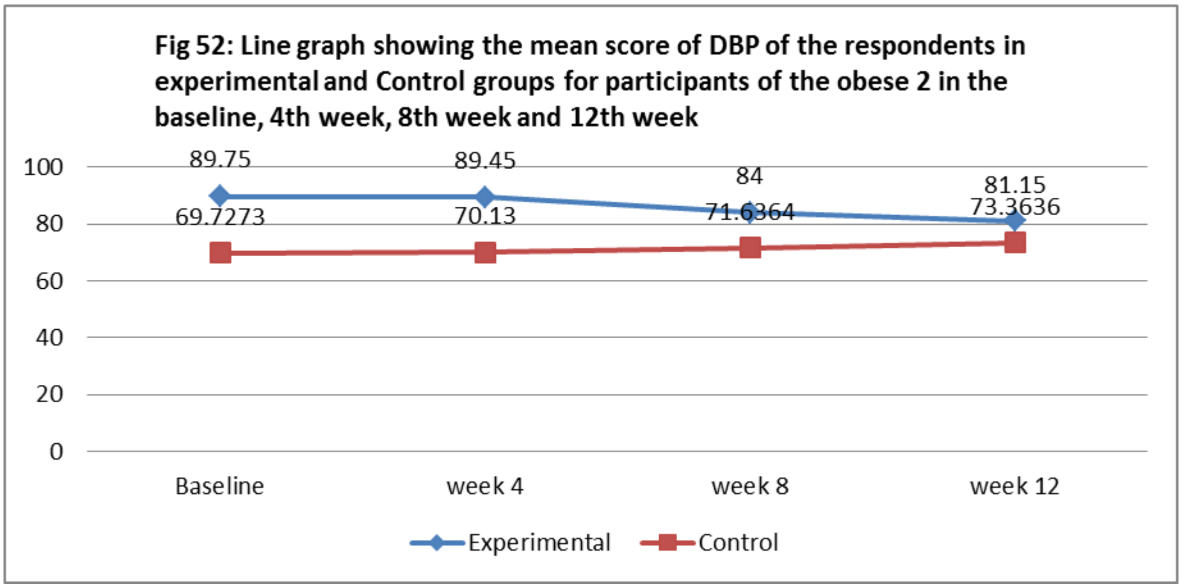
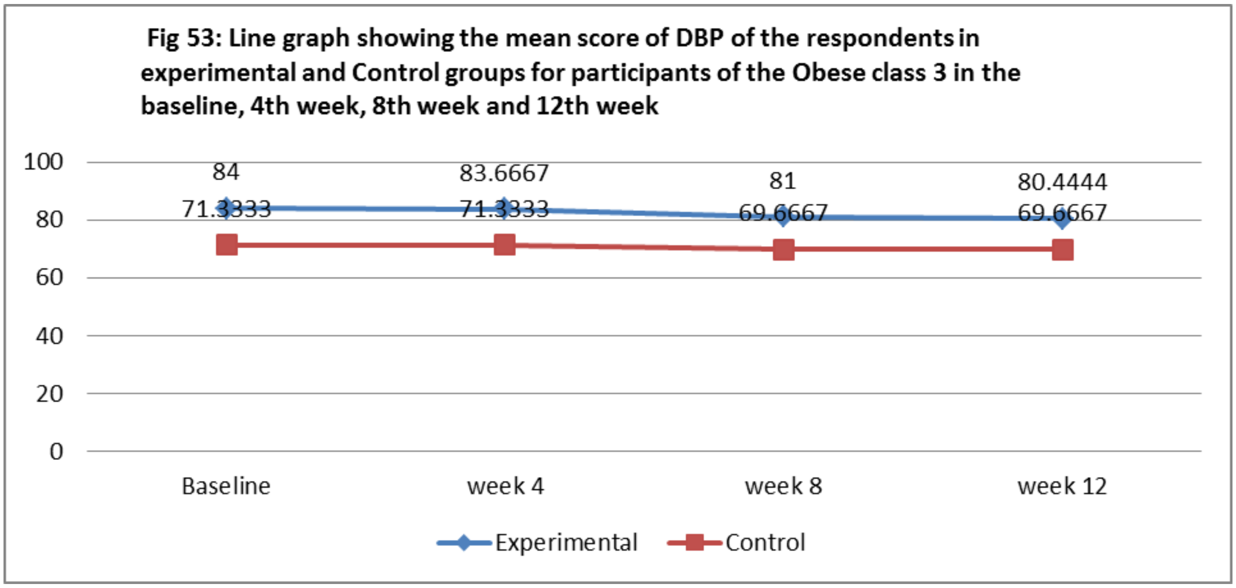


Table 31.4: The average DBP class 3 obesity female college students per week

DPB	Baseline	week 4	week 8	week 12
Experimental	84.0000	83.6667	81.0000	80.4444
Control	71.3333	71.3333	69.6667	69.6667

Table 31.4 shows the average DBP of experimental and control group class 3 obesity participants taken per week. The value shows that experimental participants DBP decrease from Baseline to the week 12 of aerobic dance circuit training.



From the figure, the line graphs reveals that the treatment was not effective from the baseline to week 4, week 8 and week 12 among the class 1 obesity, class 2 obesity and class 3 obesity in experimental group.

Hypothesis 3(bii): There will be no significant main effect of Class of obesity on SBP

From table 10.1, it shows that there was significant main effect of class of obesity on SBP ($F(3,57) = .491$, $p<.05$, $\eta^2=.006$). The Eta Square value of .006 shows that about 1% of the participants' scores were accounted for by class of obesity. Therefore, the null hypothesis is accepted.

Table 32.1: Estimated Marginal Means of Class of obesity on SBP

Class of obesity	Mean	Std Error
Class 1 obesity	116.092	0.291
Class 2 obesity	116.563	0.201
Class 3 obesity	116.776	0.467
Class 4 obesity	114.905	1.489

Table 32.1 shows the Estimated Marginal Mean Scores, across the obese classes on DBP. From the above result, it shows that class 4 obesity had the lowest means score of 14.905 compared to class 1 obesity (16.092), class 2 obesity(16.563) and class 3 obesity(16.776). This reveals that, the treatment was more effective in class 4 obesity.

Table 32.2: The average SBP of class 1 obesity female college students per week

SPB	Baseline	week 4	week 8	week 12
Experimental	134.1667	133.5000	131.3333	131.0000
Control	133.2222	132.2222	131.3333	131.3333

Table 32.2 shows the average SBP of experimental and control group class 1 obesity participant taken per week. The value shows that experimental participants SBP decrease from the Baseline to the week 8 of aerobic dance circuit training

Fig 54: Line graph showing the mean scores of SBP of the respondents in Experimental and Control groups for paticipants of the Obese class 1 in the baseline, 4th week, 8th week and 12th week

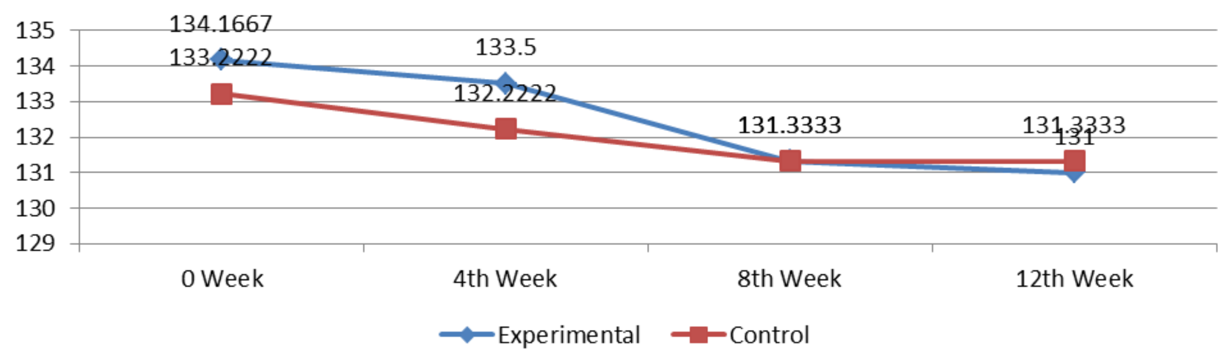


Table 32.3: The average SBP of class 2 obesity female college students per week

SPB	Baseline	week 4	week 8	week 12
Experimental	135.1000	134.8000	132.2500	131.2000
Control	130.0000	129.5000	129.2273	129.4091

Table 32.3 shows the average SBP of experimental and control group class 2 obesity participants taken per week. The value shows that experimental participants SBP decrease from the Baseline to the week 12 of aerobic dance circuit training

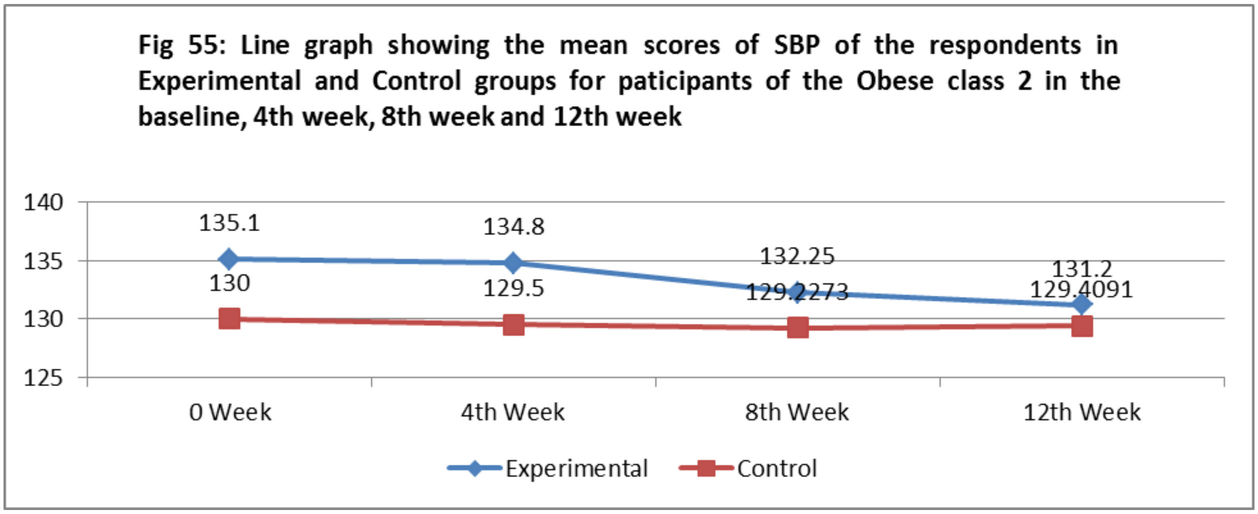
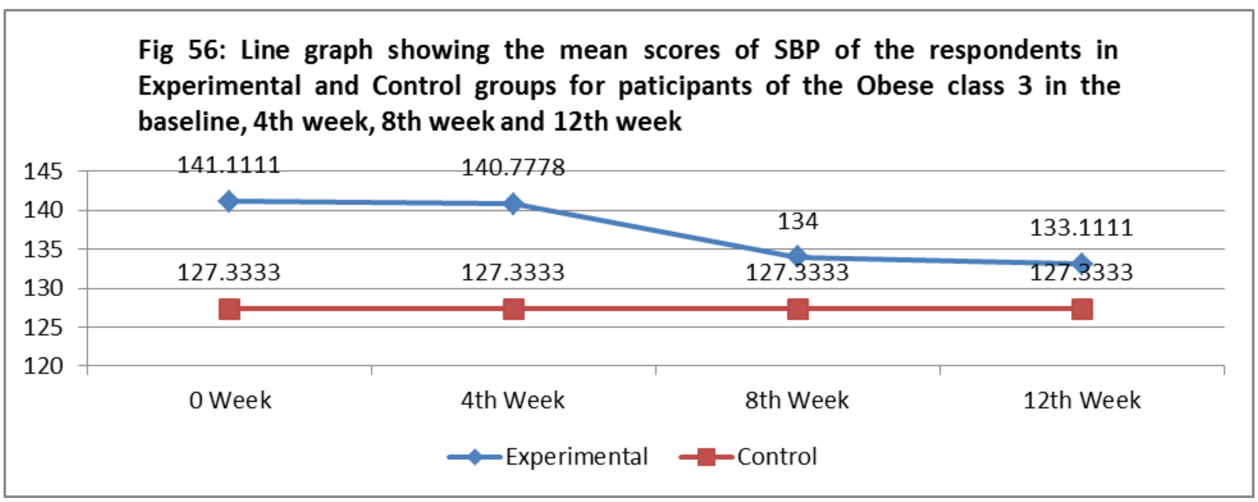


Table 32.4: The average SBP class 3 obesity female college students per week

SPB	Baseline	week 4	week 8	week 12
Experimental	141.1111	140.7778	134.0000	133.1111
Control	127.3333	127.3333	127.3333	127.3333

Table 32.4 shows the average SBP of experimental and control group class 3 obesity participants taken per week. The value shows that experimental participants SBP decrease from Baseline to the week 12 of aerobic dance circuit training.



From the figure, the line graphs reveals that the treatment was effective between the baseline and week 8 in class 1 obesity, but was more effective between the 4th and week 8 in class 2 obesity and class 3 obesity among the experimental group.

Hypothesis 3(biii): There will be no significant main effect of Class of obesity on P_{mean}

From table 10a above, it is shown that there was significant main effect of class of obesity on P_{mean} (F (3,57) = .460, p<.05, η^2=.005). The Eta Square value of .005 shows that about 5% of the participants' scores were accounted for by class of obesity. Therefore, the null hypothesis is accepted.

Table 33.1: Estimated Marginal Means of Class of obesity on P_{mean}

Class of obesity	Mean	Std. Error
Class 1 obesity	95.783	1.436
Class 2 obesity	96.14	.990
Class 3 obesity	98.351	2.302
Class 4 obesity	92.250	7.346

Table 33.1 shows the Estimated Marginal Mean Scores, across the obese classes on P_{mean}. From the above result, it shows that class 4 obesity had the lowest means score of 92.250 compared to class 1 obesity(95.783), class 2 obesity(96.14) and class 3 obesity(98.351). This reveals that, the treatment was more effective in class 4 obesity.

Table 33.2: The average P_{mean} of class 1 obesity female college students per week

P_{mean}	Baseline	week 4	week 8	week 12
Experimental	106.0333	105.5333	100.9667	83.9667
Control	93.54444	94.7444	94.7889	94.7444

Table 33.2 shows the average P_{mean} of experimental and control group class 1 obesity participant taken per week. The value shows that experimental participants P_{mean} decrease from the Baseline to the week 12 of aerobic dance circuit training

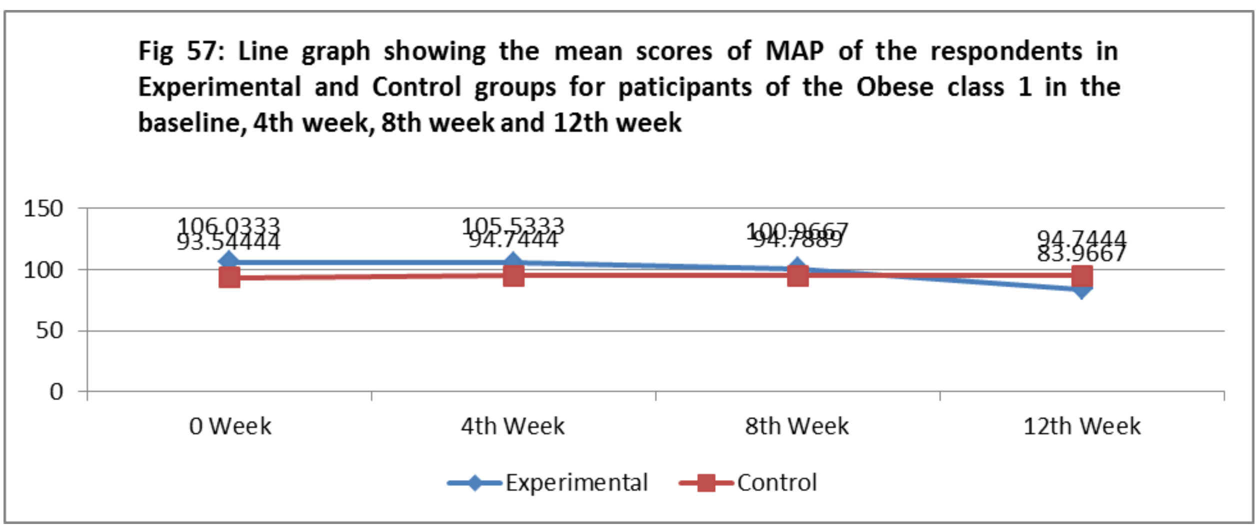


Table 33.3: The average P_{mean} of class 2 obesity female college students per week

P_{mean}	Baseline	week 4	week 8	week 12
Experimental	104.845	104.545	100.162	99.852
Control	89.7955	89.2909	89.2727	90.3136

Table 33.3 shows the average P_{mean} of experimental and control group class 2 obesity participants taken per week. The value shows that experimental participants P_{mean} decrease from the week 4 to the week 12 of aerobic dance circuit training.

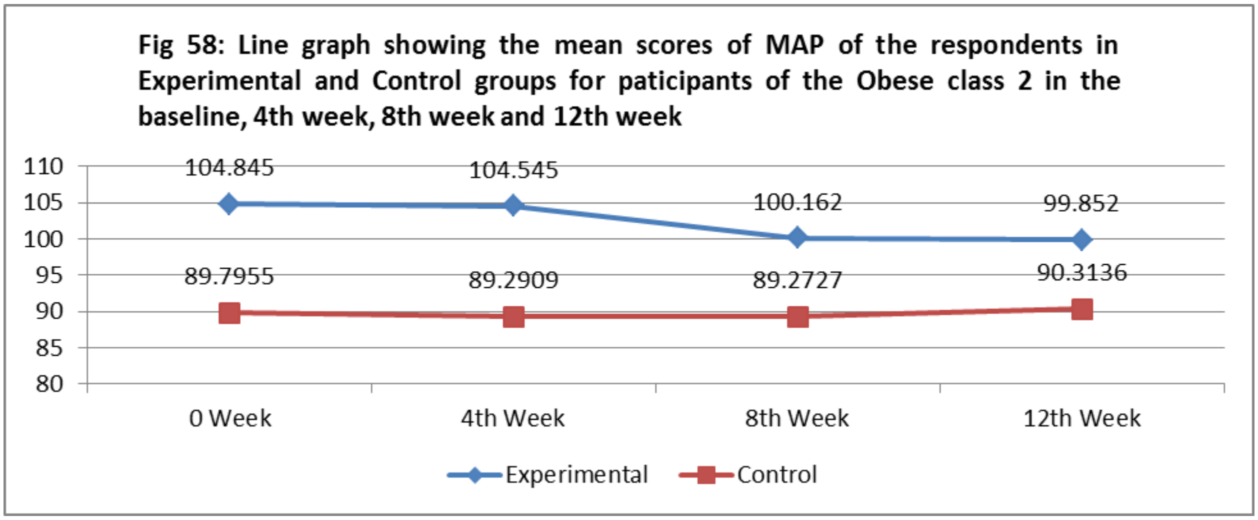
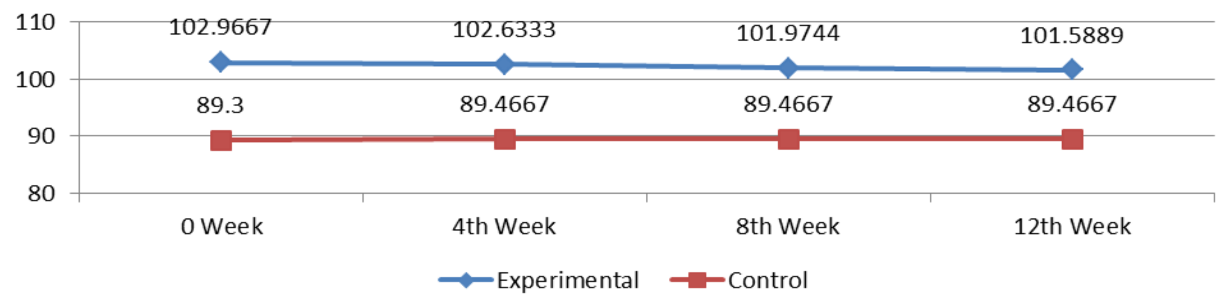


Table 33.4: The average P_{mean} of class 3 obesity female college students per week

P_{mean}	Baseline	week 4	week 8	week 12
Experimental	102.9667	102.6333	101.9744	101.5889
Control	89.3000	89.4667	89.4667	89.4667

Table 33.4 shows the average P_{mean} of experimental and control group class 3 obesity participants taken per week. The value shows that experimental participants P_{mean} decrease from week 4 to the week 8 of aerobic dance circuit training.

Fig 59: Line graph showing the mean scores of MAP of the respondents in Experimental and Control groups for paticipants of the Obese class 3 in the baseline, 4th week, 8th week and 12th week



From the figures, the line graphs reveal that the treatment was effective between 4th and week 8 in class 2 obesity but was not effective in class 1 obesity and class 3 obesity among the experimental group.

Hypothesis 3(biv): There will be no significant main effect of the Class of obesity on Vital Capacity

From table 12.1, it is shown that there was significant main effect of class of obesity on VC (F (3,57) = 2.294, $p<.05$, $\eta^2=.025$). The Eta Square value of .025 shows that about 30% of the participants' scores were accounted for by class of obesity. Therefore, the null hypothesis is accepted.

Table 34.1: Estimated Marginal Means of Class of obesity on VC

Class of obesity	Mean	Std. Error
Class 1 obesity	2212.788	47.489
Class 2 obesity	2112.217	32.722
Class 3 obesity	1993.973	76.111
Class 4 obesity	2300.000	242.864

Table 34.1 shows the Estimated Marginal Mean Scores, across the obese classes on VC. From the above result, it shows that class 4 obesity had the higher means score of 2300.000 compared to class 1 obesity(2212.788), class 2 obesity(2112.217) and class 3 obesity with the lowest means score (1993.973). This reveals that, the treatment was more effective in class 4 obesity.

Table 34.2: The average VC of class 1 obesity female college students per week

VC	Baseline	week 4	week 8	week 12
Experimental	257.667	2391.667	2450.000	2466.667
Control	1866.667	1866.667	1888.889	1888.889

Table 34.2 shows the average VC of experimental and control group class 1 obesity participant taken per week. The value shows that experimental participants VC decrease from the Baseline to the week 12 of aerobic dance circuit training

Fig 60: Line graph showing the mean scores of VC of the respondents in Experimental and Control groups for paticipants of the Obese class 1 in the baseline, 4th week, 8th week and 12th week

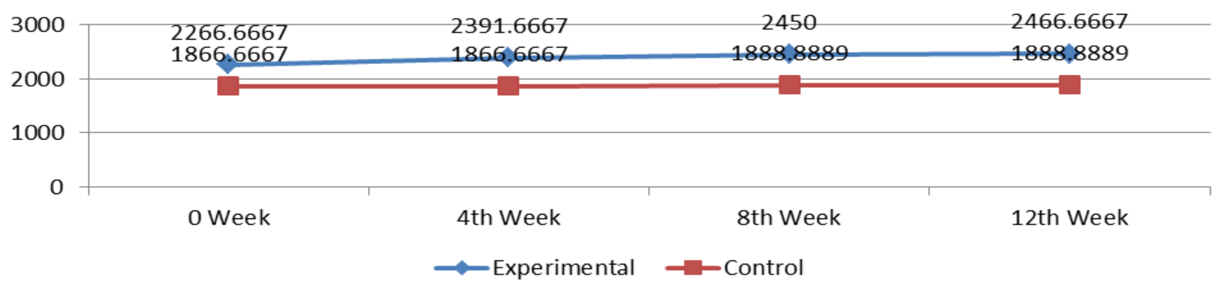


Table 34.3: The average VC of class 2 obesity female college students per week

VC	Baseline	week 4	week 8	week 12
Experimental	2375.000	2475.000	2517.500	2515.000
Control	1843.182	1843.182	1890.909	1872.727

Table 34.3 shows the average VC of experimental and control group class 2 obesity participants taken per week. The value shows that experimental participants VC increase from Baseline to week 8 of aerobic dance circuit training.

Fig 61: Line graph showing the mean scores of VC of the respondents in Experimental and Control groups for paticipants of the Obese class 2 in the baseline, 4th week, 8th week and 12th week

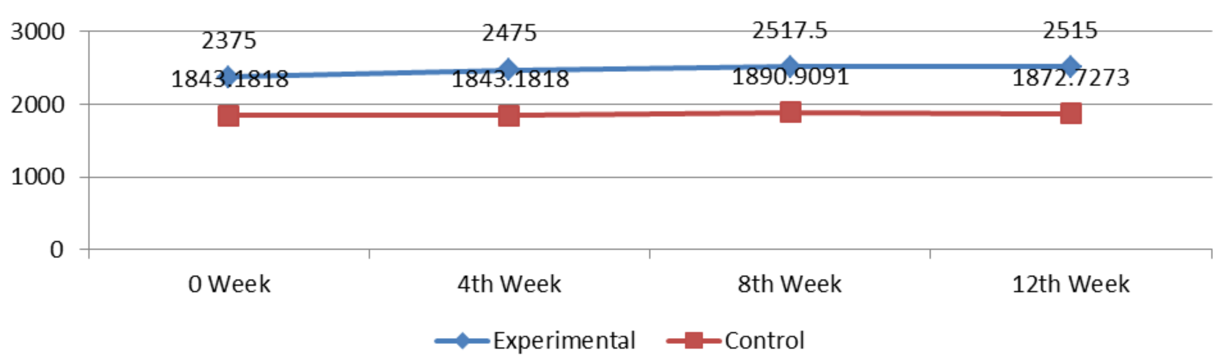
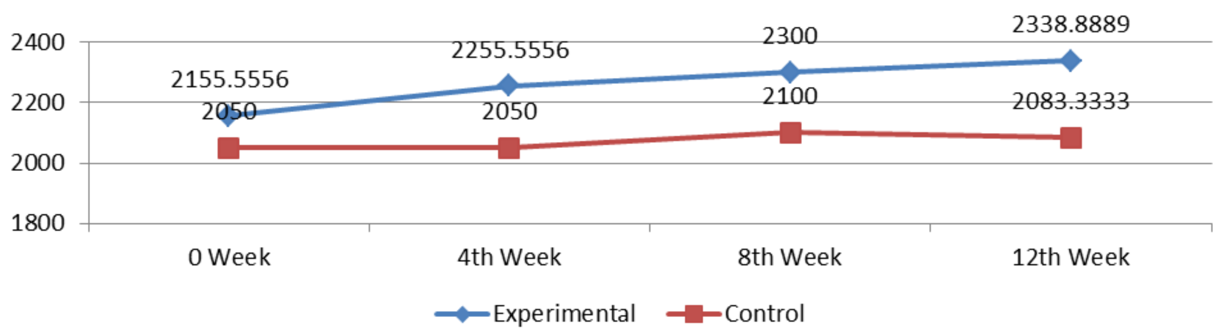


Table 34.4: The average VC class 3 obesity female college students per week

VC	Baseline	week 4	week 8	week 12
Experimental	2155.556	2255.556	2300.000	2338.889
Control	2050.000	2050.000	2100.000	2083.333

Table 34.4 shows the average VC of experimental and control group class 3 obesity participants taken per week. The value shows that experimental participants VC increase from Baseline to the week 12 of aerobic dance circuit training.

Fig 62: Line graph showing the mean scores of VC of the respondents in Experimental and Control groups for paticipants of the Obese class 3 in the baseline, 4th week, 8th week and 12th week



From the figures, the line graphs reveals that the treatment was more effective from the baseline, 4th to the week 12 in class 1 obesity and class 2 obesity, but more effective in class 3 obesity among the experimental group.

Hypothesis 3(bv): There will be no significant main effect of Class of obesity on IRV

From table 12a above, it is shown that there was significant main effect of class of obesity on IRV (F (3,57) = 1.801, $p<.05$, η^2=.020). The Eta Square value of .020 shows that about 20% of the participants' scores were accounted for by class of obesity. Therefore, the null hypothesis is accepted.

Table 35.1: Estimated Marginal Means of Class of obesity on IRV

Class of obesity	Mean	Std Error
Class 1 obesity	2172.449	62.243
Class 2 obesity	2257.395	42.888
Class 3 obesity	2166.071	99.759
Class 4 obesity	1525.000	318.321

Table 35.1 shows the Estimated Marginal Mean Scores, across the obese classes on IRV. From the above result, it shows that class 2 obesity had the higher means score of 2257.395 compared to class 1 obesity(2172.449), class 3 obesity(2166.071) and class 4 obesity with the lowest means score (1525.000). This reveals that, the treatment was more effective among the participants in class 2 obesity.

Table 35.2: The average IRV of class 1 obesity female college students per week

IRV	Baseline	week 4	week 8	week 12
Experimental	2500.000	2516.667	2698.333	2958.333
Control	1805.556	1805.556	1811.111	1805.556

Table 35.4 shows the average IRV of experimental and control group class 1 obesity participant taken per week. The value shows that experimental participants IRV increase from the week 4 to the week 12 of aerobic dance circuit training

Fig 63: Line graph showing the mean scores of IRV of the respondents in Experimental and Control groups for paticipants of the Obese class 1 in the baseline, 4th week, 8th week and 12th week

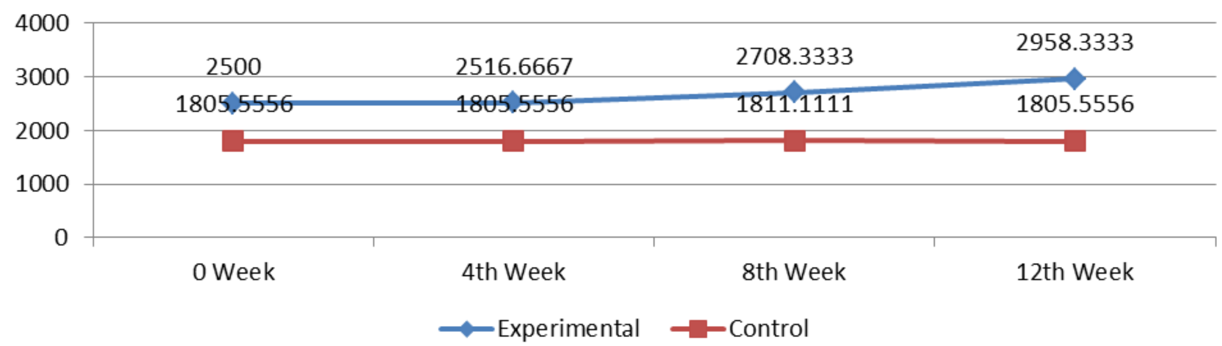


Table 35.3: The average IRV of class 2 obesity female college students per week

IRV	Baseline	week 4	week 8	week 12
Experimental	2452.500	2380.000	2685.000	2787.500
Control	1859.091	1859.091	1865.909	1859.091

Table 35.3 shows the average IRV of experimental and control group class 2 obesity participants taken per week. The value shows that experimental participants IRV decrease from Baseline to week 4 and increase from week 4 to the week 12 of aerobic dance circuit training.

Fig 64: Line graph showing the mean scores of IRV of the respondents in Experimental and Control groups for paticipants of the Obese class 2 in the baseline, 4th week, 8th week and 12th week

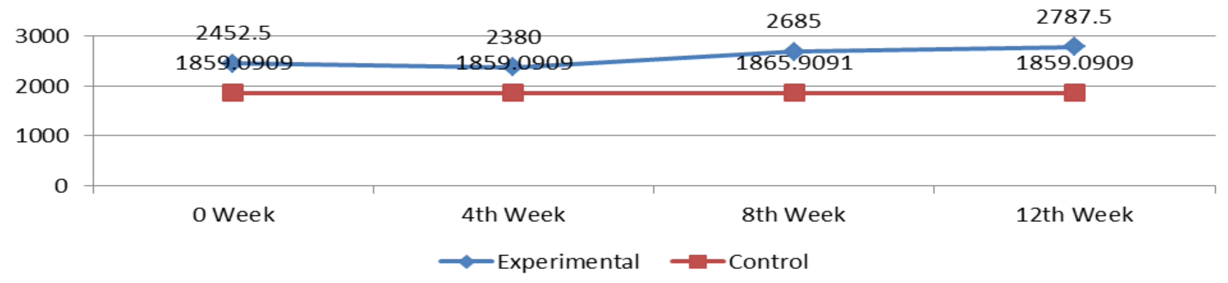
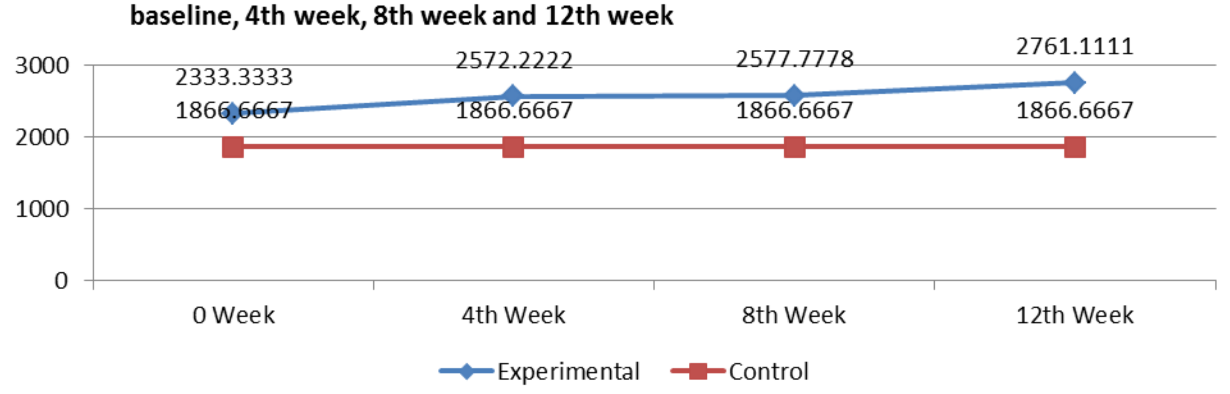


Table 35.4: The average IRV of class 3 obesity female college students per week

IRV	Baseline	week 4	week 8	week 12
Experimental	2333.333	2572.222	2577.778	2761.111
Control	1866.667	1866.667	1866.667	1866.667

Table 35.4 shows the average IRV of experimental and control group class 3 obesity participants taken per week. The value shows that experimental participants IRV increase from Baseline to the week 12 of aerobic dance circuit training.

Fig 65: Line graph showing the mean scores of IRV of the respondents in Experimental and Control groups for paticipants of the Obese class 3 in the baseline, 4th week, 8th week and 12th week



The line graph reveals that the treatment was effective from the 4th to the week 12 in all classes of obesity among the experimental group.

Hypothesis 3(bvi): There will be no significant main effect of Class of obesity on PEFR

From table 14.1, it shows that there was significant main effect of class of obesity on PEFR (F (3,57) = 1.602, p<.05, η^2=.018). The Eta Square value of .018 shows that about 2% of the participants' scores were accounted for by class of obesity. Therefore, the null hypothesis is accepted.

Table 36.1: Estimated Marginal Means on Class of obesity on PEFR

Class of obesity	Mean	Std Error
Class 1 obesity	301.918	6.184
Class 2 obesity	289.000	4.261
Class 3 obesity	269.062	9.911
Class 4 obesity	280.000	31.627

Table 36.1 shows the Estimated Marginal Mean Scores, across the obese classes on PEFR. From the above result, it shows that class 1 obesity had the highest means score of 301.918 compared to class 2 obesity (289.000), class 3 obesity (269.062) and class 4 obesity (280.000). This reveals that, the treatment was more effective among the class 1 obesity participants.

Table 36.2: The average PEFR of class 1 obesity female college students per week

PEFR	Baseline	week 4	week 8	week 12
Experimental	343.3333	346.6667	355	361.6667
Control	245.5556	245.5556	253.3333	251.1111

Table 36.2 shows the average PEFR of experimental and control group class 1 obesity participant taken per week. The value shows that experimental participants PEFR increase from the Baseline to the week 12 of aerobic dance circuit training

Fig 66: Line graph showing the mean scores of PEFR of the respondents in Experimental and Control groups for paticipants of the Obese class 1 in the baseline, 4th week, 8th week and 12th week

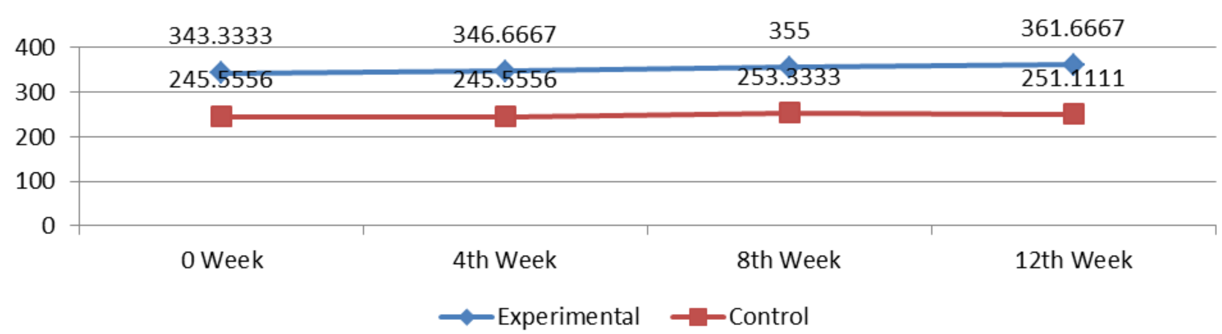


Table 36.3: The average PEFR of class 2 obesity female college students per week

PEFR	Baseline	week 4	week 8	week 12
Experimental	338.5000	245.0000	360.0000	366.5000
Control	220.4545	220.4545	230.4545	228.1818

Table 36.3 shows the average PEFR of experimental and control group class 2 obesity participants taken per week. The value shows that experimental participants PEFR decrease from Baseline to week 4 and increase from week 4 to the week 12 of aerobic dance circuit training.

Fig 67: Line graph showing the mean scores of PEFR of the respondents in Experimental and Control groups for paticipants of the Obese class 2 in the baseline, 4th week, 8th week and 12th week

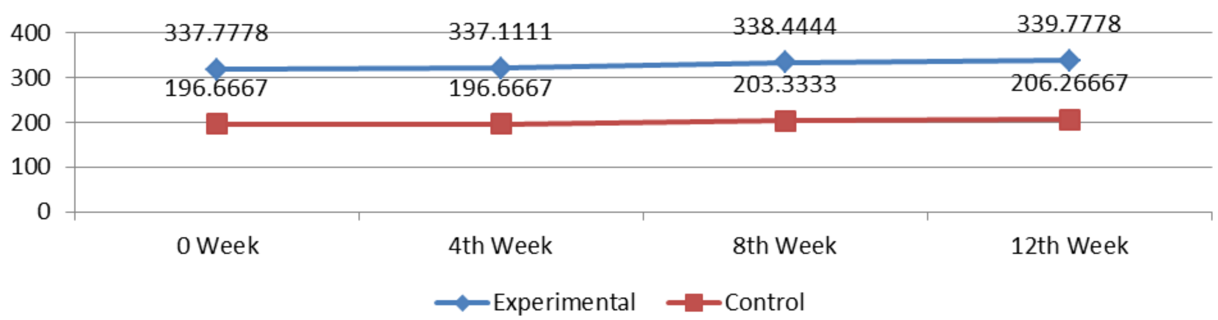
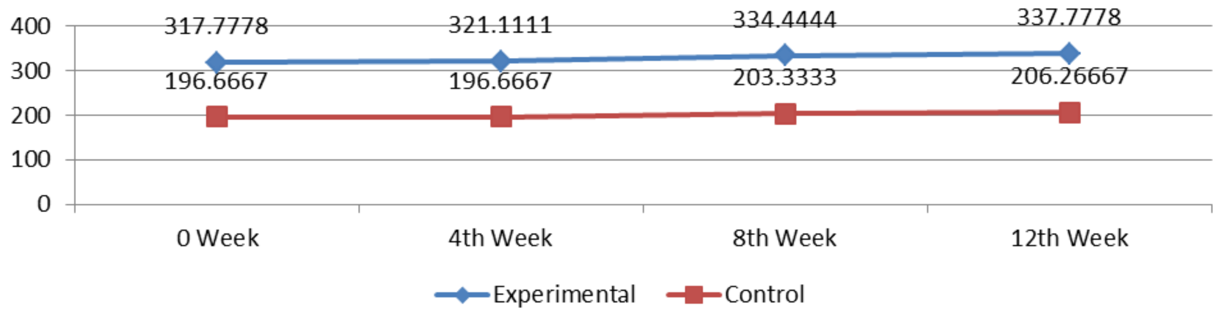


Table 36.4: The average PEFR class 3 obesity female college students per week

PEFR	Baseline	week 4	week 8	week 12
Experimental	317.7778	321.1111	334.4444	337.7778
Control	196.6667	196.6667	203.3333	206.577

Table 36.4 shows the average PEFR of experimental and control group class 3 obesity participants taken per week. The value shows that experimental participants PEFR increase from Baseline to the week 12 of aerobic dance circuit training.

Fig 68: Line graph showing the mean scores of PEFR of the respondents in Experimental and Control groups for paticipants of the Obese class 3 in the baseline, 4th week, 8th week and 12th week



From the figures, the line graphs reveal that the treatment was effective from the baseline to the week 12 in all classes of obesity among the experimental group.

Hypothesis 3(bvii): There will be no significant main effect of Class of obesity on HRR

From table 15.1, it shows that there was significant main effect of class of obesity on HRR (F (3,57) = .471, p<.05, η^2=.005). The Eta Square value of .005 shows that about 5% of the participants' scores were accounted for by class of obesity. Therefore, the null hypothesis is accepted.

Table 37.1: Estimated Marginal Means of Class of obesity HRR

Class of obesity	Mean	Std Error
Class 1 obesity	125.689	2.212
Class 2 obesity	126.228	1.524
Class 3 obesity	122.863	3.545
Class 4 obesity	134.500	11.311

Table 37.1 shows the Estimated Marginal Mean Scores, across the obese classes on HRR. From the above result, it shows that class 3 obesity had the lowest means score of 122.863 compared to class 1 obesity (125.689), class 2 obesity (126.228) and class 4 obesity(134.500). This reveals that, the treatment was more effective among the class 3 obesity participants.

Table 37.2: The average HRR of class 1 obesity female college students per week

HRR	**Baseline**	**week 4**	**week 8**	**week 12**
Experimental	123.5000	123.8333	118.3333	118.3333
Control	115.4444	118.4444	118.4444	118.4444

Table 37.2 shows the average HRR of experimental and control group class 1 obesity participant taken per week. The value shows that experimental participants HRR decrease from the week 4 to the week 8 of aerobic dance circuit training

Fig 69: Line graph showing the mean scores of RHR of the respondents in Experimental and Control groups for paticipants of the Obese class 1 in the baseline, 4th week, 8th week and 12th week

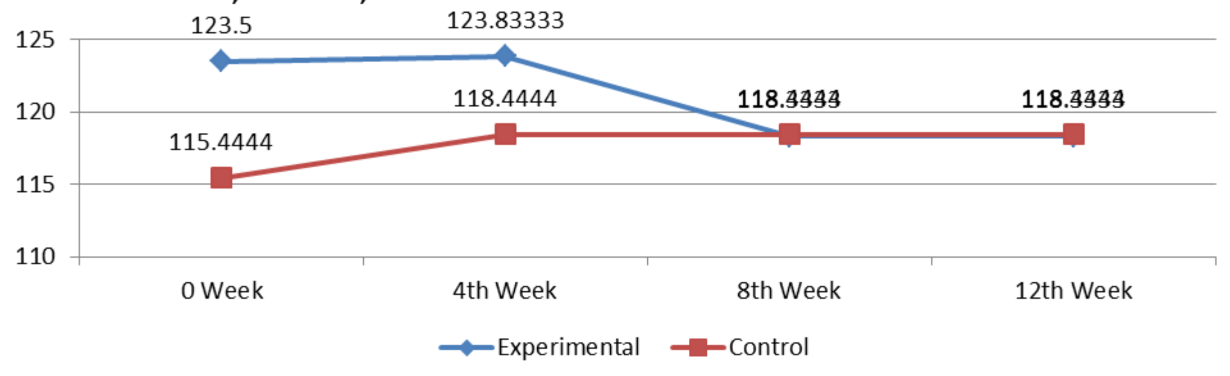


Table 37.3: The average HRR of class 2 obesity female college students per week

HRR	Baseline	week 4	week 8	week 12
Experimental	122.6500	123.2000	118.5500	119.1500
Control	112.4545	116.3636	116.3636	116.3636

Table 37.3 shows the average HRR of experimental and control group class 2 obesity participants taken per week. The value shows that experimental participants HRR increase from the Baseline to the week 4 decrease from week 4 to the week 8 and increase from week 8 to the week 12 of aerobic dance circuit training.

Fig 70: Line graph showing the mean scores of RHR of the respondents in Experimental and Control groups for paticipants of the Obese class 2 in the baseline, 4th week, 8th week and 12th week

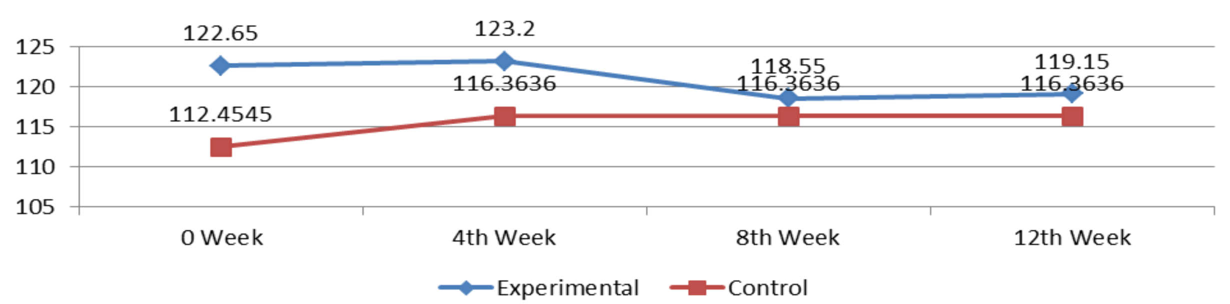
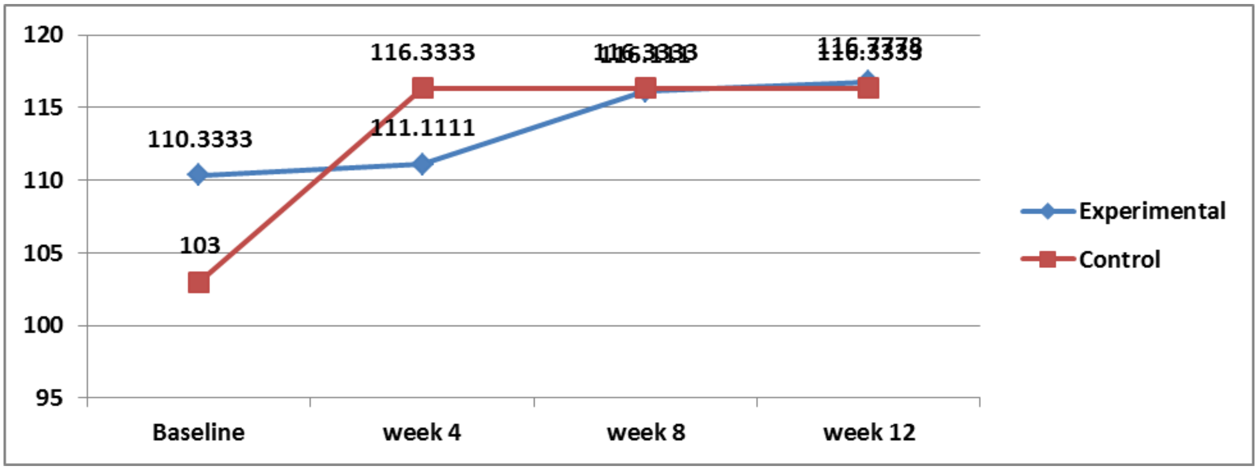


Table 37.4: The average HRR class 3 obesity female college students per week

HRR	Baseline	week 4	week 8	week 12
Experimental	110.3333	111.1111	116.1110	116.7778
Control	103.0000	116.3333	116.3333	116.3333

Table 37.4 shows the average HRR of experimental and control group class 3 obesity participants taken per week. The value shows that experimental participants HRR increase from Baseline to the week 8 of aerobic dance circuit training.



From the figures, the line graphs reveals that the treatment was effective between the week 4 and week 8 in all classes of obesity in experimental group.

Hypothesis 3(bviii): There will be no significant main effect of Class of obesity on VO_2max

From table 16.1, it shows that there was significant main effect of class of obesity on VO_2max (F (3,57) = 1.113, $p<.05$, $\eta^2=.012$). The Eta Square value of .012 shows that about 1% of the participants' scores were accounted for by class of obesity. Therefore, the null hypothesis is accepted.

Table 38.1: Estimated Marginal Means of Class of obesity on VO_2max

Class of obesity	Mean	Std Error
Class 1 obesity	38.623	0.646
Class 2 obesity	38.193	0.445
Class 3 obesity	40.051	1.035
Class 4 obesity	41.145	3.304

Table 38.1 shows the Estimated Marginal Mean Scores, across the obese classes on VO_2max From the above result, it shows that class 2 obesity had the lowest means score of 38.193

compared to class 1 obesity (38.623), class 3 obesity(40.051) and class 4 obesity(41.145). This reveals that, the treatment was more effective among the class 4 obesity participants.

Table 38.2: The average VO_2max of class 1 obesity female college students per week

$V0_2$max	Baseline	week 4	week 8	week 12
Experimental	40.6633	41.1500	37.1700	37.2400
Control	33.8322	34.0156	33.8322	33.8344

Table 38.2 shows the average VO_2max of experimental and control group class 1 obesity participant taken per week. The value shows that experimental participants VO_2max increase from the Baseline to the week 4 and decreases from week 4 to the week 8 of aerobic dance circuit training

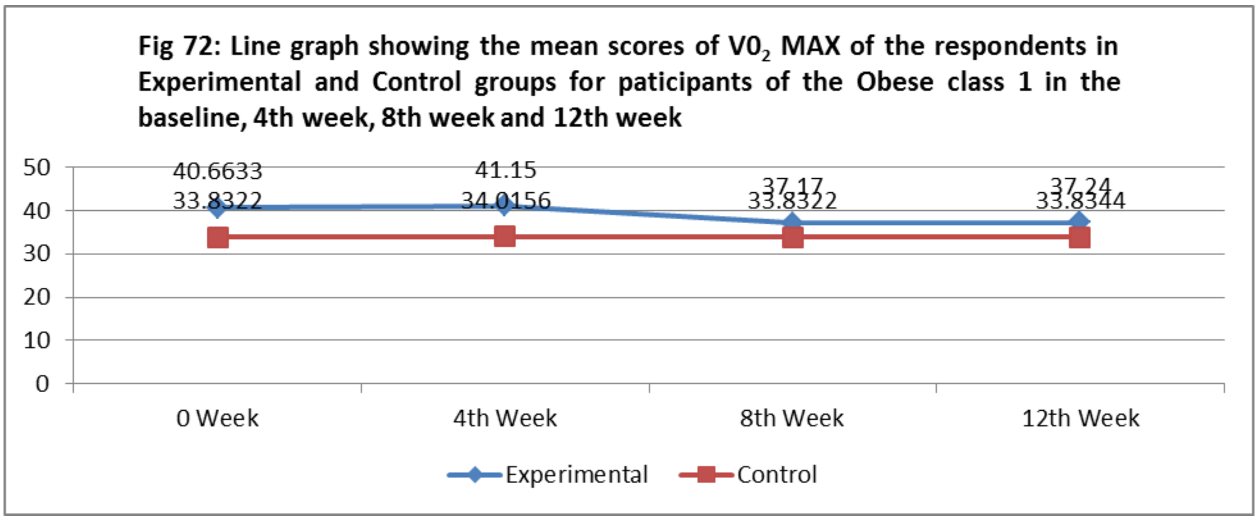


Table 38.3: The average VO_2max of class 2 obesity female college students per week

$V0_2$max	Baseline	week 4	week 8	week 12
Experimental	37.1925	38.1080	37.6365	37.8530
Control	35.7627	36.3932	37.6718	37.6941

Table 38.3 shows the average VO_2max of experimental and control group class 2 obesity participants taken per week. The value shows that experimental participants VO_2max increase from Baseline to the week 4 and decrease from the week 4 to the week 8 of aerobic dance circuit training.

Fig 73: Line graph showing the mean scores of $V0_2$ MAX of the respondents in Experimental and Control groups for paticipants of the Obese class 2 in the baseline, 4th week, 8th week and 12th week

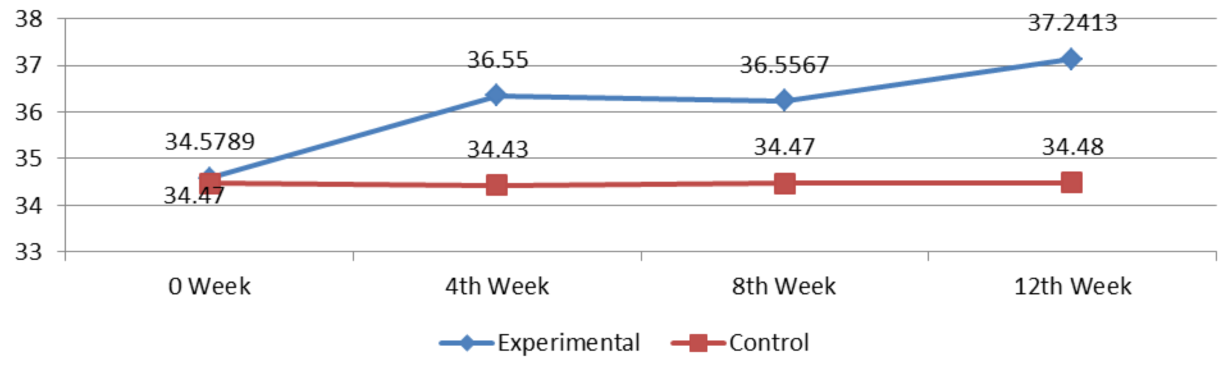
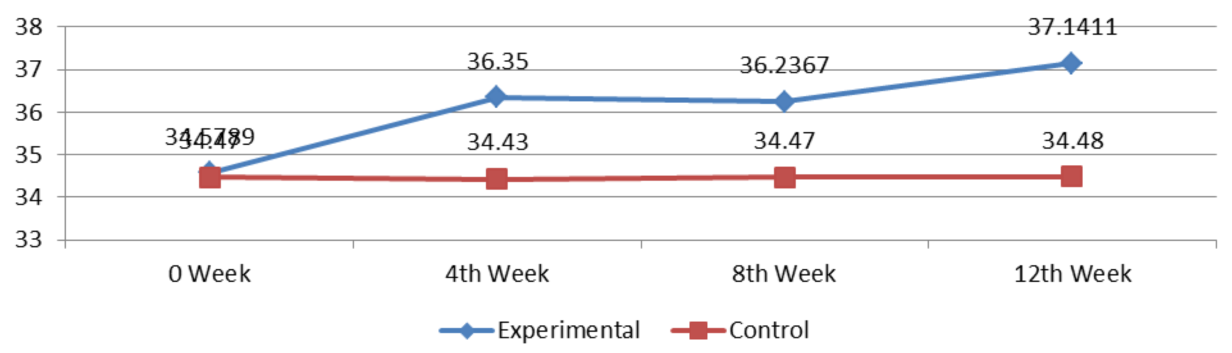


Table 38.4: The average VO_2max **class 3 obesity female college students per week**

$V0_2$max	Baseline	week 4	week 8	week 12
Experimental	34.5789	36.3500	36.2367	37.1411
Control	34.4700	34.4300	34.4700	34.4800

Table 38.4 shows the average VO_2max of experimental and control group class 3 obesity participants taken per week. The value shows that experimental participants VO_2max increase from Baseline to the week 12 of aerobic dance circuit training.

Fig 74: Line graph showing the mean scores of $V0_2$ MAX of the respondents in Experimental and Control groups for paticipants of the Obese class 3 in the baseline, 4th week, 8th week and 12th week



From the figures, the line graphs reveal that the treatment was not effective in class 1 obesity but was effective between the baseline and week 4; also between the week 8 and week 12 in class 2 and class 3 of obese in experimental group.

Hypothesis 4(ai): There will be no significant interaction effect of Treatment and Age on %bf

From table 6.1, it shows that there was no significant interaction effect of treatment and age on %bf ($F(1,57) = 3.836, p > .05, \eta^2 = .014$). The Eta Square value of .014 shows that about 1.4% of the participants' scores were accounted for by treatment and age. Therefore, the null hypothesis is accepted.

Table 39: Estimated Marginal Means on Treatment Groups and Age on %bf

Treatment	Age	Means	Std. Error
Experimental Group	19-24years	35.063	0.659
	25-30years	23.691	0.440
Control Group	19-24years	38.101	0.475
	25-30years	37.934	0.477

Table 39 shows the Estimated Marginal Mean Scores of interaction effect of Treatment Groups and Age on the %bf. In the experimental group, participants who falls between the age range of 25 to 30years had a lower mean score (23.691) while those within the age range of 19 and 24years had a mean score of (35.063) showing that participant within the age range of 25 and 30years in the experimental group performed better. In the control group, participant within the ages of 24 and 30 had a lower mean score of (37.934) while those within 19 and 24years had a mean score of (38.101). In all, participants in the experimental group performed better than those in the control group.

Hypothesis 4(aii): There will be no significant interaction effect of Treatment and Age on WHR

From table 7.1, it shows that there was no significant interaction effect of treatment and age on WHR ($F(1,57) = .413, p > .05, \eta^2 = .002$). The Eta Square value of .002 shows that about 2% of the participants' scores were accounted for by treatment and age. Therefore, the null hypothesis is accepted.

Table 40: Estimated Marginal Means of Treatment Groups and Age WHR

Treatment	Age	Means	Std. Error
Experimental Group	19-24years	0.792	.017
	25-30years	0.786	.012
Control Group	19-24years	0.831	.013
	25-30years	0.820	.013

Table 40 shows the Estimated Marginal Mean Scores of Treatment group and Age on WHR.

In the experimental group, participants who falls between the age range of 25 to 30years had a lower mean score (0.786) while those within the age range of 19 and 24years had a mean score of (0.792) showing that participant within the age range of 25 and 30years in the experimental group performed better. In the control group, participant within the ages of 25 and 30 had a lower mean score of (0.820) while those within 19 and 24years had a mean score of (0.831). In all participants in the experimental group performed better than those in the control group.

Hypothesis 4(aiii): There will be no significant interaction effect of Treatment and Age on WHtR

From table 8.1, it shows that there was no significant interaction effect of treatment and age on WHtR ($F(1,57) = .536, p>.05, \eta^2=.002$). The Eta Square value of .002 shows that about 2% of the participants' scores were accounted for by treatment and age. Therefore, the null hypothesis is accepted.

Table 41: Estimated Marginal Means of Treatment Groups and Age on WHtR

Treatment	Age	Means	Std. Error
Experimental Group	19-24years	0.520	0.012
	25-30years	0.499	0.008
Control Group	19-24years	0.550	0.009
	25-30years	0.557	0.009

Table 41 shows the Estimated Marginal Mean Scores of interaction effect of Treatment Groups and Age on WHtR. In the experimental group, participants who falls between the age range of 25 to 30years had a lower mean score (0.499) while those within the age range of 19 and 24years had a mean score of (0.520) showing that participant within the age range of 25 and 30years in the experimental group performed better. In the control group, participant within the ages of 25 and 30 had a higher mean score of (0.557) while those within 19 and 24years had a mean score of (0.550). In all participants in the experimental group performed better than those in the control group.

Hypothesis 4(bi): There will be no significant interaction effect of Treatment and Age on DBP

From table 9.1 above, it shows that there was no significant interaction effect of treatment and age on DBP ($F(1,57) = 1.548, p>.05, \eta^2=.006$). The Eta Square value of .006 shows that about 6%

of the participants' scores were accounted for by treatment and age. Therefore, the null hypothesis is accepted.

Table 42: Estimated Marginal Means of Treatment Groups and Age on DBP

Treatment	Age	Mean	Std. Error
Experimental Group	19-24years	69.840	3.478
	25-30years	71.819	2.321
Control Group	19-24years	80.852	2.506
	25-30years	89.459	2.519

Table 42 shows the Estimated Marginal Mean Scores of interaction effect of Treatment Groups and Age on DBP. In the experimental group, participants who falls between the age range of 19 to 24years had a lower mean score (69.840) while those within the age range of 25 and 30years had a mean score of (71.819) showing that participant within the age range of 19 and 24years in the experimental group performed better. In the control group, participant within the ages of 25 and 30 had a higher mean score of (89.459) while those within 19 and 24years had a mean score of (80.852). In all participants in the experimental group performed better than those in the control group.

Hypothesis 4(bii): There will be no significant interaction effect of Treatment and Age on SBP

From table 10.1, it shows that there was no significant interaction effect of treatment and age on SBP ($F(1,57) = 3.366, p > .05, \eta^2 = .012$). The Eta Square value of .012 shows that about 10% of the participants' scores were accounted for by treatment and age. Therefore, the null hypothesis is accepted.

Table 43: Estimated Marginal Means of Treatment Groups and Age on SBP

Treatment	Age	Means	Std. Error
Experimental Group	19-24years	115.063	.659
	25-30years	113.691	.440
Control Group	19-24years	118.101	.475
	25-30years	117.934	.477

Table 43 shows the Estimated Marginal Mean Scores of interaction effect of Treatment Groups and Age on SBP. In the experimental group, participants who falls between the age range of 25 to 30years had a lower mean score (113.691) while those within the age range of 19 and 24years had a mean score of (115.063) showing that participant within the age range of 25 and 30years in the experimental group performed better. In the control group, participant within the ages of 25 and 30 had a lower mean score of (117.934) while those within 19 and 24years had a mean score

of (118.101). In all participants in the experimental group performed better than those in the control group.

Hypothesis 4(biii): There will be no significant interaction effect of Treatment and Age on P_{mean} From table 11.1, it shows that there was no significant interaction effect of treatment and age on P_{mean} (F(1,57) =4.082, p>.05,η^2=.015). The Eta Square value of .015 shows that about 15% of the participants' scores were accounted for by treatment and age. Therefore, the null hypothesis is accepted.

Table 44: Estimated Marginal Means of Treatment Groups and Age on P_{mean}

Treatment	Age	Mean	Std. Error
Experimental Group	19-24years	94.291	3.252
	25-30years	88.922	2.169
Control Group	19-24years	97.930	2.343
	25-30years	103.322	2.355

Table 44 shows the Estimated Marginal Mean Scores of interaction effect of Treatment Groups and Age on P_{mean}. In the experimental group, participants who falls between the age range of 25 to 30years had a lower mean score (88.922) while those within the age range of 19 and 24years had a mean score of (94.291) showing that participant within the age range of 25 and 30years in the experimental group performed better. In the control group, participant within the ages of 25 and 30 had a higher mean score of (103.322) while those within 19 and 24years had a mean score of (97.930). In all participants in the experimental group performed better than those in the control group.

Hypothesis 4(bvi): There will be no significant interaction effect of Treatment and Age on VC From table 12.1, it shows that there was no significant interaction effect of treatment and age on VC (F(1,57) =.412, p>.05,η^2=.002). The Eta Square value of .002 shows that about 2% of the participants' scores were accounted for by treatment and age. Therefore, the null hypothesis is accepted.

Table 45: Estimated Marginal Means of Treatment Groups and Age on VC

Treatment	Age	Mean	Std. Error
Experimental Group	19-24years	2386.106	107.513
	25-30years	2327.593	71.734
Control Group	19-24years	1969.450	77.460
	25-30years	1823.636	77.869

Table 45 shows the Estimated Marginal Mean Scores of main effect of the Treatment Groups and Age on Vital Capacity. In the experimental group, participants who falls between the age range of 19 to 24years had a higher mean score (2386.106) while those within the age range of 25 and 30years had a mean score of (2327.593) showing that participant within the age range of 19 and 24years in the experimental group performed better. In the control group, participant within the ages of 25 and 30 had a lower mean score of (1823.636) while those within 19 and 24years had a mean score of (1969.450). In all participants in the experimental group performed better than those in the control group.

Hypothesis 4(bv): There will be no significant interaction effect of Treatment and Age on IRV

From table 13.1, it shows that there was no significant interaction effect of treatment and age on IRV ($F(1,57) = 4.959$, $p > .05, \eta^2 = .018$). The Eta Square value of .018 shows that about 20% of the participants' scores were accounted for by treatment and age. Therefore, the null hypothesis is accepted.

Table 46: Estimated Marginal Means on Treatment Groups and Age

Treatment	Age	Means	Std. Error
Experimental Group	19-24years	2293.460	140.917
	25-30years	2472.963	94.022
Control Group	19-24years	1678.869	101.527
	25-30years	2041.818	102.064

Table 46 shows the Estimated Marginal Mean Scores of interaction effect of Treatment Groups and Age on Inspiratory reserved volume. In the experimental group, participants who falls between the age range of 25 to 30years had a higher mean score (2472.963) while those within the age range of 19 and 24years had a mean score of (2293.460) showing that participant within the age range of 25 and 30years in the experimental group performed better. In the control group, participant within the ages of 25 and 30 had a higher mean score of (2041.818) while those

within 19 and 24years had a mean score of (1678.869). In all participants in the experimental group performed better than those in the control group.

Hypothesis 4(bvi): There will be no significant interaction effect of Treatment and Age on PEFR

From table 14.1, it shows that there was no significant interaction effect of treatment and age on PEFR ($F(1,57) = 1.119$, $p > .05, \eta^2 = .004$). The Eta Square value of .004 shows that about 1% of the participants' scores were accounted for by treatment and age. Therefore, the null hypothesis is accepted.

Table 47: Estimated Marginal Means of Treatment Groups and Age on PEFR

Treatment	Age	Means	Std. Error
Experimental Group	19-24years	333.462	14.001
	25-30years	356.148	9.341
Control Group	19-24years	213.801	10.087
	25-30years	260.808	10.141

Table 47 shows the Estimated Marginal Mean Scores of interaction effect of Treatment Groups and Age on Peak Expiratory flow rate. In the experimental group, participants who falls between the age range of 25 to 30years had a higher mean score (356.148) while those within the age range of 19 and 24years had a mean score of (333.462) showing that participant within the age range of 25 and 30years in the experimental group performed better. In the control group, participant within the ages of 25 and 30 had a higher mean score of (260.808) while those within 19 and 24years had a mean score of (213.801). In all participants in the experimental group performed better than those in the control group.

Hypothesis 4(bvii): There will be no significant interaction effect of Treatment and Age on HRR

From table 15.1, it shows that there was no significant interaction effect of treatment and age on HRR ($F(1,57) = .003$, $p > .05, \eta^2 = .000$). The Eta Square value of .000 shows that about 1% of the participants' scores were accounted for by treatment and age. Therefore, the null hypothesis is accepted

Table 48: Estimated Marginal Means of Treatment Groups and Age on HRR

Treatment	Age	Means	Std. Error
Experimental Group	19-24years	137.487	5.007
	25-30years	134.243	3.341
Control Group	19-24years	117.090	3.608
	25-30years	115.691	3.627

Table 48 shows the Estimated Marginal Mean Scores of significant interaction effect of Treatment Groups and Age on Reserved heart rate. In the experimental group, participants who falls between the age range of 25 to 30years had a lower mean score (134.243) while those within the age range of 19 and 24years had a mean score of (137.487) showing that participant within the age range of 19 and 24years in the experimental group performed better. In the control group, participant within the ages of 25 and 30 had a lower mean score of (115.691) while those within 19 and 24years had a mean score of (117.090). In all participants in the experimental group performed better than those in the control group.

Hypothesis 4(bviii): There will be no significant interaction effect of Treatment and Age on VO_2max

From table 16.1, it shows that there was significant interaction effect of treatment and age on VO_2max ($F(1,57) = 4.062$, $p > .05, \eta^2 = .015$). The Eta Square value of .015 shows that about 50% of the participants' scores were accounted for by treatment and age. Therefore, the null hypothesis is rejected

Table 49: Estimated Marginal Means on Treatment Groups and Age VO_2max

Treatment	Age	Means	Std. Error
Experimental Group	19-24years	40.430	1.463
	25-30years	40.162	.976
Control Group	19-24years	35.976	1.054
	25-30years	38.058	1.059

Table 49 shows the Estimated Marginal Mean Scores interaction effect of Treatment Groups and Age on VO_2max. In the experimental group, participants who falls between the age range of 25 to 30years had a lower mean score (40.162) while those within the age range of 19 and 24years had a mean score of (40.430) showing that participant within the age range of 19 and 24years in the experimental group performed better. In the control group, participant within the ages of 25

and 30 had a higher mean score of (38.058) while those within 19 and 24years had a mean score of (35.976). In all participants in the experimental group performed better than those in the control group.

Hypothesis 5(ai): There will be no significant interaction effect of Treatment and Class of obesity on %bf

From table 6.1, it shows that there was no significant interaction effect of treatment and class of obesity on %bf ($F(3,57) = .538$, $p > .05, \eta^2 = .006$). The Eta Square value of .006 shows that about 10% of the participants' scores were accounted for by treatment and class of obesity. Therefore, the null hypothesis is accepted.

Table 50: Estimated Marginal Means of Treatment Groups and Class of obesity on %bf

Treatment	Class of obesity	Means	Std. Error
Experimental Group	Class 1 obesity	24.130	.433
	Class 2 obesity	25.021	.276
	Class 3 obesity	25.062	.657
	Class 4 obesity	22.900	2.432
Control Group	Class 1 obesity	38.055	.389
	Class 2 obesity	28.105	.291
	Class 3 obesity	28.489	.663
	Class 4 obesity	26.910	1.719

Table 50 shows the Estimated Marginal Mean Scores of interaction effect of Treatment Groups and Class of obesity on %bf. In the experimental group, participants who falls in class 4 obesity had a lower mean score (22.900) while those class 1 obesity had a mean score of (24.130), class 2 obesity (25.021) and class 3 obesity (25.062) showing that participant in class 4 obesity in the experimental group performed better. In the control group, participant in class 4 obesity had a lower mean score of (26.910) while those in class 1 obesity had a mean score of (38.055), class 2 obesity (28.105) and class 3 obesity (28.489). In all participants in the experimental group performed better than those in the control group.

Hypothesis 5(aii): There will be no significant interaction effect of Treatment and Class of obesity on WHR

From table 7.1, it shows that there was no significant interaction effect of treatment and class of obesity on WHR ($F(3,57) = 1.281$, $p > .05, \eta^2 = .014$). The Eta Square value of .014 shows that about 10% of the participants' scores were accounted for by treatment and class of obesity. Therefore, the null hypothesis is accepted.

Table 51: Estimated Marginal Means on Treatment Groups and Class of obesity

Treatment	Class of obesity	Means	Std. Error
Experimental Group	Class 1 obesity	0.796	0.011
	Class 2 obesity	0.790	0.007
	Class 3 obesity	0.752	0.017
	Class 4 obesity	0.850	0.064
Control Group	Class 1 obesity	0.812	0.010
	Class 2 obesity	0.825	0.008
	Class 3 obesity	0.823	0.018
	Class 4 obesity	0.865	0.045

Table 51 shows the Estimated Marginal Mean Scores. It was noted that there was no significant interaction effect of Treatment Groups and Class of obesity on WHR. In the experimental group, participants who falls in class 3 obesity had a lower mean score (0.752) while those class 1 obesity had a mean score of (0.796), class 2 obesity (0.790) and class 4 obesity (o.850) showing that participant in class 3 obesity in the experimental group performed better. In the control group, participant in class 1 obesity had a lower mean score of (0.812) while those in class 2 obesity had a mean score of (0.825), class 3 obesity (0.823) and class 4 obesity (0.865). In all participants in the experimental group performed better than those in the control group.

Hypothesis 5(aiii): There will be no significant interaction effect of Treatment and Class of obesity on WHtR.

From Table 8.1, it shows that there was significant interaction effect of treatment and class of obesity on WHtR ($F(3,57) = 6.606$, $p > .05, \eta^2 = .069$). The Eta Square value of .069 shows that about 69% of the participants' scores were accounted for by treatment and class of obesity. Therefore, the null hypothesis is rejected.

Table 52: Estimated Marginal Means of Treatment Groups and Class of obesity on WHtR

Treatment	Class of obesity	Means	Std. Error
Experimental Group	Class 1 obesity	0.453	0.008
	Class 2 obesity	0.518	0.005
	Class 3 obesity	0.539	0.012
	Class 4 obesity	0.560	0.045
Control Group	Class 1 obesity	0.543	0.007
	Class 2 obesity	0.556	0.005
	Class 3 obesity	0.566	0.012
	Class 4 obesity	0.540	0.031

Table 52 shows the Estimated Marginal Mean Scores of Treatment Groups and Class of obesity on WHtR. In the experimental group, participants who falls in class 1 obesity had a lower mean score (0.453) while those class 2 obesity had a mean score of (0.518), class 3 obesity (0.539) and class 4 obesity (0.560) showing that participant in class 1 obesity in the experimental group performed better. In the control group, participant in class 4 obesity had a lower mean score of (0.540) while those in class 1 obesity had a mean score of (0.543), class 2 obesity (0.556) and class 3 obesity (0.566. In all participants in the experimental group performed better than those in the control group.

Hypothesis 5(bi): There will be no significant interaction effect of Treatment and class of obesity on DBP

From Table 9.1, it shows that there was no significant interaction effect of treatment and class of obesity on DBP ($F(3,57) = .332$, $p > .05, \eta^2 = .004$). The Eta Square value of .004 shows that about 4% of the participants' scores were accounted for by treatment and class of obesity. Therefore, the null hypothesis is accepted.

Table 53: Estimated Marginal Means of Treatment Groups and Class of obesity on DBP

Treatment	Class of obesity	Mean	Std. Error
Experimental Group	Class 1 obesity	71.964	2.286
	Class 2 obesity	69.528	1.457
	Class 3 obesity	74.417	3.454
	Class 4 obesity	65.000	12.830
Control Group	Class 1 obesity	85.287	2.053
	Class 2 obesity	86.711	1.536
	Class 3 obesity	90.143	3.500
	Class 4 obesity	67.500	9.072

Table 53 shows the Estimated Marginal Mean Scores of interaction effect of Treatment Groups and class of obesity on DBP. In the experimental group, participants who falls in class 4 obesity had a lower mean score (65.000) while those class 1 obesity had a mean score of (71.964), class 2 obesity (69.528) and class 3 obesity (74.417) showing that participant in class 4 obesity in the experimental group performed better. In the control group, participant in class 4 obesity had a lower mean score of (67.500) while those in class 1 obesity had a mean score of (85.287), class 2 obesity (86.711) and class 3 obesity (90.143). In all participants in the experimental group performed better than those in the control group.

Hypothesis 5(bii): There will be no significant interaction effect of Treatment Groups and Class of obesity on SBP

From Table 10.1, it shows that there was significant interaction effect of treatment and class of obesity on SBP ($F(3,57) = 5.852$, $p > .05, \eta^2 = .062$). The Eta Square value of .062 shows that about 72% of the participants' scores were accounted for by treatment and class of obesity. Therefore, the null hypothesis is rejected.

Table 54: Estimated Marginal Means of Treatment Groups and Class of obesity SBP

Treatment	Class of obesity	Means	Std. Error
Experimental Group	Class 1 obesity	114.130	.433
	Class 2 obesity	115.021	.276
	Class 3 obesity	115.062	.657
	Class 4 obesity	112.900	2.432
Control Group	Class 1 obesity	118.055	.389
	Class 2 obesity	118.105	.291
	Class 3 obesity	118.489	.663
	Class 4 obesity	116.910	1.719

Table 54 shows the Estimated Marginal Mean Scores of interaction effect of Treatment Groups and Class of obesity on SBP. In the experimental group, participants who falls in class 4 obesity had a lower mean score (12.900) while those class 1 obesity had a mean score of (114.130), class 2 obesity (115.021) and class 3 obesity (115.062) showing that participant in class 4 obesity in the experimental group performed better. In the control group, participant in class 4 obesity had a lower mean score of (116.910) while those in class 1 obesity had a mean score of (118.055), class 2 obesity (118.105) and class 3 obesity (118.489). In all participants in the experimental group performed better than those in the control group.

Hypothesis 5(biii): There will be no significant interaction effect of Treatment and Class of obesity on P_{mean}

From Table 11.1, it shows that there was no significant interaction effect of treatment and class of obesity on P_{mean} ($F(3,57) = 1,148$, $p > .05, \eta^2 = .013$). The Eta Square value of .013 shows that about 30% of the participants' scores were accounted for by treatment and class of obesity. Therefore, the null hypothesis is accepted.

Table 55: Estimated Marginal Means on Treatment Groups and Class of obesity P_{mean}

Treatment	Class of obesity	Mean	Std. Error
Experimental Group	Class 1 obesity	90.710	2.138
	Class 2 obesity	89.047	1.362
	Class 3 obesity	94.758	3.239
	Class 4 obesity	94.900	11.995
Control Group	Class 1 obesity	100.857	1.919
	Class 2 obesity	103.241	1.436
	Class 3 obesity	101.944	3.272
	Class 4 obesity	89.600	8.482

Table 55 shows the Estimated Marginal Mean Scores of interaction effect of Treatment Groups and Class of obesity on P_{mean}. In the experimental group, participants who falls in class 2 obesity had a lower mean score (89.047) while those class 1 obesity had a mean score of (90.710), class 3 obesity (94.758) and class 4 obesity (94.900) showing that participant in class 2 obesity in the experimental group performed better. In the control group, participant in class 4 obesity had a lower mean score of (89.600) while those in class 1 obesity had a mean score of (100.857), class 2 obesity (103.241) and class 3 obesity (101.944). In all participants in the experimental group performed better than those in the control group.

Hypothesis 5(biv): There will be no significant main effect of the Treatment and Class of obesity on Vital Capacity

From Table 12.1, it shows that there was no significant interaction effect of treatment and class of obesity on VC ($F(3,57) = 2.631$, $p > .05, \eta^2 = .029$). The Eta Square value of .029 shows that about 30% of the participants' scores were accounted for by treatment and class of obesity. Therefore, the null hypothesis is accepted.

Table 56: Estimated Marginal Means of Treatment Groups and Class of obesity of VC

Treatment	Class of obesity	Mean	Std. Error
Experimental Group	Class 1 obesity	2390.338	69.675
	Class 2 obesity	2438.889	45.039
	Class 3 obesity	2184.375	10.093
	Class 4 obesity	2500.000	396.595
Control Group	Class 1 obesity	2035.238	63.449
	Class 2 obesity	1785.545	47.480
	Class 3 obesity	1803.571	108.180
	Class 4 obesity	2100.000	280.435

Table 56 shows the Estimated Marginal Mean Scores of main effect of the Treatment Groups and Class of obesity on Vital Capacity. In the experimental group, participants who falls in class 4 obesity had a higher mean score (2500.000) while those class 1 obesity had a mean score of (2390.338), class 2 obesity (2438.889) and class 3 obesity (2184.375) showing that participant in class 4 obesity in the experimental group performed better. In the control group, participant in class 2 obesity had a lower mean score of (1785.545) while those in class 1 obesity had a mean score of (2035.238), class 3 obesity (1803.571) and class 4 obesity (2100.000). In all participants in the experimental group performed better than those in the control group.

Hypothesis 5(bv): There will be no significant interaction effect of Treatment and Class of obesity on IRV

From Table 13.1, it shows that there was no significant interaction effect of treatment and class of obesity on IRV ($F(3,57) = .784$, $p > .05, \eta^2 = .009$). The Eta Square value of .009 shows that about 10% of the participants' scores were accounted for by treatment and class of obesity. Therefore, the null hypothesis is accepted.

Table 57: Estimated Marginal Means of Treatment Groups and Class of obesity on IRV

Treatment	Class of obesity	Means	Std. Error
Experimental Group	Class 1 obesity	2512.635	92.633
	Class 2 obesity	2600.397	59.032
	Class 3 obesity	2408.333	140.366
	Class 4 obesity	1550.000	519.816
Control Group	Class 1 obesity	1832.262	83.163
	Class 2 obesity	1914.394	62.232
	Class 3 obesity	1923.810	141.791
	Class 4 obesity	1500.000	367.565

Table 57 shows the Estimated Marginal Mean Scores of interaction effect of Treatment Groups and Class of obesity on Inspiratory reserved volume. In the experimental group, participants who falls in class 2 obesity had a higher mean score (2600.397) while those class 1 obesity had a mean score of (2512.635), class 3 obesity (2408.333) and class 4 obesity (1550.816) showing that participant in class 2 obesity in the experimental group performed better. In the control group, participant in class 4 obesity had a lower mean score of (1500.000) while those in class 1 obesity had a mean score of (1832.262), class 2 obesity (1914.394) and class 3 obesity

(1023.810). In all participants in the experimental group performed better than those in the control group.

Hypothesis 5(bvi): There will be no significant interaction effect of Treatment and Class of obesity on PEFR

From Table 14.1, it shows that there was no significant interaction effect of treatment and class of obesity on PEFR ($F(3,57) = 2.271$, $p > .05, \eta^2 = .025$). The Eta Square value of .025 shows that about 30% of the participants' scores were accounted for by treatment and class of obesity. Therefore, the null hypothesis is accepted.

Table 58: Estimated Marginal Means of Treatment Groups and Class of obesity on PEFR

Treatment	Class of obesity	Means	Std. Error
Experimental Group	Class 1 obesity	365.919	9.204
	Class 2 obesity	347.103	5.865
	Class 3 obesity	313.125	13.946
	Class 4 obesity	350.000	51.646
Control Group	Class 1 obesity	237.917	8.263
	Class 2 obesity	230.897	6.183
	Class 3 obesity	245.000	14.088
	Class 4 obesity	210.000	36.519

Table 58 shows the Estimated Marginal Mean Scores of interaction effect of Treatment Groups and Class of obesity on Peak expiratory flow rate. In the experimental group, participants who falls in class 1 obesity had a higher mean score (365.919) while those class 2 obesity had a mean score of (347.103), class 3 obesity (313.125) and class 4 obesity (350.000) showing that participant in class 1 obesity in the experimental group performed better. In the control group, participant in class 4 obesity had a lower mean score of (210.000) while those in class 1 obesity had a mean score of (237.917), class 2 obesity (230.897) and class 3 obesity (245.000). In all participants in the experimental group performed better than those in the control group.

Hypothesis 5(bvii): There will be no significant interaction effect of Treatment and Class of obesity on HRR

From Table 15.1, it shows that there was no significant interaction effect of treatment and class of obesity on HRR ($F(3,57) = .654$, $p > .05, \eta^2 = .007$). The Eta Square value of .007 shows that about 10% of the participants' scores were accounted for by treatment and class of obesity. Therefore, the null hypothesis is accepted.

Table 59: Estimated Marginal Means of Treatment Groups and Class of obesity on HRR

Treatment	Class of obesity	Means	Std. Error
Experimental Group	Class 1 obesity	133.077	3.292
	Class 2 obesity	137.308	2.098
	Class 3 obesity	132.458	4.988
	Class 4 obesity	147.000	18.471
Control Group	Class 1 obesity	118.301	2.955
	Class 2 obesity	115.149	2.211
	Class 3 obesity	113.268	5.038
	Class 4 obesity	122.000	13.061

Table 59 shows the Estimated Marginal Mean Scores of interaction effect of Treatment Groups and Class of obesity on heart rate reserved. In the experimental group, participants who falls in class 4 obesity had a higher mean score (147.000) while those class 1 obesity had a mean score of (133.007), class 2 obesity (137.308) and class 3 obesity (132.458) showing that participant in class 4 obesity in the experimental group performed better. In the control group, participant in class 3 obesity had a lower mean score of (113.268) while those in class 1 obesity had a mean score of (118.301), class 2 obesity (115.149) and class 4 obesity (122.000). In all participants in the experimental group performed better than those in the control group.

Hypothesis 5(bviii): There will be no significant interaction effect of Treatment and Class of obesity on VO_2max.

From Table 16.1, it shows that there was no significant interaction effect of treatment and class of obesity on VO_2max ($F(3,57) = 2.128, p > .05, \eta^2 = .023$). The Eta Square value of .023 shows that about 30% of the participants' scores were accounted for by treatment and class of obesity. Therefore, the null hypothesis is accepted.

Table 60: Estimated Marginal Means of Treatment Groups and Class of obesity on VO_2max.

Treatment	Class of obesity	Means	Std. Error
Experimental Group	Class 1 obesity	40.430	.961
	Class 2 obesity	41.346	.613
	Class 3 obesity	40.866	1.457
	Class 4 obesity	46.400	5.395
Control Group	Class 1 obesity	36.817	.863
	Class 2 obesity	35.040	.646
	Class 3 obesity	39.236	1.472
	Class 4 obesity	35.890	3.815

Table 60 shows the Estimated Marginal Mean Scores of interaction effect of Treatment Groups and Class of obesity on VO_2max. In the experimental group, participants who falls in class 4 obesity had a higher mean score (46.400) while those class 1 obesity had a mean score of (40.430), class 2 obesity (41.346) and class 3 obesity (40.866) showing that participant in class 4 obesity in the experimental group performed better. In the control group, participant in class 2 obesity had a lower mean score of (35.040) while those in class 1 obesity had a mean score of (36.817), class 3 obesity (39.236) and class 4 obesity (35.890). In all participants in the experimental group performed better than those in the control group.

Hypothesis 6(ai): There will be no significant interaction effect of Age and Class of obesity on %bf

From Table 6.1, it shows that there was no significant interaction effect of age and class of obesity on %bf ($F(2,57) = .517$, $p > .05, \eta^2 = .004$). The Eta Square value of .004 shows that about 5% of the participants' scores were accounted for by age and class of obesity. Therefore, the null hypothesis is accepted.

Table 61: Estimated Marginal Means on Age and Class of obesity on %bf

Age	Class of obesity	Means	Std. Error
19-24years	Class 1 obesity	26.519	0.305
	Class 2 obesity	27.336	0.274
	Class 3 obesity	27.569	0.505
	Class 4 obesity	24.905	1.489
25-30years	Class 1 obesity	25.666	0.496
	Class 2 obesity	25.790	0293
	Class 3 obesity	25.982	0.785
	Class 4 obesity	-	-

Table 61 shows the Estimated Marginal Mean Scores of interaction effect of Age and Class of obesity on %bf. In 19 to 24 years, participants who falls in class 4 obesity had a lower mean score (24.905) while those in class 1 obesity had a mean score of (26.519), class 2 obesity (27.336) and class 3 obesity (27.569) showing that participant in class 4 obesity performed better. In the age range of 25 and 30 years, participant in class 1 obesity had a lower mean score of (25.666) while those in class 2 obesity had a mean score of (25.790), class 3 obesity (25.982) and non in class 4 obesity. In all participants, class 4 obesity in ages 19 and 24 years performed better.

Hypothesis 6(aii): There will be no significant interaction effect of Age and Class of obesity on WHR

From Table 7.1, it shows that there was no significant interaction effect of age and class of obesity on WHR ($F(2,57) = .158$, $p > .05, \eta^2 = .001$). The Eta Square value of .001 shows that about 1% of the participants' scores were accounted for by age and class of obesity. Therefore, the null hypothesis is accepted.

Table 62: Estimated Marginal Means of Age and Class of obesity on WHR

Age	Class of obesity	Means	Std. Error
19-24years	Class 1 obesity	0.802	0.008
	Class 2 obesity	0.807	0.007
	Class 3 obesity	0.780	0.013
	Class 4 obesity	0.857	0.039
25-30years	Class 1 obesity	0.806	0.013
	Class 2 obesity	0.808	0.008
	Class 3 obesity	0.796	0.021
	Class 4 obesity	-	-

Table 62 shows the Estimated Marginal Mean Scores of interaction effect of Age and Class of obesity on WHR. In 19 to 24 years, participants who falls in class 3 obesity had a lower mean score (0.780) while those in class 1 obesity had a mean score of (0.802), class 2 obesity (0.807) and class 4 obesity (0.857) showing that participant in class 3 obesity performed better. In the age range of 25 and 30 years, participant in class 3 obesity had a lower mean score of (0.796) while those in class 1 obesity had a mean score of (0.806), class 2 obesity (0.808) and non in class 4 obesity. In all participants, class 3 obesity in ages 19 and 24 years performed better.

Hypothesis 6(aiii): There will be no significant interaction effect of Age and Class of obesity on WHtR

From Table 8.1, it shows that there was significant interaction effect of age and class of obesity on WHtR ($F(2,57) = 6.447$, $p > .05, \eta^2 = .046$). The Eta Square value of .046 shows that about 50% of the participants' scores were accounted for by age and class of obesity. Therefore, the null hypothesis is rejected.

Table 63: Estimated Marginal Means of Age and Class of obesity on WHtR

Age	Class of obesity	Means	Std. Error
19-24years	Class 1 obesity	0.515	0.006
	Class 2 obesity	0.533	0.005
	Class 3 obesity	0.542	0.009
	Class 4 obesity	0.550	0.027
24-30yeras	Class 1 obesity	0.481	0.009
	Class 2 obesity	0.541	0.005
	Class 3 obesity	0.563	0.014
	Class 4 obesity	0.000	0.000

Table 63 shows the Estimated Marginal Mean Scores of interaction effect of Age and Class of obesity on WHtR. In 19 to 24 years, participants who falls in class 1 obesity had a lower mean score (0.515) while those in class 2 obesity had a mean score of (0.533), class 3 obesity (0.542) and class 4 obesity (0.550) showing that participant in class 1 obesity performed better. In the age range of 25 and 30 years, participant in class 1 obesity had a lower mean score of (0.481) while those in class 2 obesity had a mean score of (0.541), class 3 obesity (0.563) and non in class 4 obesity. In all participants, class 1 obesity in ages 25 and 30 years performed better.

Hypothesis 6(bi): There will be no significant interaction effect of Age and Class of obesity on DBP

From Table 9.1, it shows that there was no significant interaction effect of age and class of obesity on DBP ($F(2,57) = .418$, $p > .05, \eta^2 = .003$). The Eta Square value of .003 shows that about 3% of the participants' scores were accounted for by age and class of obesity. Therefore, the null hypothesis is accepted.

Table 64: Estimated Marginal Means of Age and Class of obesity on DBP

Age	Class of obesity	Mean	Std. Error
19-24years	Class 1 obesity	79.067	1.607
	Class 2 obesity	77.673	1.446
	Class 3 obesity	80.393	2.665
	Class 4 obesity	66.250	7.857
25-30years	Class 1 obesity	78.183	2.619
	Class 2 obesity	79.566	1.546
	Class 3 obesity	84.167	4.141
	Class 4 obesity	00.000	0.000

Table 64 shows the Estimated Marginal Mean Scores, shows the interaction effect of Age and Class of obesity on DBP. In 19 to 24 years, participants who falls in class 4 obesity had a lower mean score (66.250) while those in class 1 obesity had a mean score of (79.067), class 2 obesity (77.673) and class 3 obesity (80.393) showing that participant in class 4 obesity performed better. In the age range of 25 and 30 years, participant in class 1 obesity had a lower mean score of (78.183) while those in class 2 obesity had a mean score of (79.566), class 3 obesity (84.167) and non in class 4 obesity. In all participants, class 4 obesity in ages 19 and 24 years performed better.

Hypothesis 6(bii): There will be no significant interaction effect of Age and Class of obesity on SBP

From Table 10.1, it shows that there was no significant interaction effect of age and class of obesity on SBP ($F(2,57) = .696$, $p > .05, \eta^2 = .005$). The Eta Square value of .005 shows that about 5% of the participants' scores were accounted for by age and class of obesity. Therefore, the null hypothesis is accepted.

Table 65: Estimated Marginal Means of Age and Class of obesity on SBP

Age	Class of obesity	Means	Std. Error
19-24years	Class 1 obesity	116.519	0.305
	Class 2 obesity	117.336	0.274
	Class 3 obesity	117.569	0.505
	Class 4 obesity	114.905	1.489
25-30years	Class 1 obesity	115.666	0.496
	Class 2 obesity	115.790	0.293
	Class 3 obesity	115.982	0.785
	Class 4 obesity	-	-

Table 65 shows the Estimated Marginal Mean Scores of interaction effect of Age and Class of obesity on SBP. In 19 to 24 years, participants who falls in class 4 obesity had a lower mean score (114.905) while those in class 1 obesity had a mean score of (116.519), class 2 obesity (117.336) and class 3 obesity (117.569) showing that participant in class 4 obesity performed better. In the age range of 25 and 30 years, participant in class 1 obesity had a lower mean score of (115.666) while those in class 2 obesity had a mean score of (115.790), class 3 obesity (115.982) and non in class 4 obesity. In all participants, class 4 obesity in ages 19 and 24 years performed better.

Hypothesis 6(biii): There will be no significant interaction effect of Age and Class of obesity on P_{mean}.

From Table 11.1, it shows that there was no significant interaction effect of age and class of obesity on P_{mean} ($F(2,57) = .287$, $p > .05, \eta^2 = .002$). The Eta Square value of .002 shows that about 2% of the participants' scores were accounted for by age and class of obesity. Therefore, the null hypothesis is accepted.

Table 66: Estimated Marginal Means of Age and Class of obesity on P_{mean}

Age	Class of obesity	Mean	Std. Error
19-24years	Class 1 obesity	97.295	1.502
	Class 2 obesity	96.377	1.352
	Class 3 obesity	98.519	2.492
	Class 4 obesity	92.250	7.346
25-30years	Class 1 obesity	94.272	2.449
	Class 2 obesity	95.910	1.445
	Class 3 obesity	98.183	3.871
	Class 4 obesity	00.000	0.000

Table 66 shows the Estimated Marginal Mean Scores of interaction effect of Age and Class of obesity on P_{mean}. In 19 to 24 years, participants who falls in class 4 obesity had a lower mean score (92.250) while those in class 1 obesity had a mean score of (97.295), class 2 obesity (96.377) and class 3 obesity (98.519) showing that participant in class 4 obesity performed better. In the age range of 25 and 30 years, participant in class 1 obesity had a lower mean score of (94.272) while those in class 2 obesity had a mean score of (95.910), class 3 obesity (98.183) and non in class 4 obesity. In all participants, class 4 obesity in ages 19 and 24 years performed better.

Hypothesis 6(biv): There will be no significant main effect of Age and Class of obesity on VC

From Table 12.1, it shows that there was no significant interaction effect of age and class of obesity on VC ($F(2,57) = .208$, $p > .05$, $\eta^2 = .002$). The Eta Square value of .002 shows that about 2% of the participants' scores were accounted for by age and class of obesity. Therefore, the null hypothesis is accepted.

Table 67: Estimated Marginal Means of Age and Class of obesity on VC

Age	Class of obesity	Mean	Std. Error
19-24years	Class 1 obesity	2241.409	49.669
	Class 2 obesity	2119.257	44.710
	Class 3 obesity	2050.446	82.388
	Class 4 obesity	2300.000	242.864
25-30years	Class 1 obesity	2184.167	80.955
	Class 2 obesity	2105.177	47.790
	Class 3 obesity	1937.500	128.000
	Class 4 obesity	0000.000	000.000

Table 67 shows the Estimated Marginal Mean Scores of main effect of Age and Class of obesity on Vital Capacity. In 19 to 24 years, participants who falls in class 4 obesity had a higher mean score (2300.000) while those in class 1 obesity had a mean score of (2241.409), class 2 obesity (2119.257) and class 3 obesity (2050.446) showing that participant in class 4 obesity performed better. In the age range of 25 and 30 years, participant in class 1 obesity had a higher mean score of (2184.167) while those in class 2 obesity had a mean score of (2105.177), class 3 obesity (1937.500) and non in class 4 obesity. In all participants, class 4 obesity in ages 19 and 24 years performed better.

Hypothesis 6(bv): There will be no significant interaction effect of Age and Class of obesity on IRV

From Table 13.1, it shows that there was no significant interaction effect of age and class of obesity on IRV ($F(2,57) = 2.804$, $p > .05$, $\eta^2 = .021$. The Eta Square value of .021 shows that about 20% of the participants' scores were accounted for by age and class of obesity. Therefore, the null hypothesis is accepted.

Table 68: Estimated Marginal Means of Age and Class of obesity on IRV

Age	Class of obesity	Means	Std. Error
19-24years	Class 1 obesity	2244.064	65.102
	Class 2 obesity	2189.286	58.601
	Class 3 obesity	1986.310	107.985
	Class 4 obesity	1525.000	318.321
25-30years	Class 1 obesity	2100.833	106.107
	Class 2 obesity	2325.505	62.638
	Class 3 obesity	2345.833	167.769
	Class 4 obesity	0000.000	000.000

Table 68 shows the Estimated Marginal Mean Scores of interaction effect of Age and Class of obesity on Inspiratory reserved volume. In 19 to 24 years, participants who falls in class 1 obesity had a higher mean score (2244.064) while those in class 2 obesity had a mean score of (2189.286), class 3 obesity (1986.310) and class 4 obesity (1525.000) showing that participant in class 1 obesity performed better. In the age range of 25 and 30 years, participant in class 3 obesity had a lower mean score of (2345.833) while those in class 1 obesity had a mean score of (2100.833), class 2 obesity (2325.505) and non in class 4 obesity. In all participants, class 1 obesity in ages 19 and 24 years performed better.

Hypothesis 6(bvi): There will be no significant interaction effect of Age and Class of obesity on PEFR

From Table 14.1, it shows that there was no significant interaction effect of age and class of obesity on PEFR ($F(2,57) =.783$, $p>.05$, $\eta^2=.006$). The Eta Square value of .006 shows that about 10% of the participants' scores were accounted for by age and class of obesity. Therefore, the null hypothesis is accepted.

Table 69: Estimated Marginal Means of Age and Class of obesity on PEFR

Age	Class of obesity	Means	Std. Error
19-24years	Class 1 obesity	290.169	6.468
	Class 2 obesity	271.232	5.822
	Class 3 obesity	253.125	10.729
	Class 4 obesity	280.000	31.627
25-30years	Class 1 obesity	313.667	10.542
	Class 2 obesity	306.768	6.223
	Class 3 obesity	305.000	16.669
	Class 4 obesity	000.000	000.000

Table 69 shows the Estimated Marginal Mean Scores of interaction effect of Age and Class of obesity on Peak expiratory flow rate. In 19 to 24 years, participants who falls in class 1 obesity had a higher mean score (290.169) while those in class 2 obesity had a mean score of (271.232), class 3 obesity (253.125) and class 4 obesity (280.000) showing that participant in class 1 obesity performed better. In the age range of 25 and 30 years, participant in class 1 obesity had a higher mean score of (313.667) while those in class 2 obesity had a mean score of (306.768), class 3 obesity (305.000) and non in class 4 obesity. In all participants, class 1 obesity in ages 19 and 24 years performed better.

Hypothesis 6(bvii): There will be no significant interaction effect of Age and Class of obesity on HRR

From Table 15.1, it shows that there was no significant interaction effect of age and class of obesity on HRR ($F(2,57) = 1.159$, $p > .05, \eta^2 = .009$). The Eta Square value of .009 shows that about 9% of the participants' scores were accounted for by age and class of obesity. Therefore, the null hypothesis is accepted.

Table 70: Estimated Marginal Means of Age and Class of obesity on HRR

Age	Class of obesity	Means	Std. Error
19-24years	Class 1 obesity	128.295	2.313
	Class 2 obesity	124.842	2.082
	Class 3 obesity	121.518	3.837
	Class 4 obesity	134.500	11.311
25-30years	Class 1 obesity	123.083	115.660
	Class 2 obesity	127.615	123.233
	Class 3 obesity	124.208	112.471
	Class 4 obesity	-	-

Table 70 shows the Estimated Marginal Mean Scores interaction effect of Age and Class of obesity on HRR. In 19 to 24 years, participants who falls in class 3 obesity had a lower mean score (121.518) while those in class 1 obesity had a mean score of (128.295), class 2 obesity (124.842) and class 4 obesity (134.500) showing that participant in class 3 obesity performed better. In the age range of 25 and 30 years, participant in class 1 obesity had a lower mean score of (123.083) while those in class 2 obesity had a mean score of (127.615), class 3 obesity (124.208) and non in class 4 obesity. In all participants, class 3 obesity in ages 19 and 24 years performed better.

Hypothesis 6(bviii): There will be no significant interaction effect of Age and Class of obesity on VO_2max

From Table 16.1, it shows that there was no significant interaction effect of age and class of obesity on VO_2max ($F(2,57) = .591$, $p > .05, \eta^2 = .004$). The Eta Square value of .004 shows that about 4% of the participants' scores were accounted for by age and class of obesity. Therefore, the null hypothesis is accepted.

Table 71: Estimated Marginal Means of Age and Class of obesity on VO_2max

Age	Class of obesity	Means	Std. Error
19-24years	Class 1 obesity	39.028	.676
	Class 2 obesity	38.248	.608
	Class 3 obesity	39.130	1.121
	Class 4 obesity	41.145	3.304
25-30years	Class 1 obesity	38.218	1.101
	Class 2 obesity	38.138	.650
	Class 3 obesity	40.972	1.741
	Class 4 obesity		

Table 71 shows the Estimated Marginal Mean Scores of interaction effect of Age and Class of obesity on VO_2max. In 19 to 24 years, participants who falls in class 4 obesity had a higher mean score (41.145) while those in class 1 obesity had a mean score of (39.028), class 2 obesity (38.248) and class 3 obesity (39.130) showing that participant in class 4 obesity performed better. In the age range of 25 and 30 years, participant in class 3 obesity had a higher mean score of (40.972) while those in class 1 obesity had a mean score of (38.218), class 2 obesity (38.138) and non in class 4 obesity. In all participants, class 4 obesity in ages 19 and 24 years performed better.

Hypothesis 7(ai): There will be no significant interaction effect of Treatment, Age and Class of obesity on %bf

From Table 6.1, it shows that there was no significant interaction effect of Treatment, age and class of obesity on %bf ($F(2,57) = 1.752$, $p > .05, \eta^2 = .013$). The Eta Square value of .013 shows that about 3% of the participants' scores were accounted for by treatment, age and class of obesity. Therefore, the null hypothesis is accepted.

Table 72: Estimated Marginal Means on Treatment Groups, Age and Class of obesity on %bf

Treatment	Age	Class of obesity	Means	Std. Error
Experimental Group	19-24years	Class 1 obesity	25.060	.400
		Class 2 obesity	25.760	.375
		Class 3 obesity	26.533	.860
		Class 4 obesity	22.900	2.432
	25-30years	Class 1 obesity	23.199	.769
		Class 2 obesity	24.283	.405
		Class 3 obesity	23.592	.993
		Class 4 obesity		
Control Group	19-24years	Class 1 obesity	26.977	.460
		Class 2 obesity	28.913	.400
		Class 3 obesity	28.606	.531
		Class 4 obesity	26.910	1.719
	25-30years	Class 1 obesity	28.133	.628
		Class 2 obesity	27.297	.423
		Class 3 obesity	28.372	1.216
		Class 4 obesity	-	-

Table 72 shows the Estimated Marginal Mean Scores interaction effect of Treatment, Age and Class of obesity on %bf. In Experimental group (19 to 24 years), participants who falls in class 4 obesity had a lower mean score (22.900) while those in class 1 obesity had a mean score of (25.060), class 2 obesity (25.760) and class 3 obesity (26.533) showing that participant in class 4 obesity performed better. In 25 to 30 years, participants who falls in class 1 obesity had a lower mean score (23.199) while those in class 2 obesity had a mean score of (24.283), class 3 obesity (23.592) and non in class 4 obesity showing that participant in class 1 obesity performed better. In control group, the age range of 19 and 24 years, participant in class 1 obesity had a lower mean score of (26.977) while those in class 2 obesity had a mean score of (28.913), class 3 obesity (28.606) and class 4 obesity (26.910). In 25 to 30 years, participants who falls in class 2 obesity had a lower mean score (27.297) while those in class 1 obesity had a mean score of (28.133), class 3 obesity (28.372) and non in class 4 obesity. In all participants, class 4 obesity in ages 19 and 24 years performed better.

Hypothesis 7(aii): There will be no significant interaction effect of Treatment, Age and Class of obesity on WHR

From Table 7.1, it shows that there was no significant interaction effect of Treatment, age and class of obesity on WHR ($F(2,57) = 2.568$, $p > .05, \eta^2 = .019$). The Eta Square value of .019 shows that about 9% of the participants' scores were accounted for by treatment, age and class of obesity. Therefore, the null hypothesis is accepted.

Table 73: Estimated Marginal Means on Treatment Groups, Age and Class of obesity

Treatment	Age	Class of obesity	Means	Std. Error
Experimental Group	19-24years	Class 1 obesity	0.777	0.011
		Class 2 obesity	0.793	0.010
		Class 3 obesity	0.747	0.023
		Class 4 obesity	0.850	0.064
	25-30years	Class 1 obesity	0.815	0.020
		Class 2 obesity	0.787	0.011
		Class 3 obesity	0.757	0.026
		Class 4 obesity	-	-
Control Group	19-24years	Class 1 obesity	0.827	0.012
		Class 2 obesity	0.821	0.011
		Class 3 obesity	0.812	0.014
		Class 4 obesity	0.865	0.045
	25-30years	Class 1 obesity	0.797	0.017
		Class 2 obesity	0.829	0.011
		Class 3 obesity	0.835	0.032
		Class 4 obesity	-	

Table 73 shows the Estimated Marginal Mean Scores of interaction effect of Treatment Groups, Age and Class of obesity on WHR. In Experimental group (19 to 24 years), participants who falls in class 3 obesity had a lower mean score (0.747) while those in class 1 obesity had a mean score of (0.777), class 2 obesity (0.793) and class 4 obesity (0.850) showing that participant in class 3 obesity performed better. In 25 to 30 years, participants who falls in class 3 obesity had a lower mean score (0.757) while those in class 1 obesity had a mean score of (0.815), class 2 obesity (0.787) and non in class 4 obesity showing that participant in class 3 obesity performed better. In control group, the age range of 19 and 24 years participant in class 3 obesity had a lower mean score of (0.812) while those in class 1 obesity had a mean score of (0.827), class 2 obesity (0.821) and class 4 obesity (0.865). In 25 to 30 years, participants who falls in class 1 obesity had a lower mean score (0.797) while those in class 2 obesity had a mean score of (0.829), class 3 obesity (0.835) and non in class 4 obesity. In all the participants, class 3 obesity in ages 19 and 24 years performed best.

Hypothesis 7(aiii): There will be no significant interaction effect of Treatment, Age and Class of obesity on WHtR

From Table 8.1, it shows that there was no significant interaction effect of Treatment, age and class of obesity on WHtR ($F(2,57) = .860$, $p > .05, \eta^2 = .006$). The Eta Square value of .006 shows that about 1% of the participants' scores were accounted for by treatment, age and class of obesity. Therefore, the null hypothesis is accepted.

Table 74: Estimated Marginal Means on Treatment Groups, Age and Class of obesity

Treatment	Age	Class of obesity	Means	Std. Error
Experimental Group	19-24years	Class 1 obesity	0.479	0.007
		Class 2 obesity	0.514	0.007
		Class 3 obesity	0.527	0.016
		Class 4 obesity	0.560	0.045
	25-30years	Class 1 obesity	0.427	0.014
		Class 2 obesity	0.521	0.007
		Class 3 obesity	0.550	0.018
		Class 4 obesity	-	-
Control Group	19-24years	Class 1 obesity	0.552	0.008
		Class 2 obesity	0.552	0.007
		Class 3 obesity	0.557	0.010
		Class 4 obesity	0.540	0.031
	25-30years	Class 1 obesity	0.534	0.011
		Class 2 obesity	0.561	0.008
		Class 3 obesity	0.575	0.022
		Class 4 obesity	-	-

Table 74 shows the Estimated Marginal Mean Scores of significant interaction effect of Treatment Groups, Age and Class of obesity on WHtR. In Experimental group (19 to 24 years), participants who falls in class 1 obesity had a lower mean score (0.479) while those in class 2 obesity had a mean score of (0.514), class 3 obesity (0.527) and class 4 obesity (0.560) showing that participant in class 1 obesity performed better. In 25 to 30 years, participants who falls in class 1 obesity had a lower mean score (0.427) while those in class 2 obesity had a mean score of (0.521), class 3 obesity (0.550) and non in class 4 obesity showing that participant in class 1 obesity performed better. In control group, the age range of 19 and 24 years, participant in class 4 obesity had a lower mean score of (0.540) while those in class 1 obesity and class 2 obesity had a mean score of (0.552), and class 3 obesity (0.557). In 25 to 30 years, participants who falls in class 1 obesity had a lower mean score (0.534) while those in class 2 obesity had a mean score of

(0.561), class 3 obesity (0.575) and non in class 4 obesity. In all participants, class 1 obesity in ages 25 and 30 years performed better.

Hypothesis 7(bi): There will be no significant interaction effect of Treatment, Age and Class of obesity on DBP

From Table 9.1, it shows that there was no significant interaction effect of Treatment, age and class of obesity on DBP ($F(2,57) = .148$, $p > .05, \eta^2 = .014$). The Eta Square value of .014 shows that about 40% of the participants' scores were accounted for by treatment, age and class of obesity. Therefore, the null hypothesis is accepted.

Table 75: Estimated Marginal Means on Treatment Groups, Age and Class of obesity on DBP

Treatment	Age	Class of obesity	Mean	Std. Error
Experimental Group	19-24years	Class 1 obesity	71.027	2.109
		Class 2 obesity	69.833	1.980
		Class 3 obesity	76.500	4.536
		Class 4 obesity	65.000	12.830
	25-30years	Class 1 obesity	72.900	4.057
		Class 2 obesity	69.222	2.138
		Class 3 obesity	72.333	5.238
		Class 4 obesity	00.000	0.000
Control Group	19-24years	Class 1 obesity	87.107	2.425
		Class 2 obesity	84.514	2.109
		Class 3 obesity	84.286	2.800
		Class 4 obesity	67.500	9.072
	25-30years	Class 1 obesity	83.467	3.313
		Class 2 obesity	88.909	2.233
		Class 3 obesity	96.000	6.415
		Class 4 obesity	00.000	0.000

Table 75 shows the Estimated Marginal Mean Scores of interaction effect of Treatment Groups, Age and Class of obesity on DBP. In Experimental group (19 to 24 years), participants who falls in class 4 obesity had a lower mean score (65.000) while those in class 1 obesity had a mean score of (71.027), class 2 obesity (69.833) and class 3 obesity (76.500) showing that participant in class 4 obesity performed better. In 25 to 30 years, participants who falls in class 2 obesity had a lower mean score (69.222) while those in class 1 obesity had a mean score of (72.900), class 3 obesity (72.333) and non in class 4 obesity showing that participant in class 2 obesity performed better. In control group, the age range of 19 and 24 years, participant in class 4 obesity had a lower mean score of (67.500) while those in class 1 obesity had a mean score of (87.107), class 2

obesity (84.514) and class 3 obesity (84.286). In 25 to 30 years, participants who falls in class 1 obesity had a lower mean score (83.467) while those in class 2 obesity had a mean score of (88.909), class 3 obesity (96.00) and non in class 4 obesity. In all participants, class 4 obesity in ages 19 and 24 years performed better.

Hypothesis 7(bii): There will be no significant interaction effect of Treatment, Age and Class of obesity on SBP

From Table 10.1, it shows that there was significant interaction effect of Treatment, age and class of obesity on SBP ($F(2,57) = 3.547$, $p > .05, \eta^2 = .026$). The Eta Square value of .026 shows that about 3% of the participants' scores were accounted for by treatment, age and class of obesity. Therefore, the null hypothesis is rejected.

Table 76: Estimated Marginal Means on Treatment Groups, Age and Class of obesity SBP

Treatment	Age	Class of obesity	Means	Std. Error
Experimental Group	19-24years	Class 1 obesity	115.060	0.400
		Class 2 obesity	115.760	0.375
		Class 3 obesity	116.533	0.860
		Class 4 obesity	112.900	2.432
	25-30years	Class 1 obesity	113.199	0.769
		Class 2 obesity	114.283	0.405
		Class 3 obesity	113.592	0.993
		Class 4 obesity		
Control Group	19-24years	Class 1 obesity	111.977	0.460
		Class 2 obesity	118.913	0.400
		Class 3 obesity	118.606	0.531
		Class 4 obesity	116.910	1.719
	25-30years	Class 1 obesity	118.133	0.628
		Class 2 obesity	117.297	0.423
		Class 3 obesity	118.372	1.216
		Class 4 obesity	-	-

Table 76 shows the Estimated Marginal Mean Scores of interaction effect of Treatment Groups, Age and Class of obesity on SBP. In Experimental group (19 to 24 years), participants who falls in class 4 obesity had a lower mean score (112.900) while those in class 1 obesity had a mean score of (115.060), class 2 obesity (115.760) and class 3 obesity (116.533) showing that participant in class 4 obesity performed better. In 25 to 30 years, participants who falls in class 1 obesity had a lower mean score (113.199) while those in class 2 obesity had a mean score of (114.283), class 3 obesity (113.592) and non in class 4 obesity showing that participant in class 1

obesity performed better. In control group, the age range of 19 and 24 years, participant in class 1 obesity had a lower mean score of (111.977) while those in class 2 obesity had a mean score of (118.913), class 3 obesity (18.606) and class 4 obesity (116.910). In 25 to 30 years, participants who falls in class 2 obesity had a lower mean score (117.297) while those in class 1 obesity had a mean score of (118.133), class 3 obesity (118.372) and non in class 4 obesity. In all participants, class 4 obesity in ages 19 and 24 years performed better.

Hypothesis 7(biii): There will be no significant interaction effect of Treatment, Age and Class of obesity on $P_{mean.}$

From Table 11.1, it shows that there was no significant interaction effect of Treatment, age and class of obesity on P_{mean} ($F(2,57) = .001$, $p > .05, \eta^2 = .001$). The Eta Square value of .001 shows that about 1% of the participants' scores were accounted for by treatment, age and class of obesity. Therefore, the null hypothesis is accepted.

Table 77: Estimated Marginal Means of Treatment Groups, Age and Class of obesity on P_{mean}

Treatment	Age	Class of obesity	Mean	Std. Error
Experimental group	19-24years	Class 1 obesity	94.189	1.972
		Class 2 obesity	91.274	1.851
		Class 3 obesity	96.800	4.241
		Class 4 obesity	94.900	11.995
	25-30years	Class 1 obesity	87.230	3.793
		Class 2 obesity	86.819	1.999
		Class 3 obesity	92.717	4.897
		Class 4 obesity	00.000	0.000
Control group	19-24years	Class 1 obesity	100.400	2.267
		Class 2 obesity	101.481	1.972
		Class 3 obesity	100.238	2.618
		Class 4 obesity	89.600	8.482
	25-30years	Class 1 obesity	101.313	3.097
		Class 2 obesity	105.001	2.088
		Class 3 obesity	103.650	5.998
		Class 4 obesity	000.000	0.000

Table 77 shows the Estimated Marginal Mean Scores of interaction effect of Treatment Groups, Age and Class of obesity on P_{mean}. In Experimental group (19 to 24 years), participants who falls in class 2 obesity had a lower mean score (91.274) while those in class 1 obesity had a mean score of (94.189), class 3 obesity (96.800) and class 4 obesity (94.900) showing that participant

in class 2 obesity performed better. In 25 to 30 years, participants who falls in class 2 obesity had a lower mean score (86.819) while those in class 1 obesity had a mean score of (87.230), class 3 obesity (92.717) and non in class 4 obesity showing that participant in class 2 obesity performed better. In control group, the age range of 19 and 24 years, participant in class 4 obesity had a lower mean score of (89.600) while those in class 1 obesity had a mean score of (100.400), class 2 obesity (101.481) and class 3 obesity (100.238). In 25 to 30 years, participants who falls in class 1 obesity had a lower mean score (101.313) while those in class 2 obesity had a mean score of (105.001), class 3 obesity (103.650) and non in class 4 obesity. In all participants, class 2 obesity in ages 25 and 30 years performed better.

Hypothesis 7(biv): There will be no significant main effect of Treatment, Age and Class of obesity on VC

From Table 12.1, it shows that there was no significant interaction effect of Treatment, age and class of obesity on VC ($F(2,57) = .209$, $p > .05, \eta^2 = .002$). The Eta Square value of .002 shows that about 1% of the participants' scores were accounted for by treatment, age and class of obesity. Therefore, the null hypothesis is accepted.

Table 78: Estimated Marginal Means on Treatment Groups, Age and Class of obesity

Treatment	Age	Class of obesity	Mean	Std. Error
Experimental Group	19-24years	Class 1 obesity	2425.676	65.200
		Class 2 obesity	2425.000	61.196
		Class 3 obesity	2193.750	140.217
		Class 4 obesity	2500.000	396.595
	25-30years	Class 1 obesity	2355.000	125.414
		Class 2 obesity	2452.778	66.099
		Class 3 obesity	2175.000	161.909
		Class 4 obesity	0000.000	000.000
Control Group	19-24years	Class 1 obesity	2057.143	74.949
		Class 2 obesity	1813.514	65.200
		Class 3 obesity	1907.1 43	86.544
		Class 4 obesity	2100.000	280.435
	25-30years	Class 1 obesity	2013.333	102.400
		Class 2 obesity	1757.576	69.038
		Class 3 obesity	1690.000	198.297
		Class 4 obesity	0000.000	000.000

Table 78 shows the Estimated Marginal Mean Scores of main effect of Treatment Groups, Age and Class of obesity on Vital Capacity. In Experimental group (19 to 24 years), participants who falls in class 4 obesity had a higher mean score (2500.000) while those in class 1 obesity had a

mean score of (2425.676), class 2 obesity (2425.000) and class 3 obesity (2193.750) showing that participant in class 4 obesity performed better. In 25 to 30 years, participants who falls in class 2 obesity had a higher mean score (2452.778 while those in class 1 obesity had a mean score of (2355.000), class 3 obesity (2175.000) and non in class 4 obesity showing that participant in class 2 obesity performed better. In control group, the age range of 19 and 24 years, participant in class 4 obesity had a higher mean score of (2100.000) while those in class 1 obesity had a mean score of (2057.143), class 2 obesity (1813.514) and class 3 obesity (2100.000). In 25 to 30 years, participants who falls in class 1 obesity had a higher mean score (2013.333) while those in class 2 obesity had a mean score of (1757.576), class 3 obesity (1690.000) and non in class 4 obesity. In all participants, class 4 obesity in ages 19 and 24 years performed better.

Hypothesis 7(bv): There will be no significant interaction effect of Treatment, Age and Class of obesity on IRV

From Table 13.1, it shows that there was no significant interaction effect of Treatment, age and class of obesity on IRV ($F(2,57) = .968$, $p > .05$, $\eta^2 = .007$). The Eta Square value of .007 shows that about 1% of the participants' scores were accounted for by treatment, age and class of obesity. Therefore, the null hypothesis is accepted.

Table 79: Estimated Marginal Means on Treatment Groups, Age and Class of obesity on IRV

Treatment	Age	Class of obesity	Means	Std. Error
Experimental Group	19-24years	Class 1 obesity	2720.269	85.457
		Class 2 obesity	2678.571	80.209
		Class 3 obesity	2225.000	183.783
		Class 4 obesity	1550.000	519.816
	25-30years	Class 1 obesity	2305.000	164.380
		Class 2 obesity	2522.222	86.636
		Class 3 obesity	2591.667	212.214
		Class 4 obesity	0000..000	000.000
Control Group	19-24years	Class 1 obesity	1767.857	98.236
		Class 2 obesity	1690.000	85.457
		Class 3 obesity	1747.619	113.433
		Class 4 obesity	1500.000	367.565
	25-30years	Class 1 obesity	1896.667	134.216
		Class 2 obesity	2128.788	90.488
		Class 3 obesity	2100.000	259.908
		Class 4 obesity	0000.000	000.000

Table 79 shows the Estimated Marginal Mean Scores of interaction effect of Treatment Groups, Age and Class of obesity on Inspiratory reserved volume. In Experimental group (19 to 24 years), participants who falls in class 1 obesity had a higher mean score (2720.269) while those in class 2 obesity had a mean score of (2678.571), class 3 obesity (2225.000) and class 4 obesity (1550.000) showing that participant in class 1 obesity performed better. In 25 to 30 years, participants who falls in class 3 obesity had a higher mean score (2591.667) while those in class 1 obesity had a mean score of (2305.000), class 2 obesity (2522.222) and non in class 4 obesity showing that participant in class 3 obesity performed better. In control group, the age range of 19 and 24 years, participant in class 1 obesity had a higher mean score of (1767.857) while those in class 2 obesity had a mean score of (1690.000), class 3 obesity (1747.619) and class 4 obesity (1500.00). In 25 to 30 years, participants who falls in class 2 obesity had a higher mean score (2128.788) while those in class 1 obesity had a mean score of (1896.667), class 3 obesity (2100.000) and non in class 4 obesity. In all participants, class 1 obesity in ages 19 and 24 years performed better.

Hypothesis 7(bvi): There will be no significant interaction effect of Treatment, Age and Class of obesity on PEFR

From Table 14.1, it shows that there was no significant interaction effect of Treatment, age and class of obesity on PEFR ($F(2,57) = 2,563$, $p > .05, \eta^2 = .019$). The Eta Square value of .019 shows that about 10% of the participants' scores were accounted for by treatment, age and class of obesity. Therefore, the null hypothesis is accepted.

Table 80: Estimated Marginal Means on Treatment Groups, Age and Class of obesity on PEFR

Treatment	Age	Class of obesity	Means	Std. Error
Experimental Group	19-24years	Class 1 obesity	347.838	8.491
		Class 2 obesity	339.762	7.969
		Class 3 obesity	296.250	18.260
		Class 4 obesity	350.000	51.646
	25-30years	Class 1 obesity	384.000	16.332
		Class 2 obesity	354.444	8.608
		Class 3 obesity	330.000	21.084
		Class 4 obesity	000.000	00.000
Control Group	19-24years	Class 1 obesity	232.500	9.760
		Class 2 obesity	202.693	8.491
		Class 3 obesity	210.000	11.269
		Class 4 obesity	210.000	36.519
	25-30years	Class 1 obesity	243.333	13.335
		Class 2 obesity	259.091	8.990
		Class 3 obesity	280.000	25.823
		Class 4 obesity	000.000	00.000

Table 80 shows the Estimated Marginal Mean Scores of interaction effect of Treatment Groups, Age and Class of obesity on Peak expiratory flow rate. In Experimental group (19 to 24 years), participants who falls in class 4 obesity had a higher mean score (350.000) while those in class 1 obesity had a mean score of (347.838), class 2 obesity (339.762) and class 3 obesity (296.250) showing that participant in class 4 obesity performed better. In 25 to 30 years, participants who falls in class 1 obesity had a higher mean score (384.000) while those in class 2 obesity had a mean score of (354.444), class 3 obesity (330.000) and non in class 4 obesity showing that participant in class 1 obesity performed better. In control group, the age range of 19 and 24 years, participant in class 1 obesity had a higher mean score of (232.500) while those in class 2 obesity had a mean score of (202.693), class 3 obesity (210.000) and class 4 obesity (210.000). In 25 to 30 years, participants who falls in class 3 obesity had a higher mean score (280.000) while those in class 1 obesity had a mean score of (243.333), class 2 obesity (259.091) and non in class 4 obesity. In all participants, class 1 obesity in ages 25 and 30 years performed better.

Hypothesis 7(bvii): There will be no significant interaction effect of Treatment, Age and Class of obesity on HRR

From Table 15.1, it shows that there was no significant interaction effect of Treatment, age and class of obesity on HRR ($F(2,57) = .757$, $p>.05, \eta^2=.006$). The Eta Square value of .006 shows that about 1% of the participants' scores were accounted for by treatment, age and class of obesity. Therefore, the null hypothesis is accepted.

Table 81: Estimated Marginal Means on Treatment Groups, Age and Class of obesity on HRR

Treatment	Age	Class of obesity	Means	Std. Error
Experimental Group	19-24years	Class 1 obesity	137.054	3.037
		Class 2 obesity	134.143	2.850
		Class 3 obesity	131.750	6.530
		Class 4 obesity	147.000	18.471
	25-30years	Class 1 obesity	129.100	5.841
		Class 2 obesity	140.472	3.078
		Class 3 obesity	133.167	7.541
		Class 4 obesity	-	-
Control Group	19-24years	Class 1 obesity	119.536	3.491
		Class 2 obesity	115.541	3.037
		Class 3 obesity	111.286	4.031
		Class 4 obesity	122.000	13.061
	25-30years	Class 1 obesity	117.067	4.769
		Class 2 obesity	114.758	3.215
		Class 3 obesity	115.250	9.235
		Class 4 obesity		

Table 81 shows the Estimated Marginal Mean Scores of interaction effect of Treatment Groups, Age and Class of obesity on HRR. In Experimental group (19 to 24 years), participants who falls in class 4 obesity had a higher mean score (147.000) while those in class 1 obesity had a mean score of (137.054), class 2 obesity (134.143) and class 3 obesity (131.750) showing that participant in class 4 obesity performed better. In 25 to 30 years, participants who falls in class 2 obesity had a higher mean score (140.472) while those in class 1 obesity had a mean score of (129.100), class 3 obesity (133.167) and non in class 4 obesity showing that participant in class 2 obesity performed better. In control group, the age range of 19 and 24 years, participant in class 4 obesity had a higher mean score of (122.000) while those in class 1 obesity had a mean score of (119.536), class 2 obesity (115.541) and class 3 obesity (115.250). In 25 to 30 years, participants who falls in class 1 obesity had a higher mean score (117.067) while those in class 2 obesity had a mean score of (114.758), class 3 obesity (115.250) and non in class 4 obesity. In all participants, class 4 obesity in ages 19 and 24 years performed better.

Hypothesis 7(bviii): There will be no significant interaction effect of Treatment, Age and Class of obesity on VO_2max

From Table 16.1, it shows that there was no significant interaction effect of Treatment, age and class of obesity on HRR ($F(2,57) = 4.022$, $p > .05, \eta^2 = .029$). The Eta Square value of .029 shows that about 30% of the participants' scores were accounted for by treatment, age and class of obesity. Therefore, the null hypothesis is accepted.

Table 82: Estimated Marginal Means on Treatment Groups, Age and Class of obesity on VO_2max

Treatment	Age	Class of obesity	Means	Std. Error
Experimental Group	19-24years	Class 1 obesity	40.984	0.887
		Class 2 obesity	41.037	0.833
		Class 3 obesity	42.778	1.908
		Class 4 obesity	46.400	5.395
	25-30years	Class 1 obesity	39.875	1.696
		Class 2 obesity	41.655	0.899
		Class 3 obesity	38.955	2.203
		Class 4 obesity		
Control Group	19-24years	Class 1 obesity	37.072	1.020
		Class 2 obesity	35.459	0.887
		Class 3 obesity	35.482	1.177
		Class 4 obesity	35.890	3.815
	25-30years	Class 1 obesity	36.561	1.393
		Class 2 obesity	34.622	0.939
		Class 3 obesity	42.990	2.698
		Class 4 obesity	-	-

Table 82 shows the Estimated Marginal Mean Scores of interaction effect of Experimental and Control Groups, Age and Class of obesity on VO_2max. In Experimental group (19 to 24 years), participants who falls in class 4 obesity had a higher mean score (46.400) while those in class 1 obesity had a mean score of (40.037), class 2 obesity (41.037) and class 3 obesity (42.778) showing that participant in class 4 obesity performed better. In 25 to 30 years, participants who falls in class 2 obesity had a higher mean score (41.655) while those in class 1 obesity had a mean score of (39.875), class 3 obesity (38.955) and non in class 4 obesity showing that participant in class 2 obesity performed better. In control group, the age range of 19 and 24 years, participant in class 1 obesity had a higher mean score of (37.072) while those in class 2 obesity had a mean score of (35.459), class 3 obesity (35.482) and class 4 obesity (35.890). In 25 to 30 years, participants who falls in class 3 obesity had a higher mean score (42.990) while those in class 1 obesity had a mean score of (36.561), class 2 obesity (34.622) and non in class 4 obesity. In all participants, class 4 obesity in ages 19 and 24 years performed better.

Discussion of findings

The purpose of this study was to determine the effects of aerobic dance circuit training on body composition and cardiorespiratory variables in obese female college students with the intention of findings a way to prevent the likely health consequences of obesity at the later stage of their life. Seventy obese college female participants participated in this study, (35 Experimental and 35 Control groups). Experimental group participants were made to undergo Aerobic Dance Circuit Training programme for 12 weeks in accordance with the recommendation of American College of Sport Medicine (2009) that deconditioned participants should be subjected to relatively lower intensity (40% MaxHR) of aerobic training on their training attempts. Control group participants were placed on placebo of lifestyle education for 12 weeks. The age range fell between 19-30 years. The training programme were carried out three times per week for 12 weeks, which was in line with the reccomendation of ACSM (2009) that for the participants benefit from aerobic exercise they must undergo minimum frequency of three times per week for sufficient physiological adaptation and improvement in performance.

Physical characteristics of the participants

The participant's age was 21.0±2.46 years which indicated that 44(62.9) of the participants are aged 19-24 years and 26(37.1%) are aged 25-30 years. It was indicated that high degree of the participants were in the age range of 25-30 years. According to Jackson et al (2002) it is the belief that at the younger age, there is a decline in physical activity level, so the tendency is that at the younger age, there is an accumulation of fat in the body and tends to become obese due to positive energy inbalance high energy intake and physical inactivity. This may expain why the younger participants fall withing the age range of 19-24 years. The height of the participants at the pre treatment shows that 9(12%) weighed 61-70kg, 30(42.9) weighed 71-80kg, 30(42.9%) weighed 81-90kg and 1(1.4%) weighed 90kg and above. Also it was reported in the study that the participants height indicated 13(18.6%) fall withing 145-155cm, 45(64.3%) falls within156-165cm and 12(17.1%) were at the range of 166cm and above. The average height of the participants was around 1.60 meters with a weight range value of 61 kilograms to 90 kilograms and BMI ≥25.0 to > 40 respectively. It was also revealed that all the participants were unfit based on finding from the comparison of the baseline data of their physical characteristics in inclusion criteria variable with a standardized fitness norm at. It was observed at the baseline data that 21.4% class 1 obesity fall within the average level of the standard norms while 60% class 2 obesity of ≥30.0-35.0 were fater than the average and 17.1% and 1.4% were fat and overfat compared with the norms applied in this study. This had earlier been pointed out in finding of Oyewole and Oritogun (2009) that conducted a study among Nigeria youth and found out that prevalence level of obesity were 4% for ages 26-30 years respectively with higher values among the females. This is also in agreement with the finding of Akinpelu, Oyewole and Oritogun, (2009) who equally reported prevalent of obesity among youth ranging from 0.9% to 2.7%.

Main and interaction effects of Treatment Group, Age and Class of obesity on %bf

In the main effect, there was main significant effect of Treatment groups F(1,57 = 31.057, P<0.05, ^{2} = 0.105),and Age F(1,57 = 11.589, P<0.05, ^{2} = 0.042),but none was found in Class of obesity F(3,57 = 1.488, P>0.05, ^{2} = 0.017),

There was significant difference in the pretest and posttest scores of participant's % bf following the ADCT in obese female college of education students.

Estimated Marginal Mean Scores reveals that Experimental group (14.475) ≤ Control group (18.030) indicated a significant difference between experimental and control group following 12-week ADCT intervention.

In the 2-way interactions, there were no significant interaction effect between Treatment and Age F(1,57 = 3.836, P>0.05, ^{2} = 0.014), Treatment and Class of obesity F(3,57 = 0.538, P>0.05, ^{2} = 0.006, as well as Age and Class of obesity F(2,57 = 0.517, P>0.05, ^{2} = 0.04),

There was no significant 3-way interaction effect between Treatment, Age and Class of obesity (F(13,57 = 5.912, P>0.05, ^{2} = .0.013).

Main and interaction effects of Treatment Group, Age and Class of obesity on WHR

In the main effect, there was a significant difference in Treatment (F(1,57 = 3.975, P>0.05, ^{2} = 0.015), but none was found in Age (F(1,57 = 0.467, P>0.05, ^{2} = .0.002).and Class of obesity; (F(3,57 = 1.460, P>0.05, ^{2} = .0.016).

There was significant difference in the pretest and posttest scores of participant's WHR following the ADCT in obese female college of education students.

Estimated Marginal Mean Scores reveals that Experimental group (.789) ≤ Control group (.826).

2-way interactions, there was no significant interaction effect between Treatment and Age F(1,57 = 0.413, P>0.05, ^{2} = 0.02,, Treatment and Class of obesity F(3,57 = 1.281, P>0.05, ^{2} = 0.014), as well as Age and BMI Class F(2,57 = 0.158, P>0.05, ^{2} = 0.001),

There was no significant 3-way interaction effect between Treatment, Age and Class of obesity (F(13,57 = 2.568, P>0.05, ^{2} = .0.019).

Main and interaction effects of Treatment Group, Age and Class of obesity on WHtR

In the main effect, there was main significant effect of Treatment F(1,57 = 10.345, P<0.05, ^{2} = 0.037),and Class of obesity F(3,57 = 15.544, P>0.05, ^{2} = 0.149,but none was found in Age F(1,57 = 0.096, P<0.05, ^{2} = 0.000),

There was significant difference in the pretest and posttest scores of participant's WHtR following the ADCT in obese female college of education students.

Estimated Marginal Mean Scores reveals that Experimental group (.511) ≤ Control group (.553).

2-way interactions, there were significant interaction effect between Treatment and Class of obesity F(3,57 = 6.606, P>0.05, ^{2} = 0.069), as well as Age and Class of obesity F(2,57 = 6.447, P>0.05, ^{2} = 0.046),but none was found in Treatment and Class of obesity F(2,57 = 6.447, P>0.05, ^{2} = 0.046),

There was no significant 3-way interaction effect between Treatment, Age and Class of obesity (F(13,57 = 0.860, P>0.05, ^{2} = .0.006).

Main and interaction effects of Treatment Group, Age and Class of obesity on DBP

In the main effect, there was main significant effect of Treatment groups (F(1,57 = 13,954, p<0.05, ^{2} = .050) but none was found in Age(F(1,57 = .599, p>0.05, ^{2} = .002) and class of obesity (F(3,57 = 1.463, p>0.05, ^{2} = .016)

There was no significant difference in the pretest and posttest scores of participant's DBP following the ADCT in obese female college of education students.

2-way interactions, there were no significant interaction effect between Treatment group and Age (F(1,57 = 1.548, p<0.05, ^{2} = .006), Treatment and Class of obesity (F(3,57 = .332, p<0.05, ^{2} = .004) as well as Age and Class of obesity (F(2,57 = .418, p<0.05, ^{2} = .003)

There was no significant 3-way interaction effect between Treatment, Age and Class of obesity (F(13,57 = 1.925, P>0.05, ^{2} = .0.014

Main and interaction effects of Treatment Group, Age and Class of obesity on SBP

In the main effect, there was main significant effect of Age (F(1,57 = 7.720, $p<0.05$, ^{2} = .028) but none was found in Treatment Group (F(1,57 = 13,954, $p<0.05$, ^{2} = .050) as well as Class of obesity (F(3,57 = .491, $p<0.05$, ^{2} = .006).

There was significant difference in the pretest and posttest scores of participant's SBP following the ADCT in obese female college of education students.

In the 2-way interactions, there was significant interaction effect between Treatment and Class of obesity (F(3,57 = 5.852, $p<0.05$, ^{2} = .062), but none was found in Treatment and Age (F(1,57 = 3.366 $p<0.05$, ^{2} = .012) as well as Age and Class of obesity (F(2,57 = .696, $p<0.05$, ^{2} = .005).

There was no significant 3-way interaction effect between Treatment, Age and Class of obesity (F(13,57 = 3.547, $P>0.05$, ^{2} = .0.026).

Main and interaction effects of Treatment Group, Age and Class of obesity on the P_{mean}

In the main effect, there was no main significant effect of Treatment groups (F(1,57 = 6.082 $p<0.05$, ^{2} = .022), Age (F(1,57 = .508 $p<0.05$, ^{2} = .002), as well as Class of obesity (F(3,57 = .710 $p<0.05$, ^{2} = .005).

There was no significant difference in the pretest and posttest scores of participant's P_{mean} following the ADCT in obese female college of education students.

2-way interactions, there were no significant interaction effect between Treatment and Age(F(1,57 = 4.082 $p<0.05$, ^{2} = .015),, Treatment and Class of obesity (F(3,57 = 1.148 $p<0.05$, ^{2} = .013), as well as Age and Class of obesity (F(2,57 = .287 $p<0.05$, ^{2} = .002),

There was no significant 3-way interaction effect between Treatment, Age and Class of obesity (F(13,57 = 0.001, $P>0.05$, ^{2} = .0.001).

Main and interaction effects of Treatment Group, Age and Class of obesity on Vital Capacity

In the main effect, there was main significant effect of Treatment groups (F(1,57 = 17.908 $p<0.05$, ^{2} = .063), but none was found in Age (F(1,57 = .931 $p<0.05$, ^{2} = .003), and Class of obesity (F(3,57 = 2.294 $p<0.05$, ^{2} = .025),

There was significant difference in the pretest and posttest scores of participant's VC following the ADCT in obese female college of education students.

2-way interactions, there were no significant interaction effect between Treatment and Age (F(1,57 = .412 p<0.05, ^{2}=.002), Treatment and Class of obesity (F(3,57 = 2.631 p<0.05, ^{2} = .029), as well as Age and Class of obesity (F(2,57 = .208, p<0.05, ^{2} = .002),

There was no significant 3-way interaction effect between Treatment, Age and Class of obesity (F(13,57 = .209, P>0.05, ^{2} = .002).

Main and interaction effects of Treatment Group, Age and Class of obesity on Inspiratory Reserved Volume

In the main effect, there was main significant effect of Treatment groups (F(1,57 = 11.621 p<0.05, ^{2} = .042), but none was found in Age (F(1,57 = 1.983 p<0.05, ^{2} = .007), and Class of obesity (F(3,57 = 1.801 p<0.05, ^{2} = .020),

There was significant difference in the pretest and posttest scores of participant's IRV following the ADCT in obese female college of education students.

2-way interactions, there were no significant interaction effect between Treatment and Age (F(1,57 = 4.959 p<0.05, ^{2} = .018), Treatment and Class of obesity (F(3,57 = .784 p<0.05, ^{2} = .009), as well as Age and Class of obesity (F(2,57 = 2.804 p<0.05, ^{2} = .021),

There was no significant 3-way interaction effect between Treatment, Age and Class of obesity (F(13,57 = .968, P>0.05, ^{2} = .0.007).

Main and interaction effects of Treatment Group, Age and Class of obesity on Peak Expiratory Flow Rate

In the main effect, there were main significant effect of Treatment groups (F(1,57 = 60.867 p<0.05, ^{2} = .186), and Age (F(1,57 = 19.886 p<0.05, ^{2} = .069), but none was found in Class of obesity (F(3,57 = 1.602 p<0.05, ^{2} = .018),

There was significant difference in the pretest and posttest scores of participant's PEFR following the ADCT in obese female college of education students.

2-way interactions, there were no significant interaction effect between Treatment and Age (F(1,57 = 1.119 p<0.05, ^{2} = .004), Treatment and Class of obesity (F(3,57 = 2.271 p<0.05, ^{2} = .025), as well as Age and Class of obesity (F(2,57 = .783, p<0.05, ^{2} = .006),

There was no significant 3-way interaction effect between Treatment, Age and Class of obesity (F(13,57 = 2.563, P>0.05, ^{2} = .0.019).

Main and interaction effects of Treatment Group, Age and Class of obesity on Heart Rate Reserved

In the main effect, there was main significant effect of Treatment groups (F(1,57 = 15.638 p<0.05, ^{2} = .056), but none were found in Age (F(1,57 = .001 p<0.05, ^{2} = .000), and Class of obesity (F(3,57 = .471 p<0.05, ^{2} = .005),

There was no significant difference in the pretest and posttest scores of participant's HRR following the ADCT in obese female college of education students.

2-way interactions, there were no significant interaction effect between Treatment and Age (F(1,57 = .003 p<0.05, ^{2} = .000), Treatment and Class of obesity (F(3,57 = .654 p<0.05, ^{2} = .007), as well as Age and Class of obesity (F(2,57 = 1.159 p<0.05, ^{2} = .009),

There was no significant 3-way interaction effect between Treatment, Age and Class of obesity (F(13,57 = 0.757 P>0.05, ^{2} = .0.006).

Main and interaction effects of Treatment Group, Age and Class of obesity on VO_2max

In the main effect, there was main significant effect of Treatment groups (F(1,57 = 10.987 p<0.05, ^{2} = .040), but none was found in Age (F(1,57 = .126 p<0.05, ^{2} = .000), and Class of obesity (F(3,57 = 1.113 p<0.05, ^{2} = .012),

There was no significant difference in the pretest and posttest scores of participant's VO_2max following the ADCT in obese female college of education students.

2-way interactions, there was a significant interaction effect between Treatment group and Age (F(1,57 = 4.062 p<0.05, ^{2} = .015), but none were found in Treatment and Class of obesity (F(3,57 = 2.128 p<0.05, ^{2} = .023), as well as Age and Class of obesity (F(2,57 = .591 p<0.05, ^{2} = .004),

There was a significant 3-way interaction effect between Treatment, Age and Class of obesity (F(13,57 = 4.022, P>0.05, ^{2} = .0.029).

It was observed in this study that a 12-week aerobic dance circuit training intervention led to significant decrease in measurements of body composition. Considering the fact that the participants of the control group did not engaged in any forms of physical activity organised, it is clear that the researcher did not expect any significant changes in body composition, and the significant changes to the values can be explained by the inactivity of these subjects.

The results of this study reveal that there were decreases on participants body composition based on %bf with the means score at the baseline was 36.8913±1.62, 4th week 36.1277±1.45, 8th week

30.0567±1.66 and post intervention 29.9617±0.09, the means score of WHR at the baseline was 0.8033±8.15, 4th week 0.8052±4.73, 8th week 0.7932±2.14 and at the post intervention was 0.7742±1.23, WHtR participants means score at the baseline was 0.5242±1.45, 4th week 0.5212±0.28, 8th week 0.5076±0.83 and at the post intervention was 0.4924±0.86. The treatment effects of %bf revealed that the post training values of the experimental group slightly decrease from the baseline to thae 4th week and the training have more effects from the 4th week to the 12th week. It was observed that the WHR of the experimental group decreased from the 4th week to the 12th week, while that of the control group had no decrease in WHR. The result of WHtR of experimental group was effective from 4th week through the 12th week while that of the control group does not have any effect because they were not exposed to the training. This is as a result of overload principle of increasing the tempo of aerobic dance music corresponding to increased MaxHR of 45%-69% predicted MaxHR. This procedure agrees with the documentation of American College Sport Medicine (2003) which recommeded that training frequency should be 2-3 days per week for non-athletes. Also, based on the recommendation of ACSM (2002) on the principle of progression of 8-12 repitition maximum (RM), the relation of overload principles on the bases of execise intensity that 1-12 RM be used in periodized fashion.

The decrease in partipants body composition (%bf, WHR and WHtR) correspond with the Kinetography Laban (1920) theory of movement that the human movement is the mechnics of the moving body in space as a results of time, the space as the movement paths, the rhythm and timing of the body movement involved, human action perception and its activity. This study was based on dance choreography, observation of movement, computerised analysis of human motion, computer vision and recognision of human movement in circuit manner. The findings are in line with that of Akinpelu, Oyewole and Oritogun (2008) that inadequate exercise had been a major cause of obesity. Also, this is line with Amano, Kanda and Maritani, (2001) who reported on application of 12-weeks aerobic dance exercise componets of 30 minutes; three days/week on obesity (female and male) subjects, found out a significant decreased between an average weight, body mass index, fat mass, %bf and lean body mass after exercise program. It was observed in this study that the experimental group %bf decrease from the 4th week to the 8th week and decreased slightly from 8th week to 12th week. WHR also descrese from the 4th week to 12 th week while WHtR reduced from 4th week to the 12th week. This is in line, according to

Corbin and Pangrazi (1998); and Olson et al (2008) reported that there was reduction in body weight and body fat composition following a 12-week step aerobic dance exercise program among undergraduate female students in Scorttdale. In another study performed at 6 weeks aerobic dance exercise on 7 women with age average of 21.0±0.8 years. They found that, there was a reduction on body mass of 2.2%, %bf of 1.3%, BMI of 3.4 percent after the training program (Szmedra, Lemural and Shearm, 1998). It was observed that percent body fat values for females participants when compared to a standard norm values was inadequate given that 4 out of 12(13.57%) participants within the age bracket of 15-28 years had an adequate body fat while 8 out of 26(68.42%) participants had adequate body fat. Other participants had inadequate body fat at both category based on the comparism made.

WHR and WHtR are really interesting for female obesity detection. Meanwhile central obesity is obvious only by looking at the bare body, based on this central obesity; it is identified by taking waist and hip measurements. However, no response was observed on control group participant's %bf, WHR and WHtR.

It was also observed in this study that the training programme led to a reduction in weight and percent body fat and might be more effective for developments of physical fitness and risk factors for cardiorespiratory diseases during fat reduction in obese female college students. Based on the intensity applied in ADCT there was a demote of obesity level with weight defeat and consequently it may be effective in the development of health and may encourage a reduction in the risk of obesity later in life, muscle weakness, postural default in health-related fitness diseases in sedentary people.

The intensity applied in this study as regards an increase in the tempo of aerobic dance music to achieve the principle of overload (40%-69% of age predicted MaxHR) was corroborated with the submissions of Terbizan and Strand (1998) on intermediate intensity of aerobic dance activity reduces body weight, body fat percentage, WHR and waist-to-height ratio (WHtR) which are regular for a long period of time as it occur in this study. They also reported that there was an effect of aerobic exercise programme on body composition variables, and measures of central adiposity in overweight women which shows a demote in the quantity of weight change in overweight/obese women. Also, obtained in this study, from all parameters, aerobic dance circuit training group was significantly decreased in bodyweight, BMI, %bf, WC following exercise program ($p<0.05$). Therefore, the training programme had a better weight loss, decrease in %bf if compared with the control group. WC measured at post exercise training also observed a reductions following aerobic dance group which is more significant than control group ($p<0.05$).

The strong interaction effect of age on body composition variables among the college females was interestingly noted in this study. The prevalence of obesity is greater than for blacks than it is for white (Pi-Sunyer, 1991) and in female it varies with age, reaching a childhood and adolescent peak at age of 11, before falling to the age 29 and subsequently ruining to as much higher prevalence at 36 years (Braddon, Rodger, Wadsworth and Dvies, 1986). Obesity in female as related to age is a matter of great concern because 25-30 years participants responded to the training programme. Obesity among females is likely to be rooted in the social norms and gender roles in our societies. Women are seen mainly as child bearers and child rearers, confined to their homes due to their pressing household duties with little chance for recreational or sporting activities.

This is similar to the findings of Kamel *et al*. (2000) who found that in 22 obese women, WHR and WHtR were equally correlated with age and total intra-abdominal fat. This also buttresses the importance of WHR as a preferred index over WHtR in detecting global obesity (Ferland *et al*., 1989; Pouliot *et al*., 1994). A study of (210 men and 200 women) in India (Kaushik, 2006) confirmed the preference of WC over WHR as predictive index for obesity. In their study, three indices; Waist Circumference (WC), Waist-Hip Ratio (WHR) and WHtR were undertaken to determine which measure of abdominal adiposity best relates with age. It was shown that, WHR had the strongest partial (age controlled) correlations with WHtR (0.56, Women = 0.80).

Thus WHR can be used as an excellent screening tool in medical practice. Moreover, it is an easy, convenient and single measurement in assessing regional obesity unlike WHtR which requires two measurements waist circumference and height which may contribute to summative measurement error. Further studies on the determinants of female obesity such as nutritional norms and practices are urgently required to obtain a full picture of the burden of overweight and obesity in women.

This study showed that WHR has a strong predictive capacity for global obesity in female and also accurately rules out those females who don't have obesity (sensitivity 100%, negative predictive value 100%). The high negative predictive value demonstrates that the non-obese females were correctly identified by WC.

While this predictive capacity was relatively lower in males, it still possessed a fairly strong ability to exclude males who are not obese (Negative Predictive Value =91.1%). This relationship between WC and BMI was very significant ($X2 = 33.1$, $p<0.001$) in both sexes.

The WHtR ratio was originally proposed more or less simultaneously in Japan (Hsieh and Yoshinaga 1995a, 1995b) and the UK (Ashwell 1995, Ashwell *et al* 1996, Cox and Whichelow 1996) as a way of assessing body shape and monitoring risk reduction. It was suggested that WHtR values above 0.5 should indicate increased risk (Ashwell 1995, Hsieh and Yoshinaga 1995b, Ashwell *et al* 1996, Cox and Whichelow 1996). It was also suggested that values above 0.6 indicate substantially increased risk (Cox *et al* 1997). Prospective studies have also shown that waist circumference and WHtR are better than BMI at predicting deaths from coronary heart disease and all-cause mortality (Cox and Whichelow 1996, Hadaegh *et al* 2006, Lu *et al* 2006, Chei *et al* 2008). WHtR is a slightly better predictor than waist circumference alone. This is probably because there is a positive association between waist and height in global populations of mixed ethnicity that include a wide range of heights.

An advantage of using WHtR over waist circumference in a public health context is that boundary values can be set that are the same for men and women. The suggested boundary value of 0.5 proposes that individuals should 'keep waist circumference to less than half your height'. Another boundary value of 0.6 indicates that adults should 'take action'. A second advantage of these suggested boundary values is the estimated proportion differentiate between the over-muscled and the overweight (Garrow 1981). There is another problem with BMI: even in the overweight, it is only a proxy for total fat in the body and does not distinguish between individuals with different types of fat distribution. Vague (1956) first pointed out in the 1940s and 1950s that people with a 'central' type of fat distribution (android shape) were at greater health risk than those whose fat was deposited 'peripherally' (gynoid shape). However, it has only been in the past two decades that there has been a consensus that health risks (predominantly cardiovascular disease (CVD) and diabetes) can be determined as much by the relative distribution of the excess fat as by its total amount (Björntop 1988). Also, only recently has there been media interest in the 'unhealthy apple shape' and the 'healthy pear shape'. The use of imaging techniques, such as computed tomography (CT) (Ashwell *et al* 1985) and magnetic resonance imaging (MRI) (Seidell *et al*1990) have indicated that the unhealthy apple shape is associated with a preferential deposition of fat in the internal, visceral fat depots rather than the external, subcutaneous fat depots. The healthy pear shape has proportionately more fat in the external fat depots. Relative fat distribution can be measured by the waist-to-hip ratio (WHR). This was shown to be a good predictor of health risk and was popular for many years (Björntorp 1988). Although useful for risk assessment, WHpR is not helpful in practical risk management because the waist and hip can decrease with weight reduction, so the ratio of WHpR changes very little. As a result of this, attention shifted to the use of waist circumference by itself as a possible replacement for BMI.

Consistent with this study, Arslan (2011) reported that intervention of aerobic dance for 12 weeks reduced WHR, WHtR, and %bf of obese women in Turkey. Kromeyer-Hauschild *et al*. (2007) showed a reduction of body composition, lipid profile, and insulin resistance in young obese women in Africa after 12 weeks of aerobic intervention. They also reported the reduction is increased in collaboration with the intensity of this study 40% MaxHR-70%MaxHR. Kurmar (2013) reported that aerobic training also give a significant reduction in body fat percentage if given alone or combined with circuit training in patients with type 2 diabetes. Although some researches support the result study, some other studies showed inconsistency. Park (2010) demonstrates no statistically significant changes in body composition after ten weeks of step aerobics training. Absence of changes in body composition might be due to the fact that eating patterns or calorie intakes of subjects were not controlled during the research. Sturm(2012) reported there was no significant difference of waist circumference before and after physical intervention combined with dietary intervention for 12 weeks in ages 15-24 years. Absence of changes in waist circumference might be due to different method of intervention. Aerobic dance can affect waist circumferenece by reducing body fat. Aerobic (endurance) exercise increases skeletal muscle capitalization and blood flow, muscular GLUT4 levels, hexokinase, and glycogen synthase activities. Aerobic exercise is also known to manage glycaemic control and cardiovascular risk factors. The American Diabetes Association (ADA) recommends at least 150 min every week of moderate-intensity aerobic physical activity or at least 90 min every week of vigorous aerobic exercise distributed over at least 3 day every week and with no more than 2 consecutive days without physical activity (Winnicki, 2006).

Consequently, a significant effect of training programme was observed on some of the cardiorespiratory variables (SBP, PEFR, VC and IRV) of the participants, while DBP, HRR, $V0_2Max$ and P_{mean} were not significant. As it was observed in another study, Cornelissen (2005) reported that aerobic dance training lead to significant changes in cardiorespiratory fitness, body fat percent in women. Therefore, according to the results obtained in this study, it seems that combination training ADCT had a superior impact on cardiorespiratory fitness, aerobic fitness and body composition. These training are also more interesting and easier for women compared to other sports and exercise training methods. On the other hand, exercise training and modified physical activity on cardiorespiratory disease risk factors, but the influences of different types of exercises and combination of them on cardiorespiratory disease risk factors has rarely been investigated. There was no study executed considering uses of aerobic dance, in circuit training effects on cardiorespiratory disease risk factors. The treatment reduces the participants' diastolic blood pressure and increased heart rate reserved while the vital capacity, inspiratory reserved volume, peak expiratory flow rate and maximal oxygen consumption increased.

High blood pressure (BP) is one of the most important modifiable risk factors for cardiorespiratory diseases, which accounts for one in every eight deaths worldwide in obesity. Total deaths due to cardiorespiratory diseases were 9.1 million in developing countries and 1.5 million in India. It has been predicted that by 2020, there would be 111 per cent increase in cardiorespiratory deaths in the world as a results of obesity.

In this present review, it was analyzed that aerobic dance circuit training of 12 weeks duration on blood pressure (SBP and DBP) was effective but more effective in SBP than DBP. The results suggest that there was mean reduction of -5.02 mmHg in SBP and -3.142 mmHg in DBP in experimental group and also there was reduction of -3.015 mmHg in SBP and -1.415 mmHg in DBP in control group. This review revealed that reduction in SBP which reached statistical significance in ADCT group may be because of favorable changes in vascular compliance, which might have occurred after exercise training. It was also revealed that the post training value of ADCT started droping from the 4^{th} week to 8^{th} week and 12^{th} week as a results of increment in the aerobic music tempo used to determine the participants intensity from 40% - 69% of age predicted MaxHR. Experimental group might have extra benefits due to less myocardial oxygen consumption and load.

This mean effect is similar to the findings of an earlier Metanalysis focusing on aerobic training and resting blood pressure (Kelley, 2001). A previous prospective western study reported that a 2 mmHg reduction in SBP would result in 10% lower stroke mortality and 7% lower mortality from ischaemic heart disease or other vascular causes in middle age female obese (prospective studies collaboration, 2002) thus highlighting the clinical significance of even small changes in resting blood pressure. The theory of Kinetography Laban theory and loading principleas it was applied in this study resulted to decrease SBP and DBP among the experimental group. Data from a small number of aerobic dance circuit training studies suggest this form of training has the potential for the largest reductions in SBP.

The finding from this study on duration of 12 weeks, frequency of 3 tmies per week of 40%-70% of age predicted MaxHR correlated with the study of Chaudhary (2010) investigated the effect of Aerobic dance training on cardiorespiratory fitness in 20 obese sedentary females (20-35 years) for 8 weeks. The Training protocol consisting with Intensity of 4 sets of 10 repetitions and frequency was 3 times/week. Training started with 45% of 10RM, then 65% of 10 RM, and progressed to 75% of 10RM. Regular aerobic dance training reduced SBP from 128.10±4.954 mmHg to 124.20±2.820 mmHg and DBP from 85.00±3.265 mmHg to 81.80±3.119 mmHg. There was significant reduction in resting blood pressure (mean SBP **-** 3.9±2.134 mmHg and DBP -3.2±0.146 mmHg)**.** Aerobic dance training protocol consisting of 30 minute duration at 45-70% HRmax and frequency was 3 times/week. Regular aerobic dance training reduced SBP from 138.10±4.954 mmHg to 124.20±2.820 mmHg and DBP from 85.00±3.265 mmHg to 81.80±3.119 mmHg. There was significant reduction in resting blood pressure (mean SBP **-** 3.9±2.134 mmHg and DBP -3.2±0.146 mmHg). Purvi K.Changela (2013) compared the effect of Aerobic dance and resistance training on cardiorespiratory fitness in 10 young obese sedentary females (19-25 years). Resistance training was given for alternate days for 6 weeks with Intensity of 4 sets of 10 repetitions. Training was started with 10 lifts with 50% of 10RM, then 75% of 10 RM, and progressed to 100% of 10RM. Results showed SBP reduced from 131.70±4.667 to 127.20±3.190 mmHg and DBP reduced from 83.00±2.160 to 82.60±1.349

mmHg and significant mean difference in SBP (-3.73±0.15 mmHg) and DBP (-1.73±0.49 mmHg). Aerobic dance training was given for 3 days a week at 50-75% MHR. Training given for 30 minutes duration included warm up and cool down time for 2 months. Results showed SBP reduced from 131.70±4.083 to 123.70±2.540 mmHg and DBP reduced from 86.20±2.820 to 80.70±2.750mmHg and significant mean difference in SBP (-8.0±1.54 mmHg) and DBP (-5.5±0.07 mmHg).

Patel (2014) investigated the effect of aerobic dance training and circuit training on 60 female obese (20-35 Years). Training given for 30 minutes duration included warm up and cool down time for 12 weeks. Results showed mean difference was -1.60±0.503 mmHg for SBP and -1.80±0.410 mmHg for DBP after 12 weeks. Training given for 30 minutes duration included warm up and cool down time for 12 weeks. Results showed mean difference was - 3.35±.933 mmHg for SBP and -2.00±.649 mmHg for DBP after 12 weeks training**.** Jaiswal (2015) evaluated the effect of Interval and Circuit training on blood pressure, heart rate and rate of perceived exertion in individuals with 30 obese female subjects (20-30 years). Resistance exercise was given 30 minutes with intensity of 50% to 70% of 1 RM for 5 days in a week for 8 weeks. Regular resistance training reduced SBP from 138.26±2.91 to 134.53±3.06 mmHg and DBP reduced from 81.73±2.12 to 80.00±2.61 mmHg. Author showed mean difference of SBP (-3.73±0.15) and DBP (-1.73±0.49). Aerobic Exercise was 30 minutes on a treadmill with intensity alternating between 50% (2 min) and 80%(1 min) of Heart Rate Reserve for 5 days in a week for 8 weeks. Regular aerobic training reduced SBP from 129.46±2.87 mmHg to 124.6±1.95 mmHg and DBP from 81.37±2.37 mmHg to 79.86±2.56 mmHg. Author showed mean difference of SBP (-4.86±0.91mmHg) and DBP (-1.87±0.19 mmHg).

This confirmed the findings of Philips (2013) that DBP will decrease slightly or may remain rather constant. Also the finding is in line with Adienbo, Hart and Oyeyemi (2012) that individual may not usually have high DBP if their fitness level is average and their SBP in normal if exercise 3-5 days per week at 40%-60% MaxHR. The American Heart Association (2000) recommends at least 30 minutes of aerobic activity, five days a week, in order to lower blood pressure. The findings of this study was confirmed with the study of Banfi, Malavazos, Iorio, Dolci, Doneda,Verna and Corsi (2006) that, aerobic dance has demonstrated a good response benefit on cardiorespiratory and metabolic such as increased maximal oxygen consumption (VO_2max) when it performed within a target heart rate of between 40% and 70% of the maximal heart rate as it related to this study (40%-70%MaxHR) like other forms of aerobic exercise. The review thoroughly supports the evidence that exercise intensity is directly related to the change in VO_2max. Higher doses of aerobic exercise produce greater increases in VO_2max, although these improvements are not proportionately greater in this study (Gossard, Haskell, Taylor, Mueller, Rogers and Chandler, 2006). Adequate participation in aerobic dance circuit training exercise often results in an increase in Reserved Heart rate.

Aerobic exercise is an important component of cardiorespiratory rehabilitation for obese. Physical inactivity and low cardiorespiratory fitness are recognized as important causes of morbidity and mortality in obesity. It is generally accepted that people with higher levels of physical activity tend to have higher levels of fitness and that physical activity can improve cardiorespiratory fitness of obese individual if performed according to the prescription ACSM as it was applied in this study; duration of 12 weeks, frequency of 3 days per week at 40%-70% of age predicted MaxHR.

According toYue Chen, Donna, Tuon and James; 2007) accumulation of fat mechanically affects expansion of diaphragm due to encroachment of fat into the chest wall and diaphragm. It also impedes decent of diaphragm during forceful inspiration as intra-abdominal adipose tissue pressing upward on it. Thick layer of subcutaneous fat over the chest wall compress the thoracic cage as a strapping around it and hence affects its expansion. There is decrease in the chest wall, lung and total respiratory system compliance. The results obtained in this study on main effect of treatment and age on PEFR was significant (F 13,57 = 60.867, 19.886 $P>0.05$, ^{2} 0.186, 0.069). In the present study, PEFR increased significantly in the experimental group after 12 weeks of aerobic dance circuit training plan. It can be explained that as both groups had similar conditions at the beginning of the study, the training caused the increase among the experimental group, this was observed from the baseline to the 4th week, 8th week and 12th week, it was as a results of the overload principle applied in this study from 40% age predicted MaxHR at the beginning of the exercise to 69% MaxHR. Thus an association between aerobic exercise training and improvement of lung function was supported by this data. The literature thoroughly supports the evidence that exercise intensity is directly related to the change in VO_2max (Jackson and Pollock, 1999). Higher doses of aerobic exercise produce greater increases in VO_2max, although these improvements are not proportionately greater. Regular participation in aerobic exercise often results in a decrease in resting heart rate (Johnson, 1999). Similar study conducted by James, Davis and Green (2005) on effect of different intensities of aerobic training on VC of obese female aged 19-30 years; The results showed that High intensity aerobic training positively influences the cardiorespiraory (vital capacity). Kumar (2013) also conducted a study on "Effectiveness of Circuit Training on Maximum Oxygen Consumption and HRR". He found that the twelve weeks of circuit training programme significantly improved maximum oxygen consumption and HRR.

Other studies comparing respiratory function among men and women engaged in various sports found that sports person have higher level of function (Mehrotra, Varma and Tiwari, 1998) than sedentary people. This result correlates with Cheng (2003) who showed in his study that physical activity improved pulmonary function in obese female. It also corresponds with Farid (2005) who reported an improvement in pulmonary function with aerobic dance exercise training among the obese female (20-35 years). Nourrey (2015) showed in a prospective study that 30 minutes aerobic dance exercise of 3 days per week for 12 weeks improves pulmonary function and alters exercise breathing pattern in obese female youth. Kaufman (2007) studied the effect of circuit training on ventilatory efficiency in overweight/obese children, and found that the training helped to reverse the decrements in cardiorespiratory function observed overtime in overweight/obese children. This study also correlates with the above findings.

This study also showed that the experimental group was able to have more powerful and more effective inspiration and expiration as opposed to what they have been able to before participating in such aerobic exercise.

Functional principles of cardiorespiratory function tests vary with age, sex, height, weight, body mass index and waist circumference. PEFR is a good indicator of bronchial hyper responsiveness and good parameter for lung functions in obese. Overfat in the body has associated with impair pulmonary function and there is relative paucity of literature about the status of PEFR in obese female. Decreased PEFR in obesity is due to deposition of fat in thoracic cage and mechanical effects on the diaphragm can results to rise in the metabolic demands and work-load of breathing. In obesity, rise in respiratory effort and impaired transport of gas can result in altered respiratory function even if the lungs are normal. In obesity, the function of respiratory muscles is impaired and tends to decrease the PEFR (Anuradha, Joshi, Ratan and Joshi; 2008). Increment in number of study reported that a high obesity prevalence and overweight in developing countries undergoing nutritional transition (Cheong, Kandiah, Chinna, and Saad, 2010). A study conducted in Korean reveals that changes of pulmonary function were related to menstrual cycle and obesity in adolescent girls. However, the association between obesity and pulmonary function among university students is still unclear.

In general, it was admitted that aerobic dance circuit training have a significant effect on VC (vital capacity), IRV (inspiratory reserved volume), PEFR (peak expiratory flow rate) (Table 5.8, 5.9 and 5.10). Khosravi, Tayebi & Safari (2013) combined aerobic dance with resistance training and reported that the training has greater effect on VC, IRV, FEF rating at 25%-75%, PEFR except MVV. Also the VC, IRV were found higher in female obese in another study. According to Farid (2005) aerobic exercise training programme in a group of obesity for 12 weeks 3 times in week at 40%-70% MaxHR produced significant improvement in VC, PEFR and IRV. This report also supports the outcome of this study. According to Cheng (2003) that female who remain physically active had higher VC, PEFR, FVC and IRV than those that are sedentary. Weight loss by circuit training (Santana, 2006; Thomas, Cowen, Hullands and Milledge, 1989) has been found to bring about improvement in pumolnary function.

Lazarus (1997) investigated the effects of obesity on the ventilatory function of Australian children aged nine, 20 and 35 years. Their main hypothesis was that the percentage of body fat might affect ventilatory function regardless of height, weight and age. Their study data were collected in the Australian Health and Fitness Survey (AHFS) of college female students in 1985 and included 84 children aged seven to 25 years. Data about ventilatory function were available for only 64 individuals' females. Their main results were a positive association between weight and increased VC and PEFR, regardless of height, age or weight. Those authors reported that large proportions of body fat are associated with decreased values of ventilatory function, and also described two important limitations of their study: the lack of a prediction equation, according to ethnicity in their population and a direct method to evaluate body composition.

Conversely, Ulger (2006) conducted an investigation based on previous studies to explain the effects of obesity on respiratory function tests in childhood and to define the association between the degree of obesity and respiratory function. Their sample comprised 68 children aged 20 to 35 years, where 38 (55%) were obese and 30 (44%) whose weight was normal and formed the control group. Their inclusion and exclusion criteria, such as age, exposure to smoking and cardiopulmonary disease, aimed at reducing study biases. Pulmonary function tests were performed using a calibrated spirometer and following the guidelines of the European Respiratory Society (ERS). Those authors found heterogeneous results for weight and %bf in the groups. The respiratory function results, except FRV1/FVC, were lower in the group of obese female than in the control group. In the same study, the authors mention that one of the limitations of the respiratory function test was the lack of reference parameters for the Turkish population.

Also to evaluate the effect of obesity on the pulmonary function of children, Eisenmann (2007) examined 27 (68%) Navajo children and 26 (21%) Hopi children aged five to 20-35 years in the state of Arizona. Out of the Navajo children, all underwent tests to investigate allergies and preexisting pulmonary diseases. Spirometry was performed according to the standards defined by the American Thoracic Society (ATS) and the unit was properly calibrated. Their main result was a decrease in pulmonary function of obese children.

The study conducted by Chow (2009) evaluated airway inflammation in addition to investigating the association between obesity and spirometric parameters among children. Children and youth aged 21 to 28 years were recruited (n=55) and divided into four study groups: non obese and without asthma (n=13); obese and without asthma (16); non obese with asthma (n=15) and obese with asthma (n=11). The authors classified obesity according to the WHO criteria using the Z score. As in the study conducted by Ulger (2006), they used rigorous inclusion and exclusion criteria to avoid biases in data collection, such as the exclusion of patients exposed to smoking and those with systemic diseases. They did not follow any specific guidelines to standardize collection of spirometric data and did not describe how the spirometer was calibrated. The main result for the spírometric variables was the positive correlation between Z score and VC; however, the antropometric variable was inversely associated with PEFR.

He *et al* (2009) examined the association between obesity and asthma and the characteristic symptoms of asthma with pulmonary function. Their sample comprised 2,179 chil-dren divided into three groups: normal weight (n=1,845), overweight (n=183) and obese (n=151). Pulmonary function was evaluated using the ATS standards. The authors used the Pearson test to compare the basic characteristics between groups and linear regression to evaluate whether spirometric parameters and levels of obesity were associated. Their main result in the analysis of obesity and pulmonary function was the positive correlation between VC and BMI increases. The diagnosis of asthma severity was not evaluated among children.

Therefore, this systematic review could not generate a meta-analysis to provide quantitative evidence of pulmonary function in these age groups.

This study analyzed evidence of significant interaction between age and class of obesity on cardiorespiratory lower VC, PEVR and IRV values in obese college female students. Further studies should investigate pulmonary function in female obesity because studies so far are scarce and often have methodological flaws. Moreover, reference parameters should be established for BMI values among children and youth.

There have been studies on continuation of being obese at adulthood, which basically started at youthful age. A study showed that 26-41% of fat children at ages 15-30 years, and 42-63% of fat children at school age went on keeping fat at adulthood (Flormark, Marcus and Britton, 2006). Having this parameter in the present study as a results of physical inactivity. Also in this study, a meaningful difference at the level of $p< 0.05$ was also seen in the aerobics dance circuit training programme based on these parameters. De Vito and others conducted a study on college female students in Italy, in 1999. It was seen that daily physical activity span and obesity were inversely related. That is, a decrease in the span caused an increase in the incidence of obesity (Goram, 2000). Elgar, F.J. and others' study on youth stated that sedentary lifestyle is effective on obesity classifications, and sedentary lifestyle leads to gaining weight.

This study has also shown that ADCT but of more effective in obese class 1 and class 3 and results to decreases the incidence of obesity. It was also seen in this study that aerobics-exercise programmes lead to changes in the participant's age distribution between 25 and 30. A difference was observed in the participants' %bf. Body fat percentage measurements of sedentary participants who had no exercise, posed a risk in terms of obesity. A decrease in the capacity of aerobics was also seen. This study has shown that aerobics dance circuit training lead to decrease in measurements of weight and body fat percentages. Therefore the study has stated the importance of aerobics dance circuit training in fighting against obesity. It was seen that body composition decreased in the study of Asfaw (2005), Kings (2002) and Sanya and Adesina (1998), and this study presented.

The most effective exercise form in exercise theraphy is “Aerobics dance circuit training” which provides the rhythmic training of big muscle groups for specific periods of time (12 weeks of 3 days per week at 40%-70% MaxHR). The more the span and the frequency of the exercise, the better the effects received. In this way, meaningful decreases can be achieved in measurements of weight. King, Brown and Diba (2005) found a meaningful difference in the relationship of aerobic dance exercise, class of obesity, and pulmonary function.

With age grows peoples fat mostly accumulates in abdominal and back. According to clinical survey, in the obese people around China, 45.00% and 84.00% are male and female recessive obese people accordingly. At present, the number of college students with recessive obesity, especially female college students increase year by year. The reason includes inappropriate diet, no sports exercises, and various weight loss products. In this way, it is of great importance to make a scientific and reasonable exercise prescription to prevent and reduce the health risks brought by recessive obesity. In this study, the female college students in the experimental group received aerobic dance circuit training for 12 weeks 3 times per week. Compared with values before experiment and that of the control group, the %bf, WHR and WHtR declined. But the data showed no statistical significance age interaction in 19 and 24 years. The reason is that despite the energy consumed by exercise, their muscle fiber and FFM increases, which leads to the insignificant difference when compared with values before experiment. The body composition of participants that fall within the ages 25 and 30 years of the experimental group show statistically significant difference when compared with values before experiment and that of the control group, with $P<0.05$. That is to say, long term aerobic dance circuit training exercise can help build better figure and more reasonable body composition.

In this study, class 1 and class 3 obesity classification of the experimental group decreased, thanks to ADCT of 3 times a week for 12 weeks. Compared with control group, the difference was statistically significant, with $P<0.05$. The HRR concentration increases significantly. Compared with the control group, the data shows significant difference, with $P<0.05$, which supports the above idea.

Kumar (2013) reported that among the harmful effects of obesity on health, the respiratory changes which represent an additional factor of functional limitation and detriment to the quality of life of obese individuals. Obese people are at increased risk of respiratory symptoms, such as breathlessness (particularly during exercise) even if they have no obvious respiratory illness. Youth obesity was associated with altered VC, PEFR and IRV which indicates decreased to the same extent, therefore obesity is said to be associated with restrictive pattern of lung impairment (Lang, 2003) .This may be explained on the grounds that obesity exerts a direct mechanical effects on the diaphragm (impeding descent into the abdominal cavity) and applying pressure on the thoracic cage and lungs causing mechanical limitation of expansion during the VC maneuver. This added to the decline in compliance, and elastic recoil, with increment in the work of breathing this lead to altered spirometric measures.

The results on classification of obesity in this study agreed with other obesity works like the study of Malnnis (2004) who found that obese women had significant decline in VC, IRV and PEFR than normal group, at the same time there was an absence of significant difference between both groups in IRV% and no correlation existed between BMI and this ratio. However in contrast with the present study no significant interaction effect of age and class of obesity and VC, PEFR and IRV might be due to inclusion of higher frequency in class 2 obesity. Wang (2004) collected spirometric results of 33 obese patients from both genders with BMI more than 30 kg/m2 and reported that BMI had a significant negative impact on VC, IRV in both men and women. Shannon (2007) included 55 female aged 20–50 years in their study and grouped them into normal, over weight and obese. There was a trend for a decrease in IRV, VC and PEFR with increasing BMI which in agreement with this study. In a recent Asian study of Saxena et al. (2002) reported that obese women had a significant lower IRV and VC than normal group and there was a significant negative association between class of obesity and these dynamic lung volumes. Absence of clinical pulmonary symptoms and signs does not necessarily indicates absence of subclinical changes in the lungs so the studied tests provide additional and useful laboratory test for the assessment of obese women and helps to identify and treat these changes at an early stages in order to prevent negative effects on health and quality of life.

There was a significant interaction of treatment, class of obesity and age on VC and IRV and PEFR in obese female college student. As IRV is part of VC and is the marker volume of classes of obesity. In this context, the results obtained in this study showed a significant negative interaction between age and VC, IRV, PEFR, BP (systolic and diastolic) and HRR, with the higher the age, the lower the respective variable values. Flodmark et al (2006) analyzed the spirometric measurements of the participants of groups of elderly persons and identified a significant interaction between age and VC, suggesting a decrease in VC values with increasing age, corroborating the results of the present study. The decrease in VC due to aging was also observed by Goram (2000) and Gossard et al (2006) who described the influence of age on both VC and PEFR in healthy subjects, suggesting that aging causes a genuine impact on lung function, leading to a decrease in VC and PEFR. PEFR is a variable of interest when studying lung function and is considered to be a reproducible measure as it is effort-independent.

According to Godwin (2006) the severity of ventilator disorders is characterized by changes in PEFR percentage, and this value is commonly used to stratify severity in patients with an obstructive, restrictive or mixed component. The reduction in PEFR in the obese may signify obstructive changes, which can be explained by a decrease in elastic lung retractility, a reduction in chest wall compliance and a reduction in the strength of the respiratory muscles, leading to the progressive decline in lung function over time (Goram 2000). With respect to the decrease in respiratory muscle strength, Shorts (2002) suggested the application of respiratory muscle training among this population, as this can potentiate the respiratory muscles of the elderly and thus constitute a preventive strategy against the decline of respiratory muscle strength and pulmonary function. In a study aimed at evaluating the harm obesity can cause to lung function, Sanya and Adesina (1998) found significant differences in VC and PEFR between the obese and normal weight groups. The authors demonstrated pulmonary damage through the concept of lung age and found that this measure increases in patients with morbid obesity, suggesting early damage and accelerated lung aging in these individuals. In the present study, there was also a significant and positive interaction between class of obesity and VC and IRV, demonstrating that VC and IRV increase with class of obesity using BMI applied in this study and that there is a negative interaction between BMI and PEFR, where a higher BMI results in a lower PEFR. Similar results were described by Orie (1999) who observed that the higher the BMI, the greater the degree of lung function impairment, corroborating the present study. In the study by Schimatoto et al (1998) the aim of which was to correlate BMI and waist circumference with spirometric values in obese individuals, IRV was also significantly lower in men with increased abdominal fat deposition.

As in the study of Jones and Nzekwu (2005) it was observed that IRV decreased exponentially with an increase in BMI. Gopinath (2012) evaluated the lung function of morbidly class 1 obese individuals and concluded that class 1 obesity influenced IRV and VC. The authors explained that the increase of IRV and VC in obesity occurs due to mechanical changes in the chest wall, a increase in total respiratory compliance, and increased lung flow and volume due to application of 12 weeks 3 days per week at 40%-70% MaxHR aerobic dance which is in line with this study. Clinically, this change is important as female obese individuals are more prone to the appearance of low pulmonary function. Consequently Pi-Sunyer (1991) reported that VC and PEFR were significantly lower in obese class 1 women than in normal-weight women, arguing that obesity can reduce VC as it can interfere with the movement of the diaphragm and excursion of the chest wall.

However, according to Biring, Lewis and Liu (1999) there were no differences between obtained and predicted VC and IRV values in subjects with varying degrees of obesity (class 1, class 2 and class 3). According to the authors there is controversy regarding pulmonary function and obesity classification, as some studies have found decreased lung volumes and capacities, while others report that these volumes remain constant. Among the limitations of this study, since the results are limited to a population of female obese and cannot be extrapolated to other BMI classifications nor to the male gender.

In conclusion, long-term aerobic dance circuit training exercise can help reduce body composition of obesity and build a healthier body for better school life.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary

Physical inactivity has been linked with an increase in the prevalence of college students' obesity which leads to serious global and growing epidemics in developed and developing countries as a result of excess fat in the body. Obesity is known to be related with respiratory complications and these complications can be reversed and maintained with fat reduction using Aerobic Dance Circuit Training. The study provided two (2) research questions and eight (8) hypotheses were formulated. Literature review for this study focused on the conceptual model and theoretical framework where the study was based on and also, an empirical review of several related literature pertaining to the response of obesity following aerobic dance and circuit training progrmme. The study therefore examined the effect of 12 weeks' aerobic dance circuit training programme on body composition and cardiorespiratory variables of obese college students in Oyo town. Pretest-posttest control group *quasi* experimental research design was adopted and seventy (70) obese female youth (35 each of Experimental and Control group) were purposively sampled in Oyo state was used for the study. Analyses were done with the use of descriptive and inferential statistic of mean, standard deviation, Cochran Q test and ANCOVA. Alpha level was set at 0.05. The study demonstrated that 12 weeks' aerobic dance circuit training programme effectively decreases and improves respectively obese female college students' body composition and cardiorespiratory variables.

Conclusion

The following conclusions were drawn from this research work:

1. The 12-weeks' aerobic dance circuit training programme elicited significant changes in the values of body composition (percent body fat, waist-to-hip ratio and waist-to-height-ratio) of obese female college students.
2. The values of body composition of obese female college students significantly decreased from the 4th to the 12th week of aerobic dance circuit training.
3. The treatment reduces the participant's systolic blood pressure and Mean arterial blood pressure, also increases reserve heart rate, vital capacity, inspiratory reserved volume, peak expiratory flow rate and maximal oxygen consumption.

4. Aerobic dance circuit training was more potent in reducing percent body fat in ages 25 and 30 years.
5. The treatment reduces the participant's systolic blood pressure and peak expiratory flow rate in ages 25 and 30 years than ages 19 and 24 years but with no significant effect of age on diastolic blood pressure, mean arterial blood pressure, vital capacity, inspiratory reserved volume, heart rate reserved and maxima oxygen consumption.
6. Aerobic dance circuit training decreases percent body fat in class 1 obesity, class 2 obesity and class 3 obesity. Also, the treatment was more effective in waist-to-hip ratio and waist-to-height ratio in class 1 obesity and class 3 obesity.
7. There was a significant interaction of treatment and age on waist-to-height ratio but with no interaction response of treatment and age on percent body fat and waist-to-hip ratio.
8. Treatment and age elicited significant interaction on participants maximal oxygen consumption but with no significant interaction on diastolic blood pressure, systolic blood pressure, mean arterial blood pressure, vital capacity, inspiratory reserved volume, peak expiratory flow rate and heart rate reserved.
9. There was a significant interaction effect of treatment and class of obesity on waist-to-height ratio but with no significant interaction of treatment and age on percent body fat and waist-to-hip ratio.
10. Significant interaction effect of treatment and class of obesity was observed on participants systolic blood pressure but with no significant interaction on diastolic blood pressure, mean arterial blood pressure, vital capacity, inspiratory reserved volume, peak expiratory flow rate, heart rate reserved and maximal oxygen consumption.
11. The twelve week aerobic dance circuit training showed significant interaction effect of age and class of obesity on waist-to-height ratio but none on percent body fat and waist-to-hip ratio.
12. There was no significant interaction effect of age and class of obesity on diastolic blood pressure, systolic blood pressure, mean arterial blood pressure, vital capacity, inspiratory reserved volume, peak expiratory flow rate, heart rate reserved and maximal oxygen consumption.

13. The 3-way interaction effect of treatment, age and class of obesity shows that there was a significant positive improvement on maximal oxygen consumption but did not elicit significant changes in the participants %bf, WHR, WHtR, diastolic blood pressure, systolic blood pressure, mean arterial blood pressure, vital capacity, inspiratory reserved volume, peak expiratory flow rate and heart rate reserved.
14. There was significant difference in the pretest and posttest scores of body composition variables (% bf, WHR and WHtR) following the ADCT in obese female college of education students.
15. There was significant difference in the pretest and posttest scores of cardiorespiratory variables (SBP, PEFR, VC and IRV) but none was observed in DBP, HRR, VO_2max and P_{mean} following ADCT in obese female college students

Recommendations

Based on the outcome of this research work, the following recommendations were made:

1. Obese female college students should endeavour to take part in regular aerobic dance circuit training exercises for improved health benefits.
2. Exercise trainers, coaches and exercise physiologists should consider the principle of exercise frequency, intensity, type and time (FITT) and other factors which will decrease the body composition as used in this study when planning the exercise programme.
3. Aerobic dance circuit training exercise can usually be accommodated with less stress by people of all ages and fitness level. This is one of the unique characteristics of Aerobic Dance Circuit Training, in that the same step can be modified by the participants to meet the needs of her individual workout.
4. There should be fitness care programmme for this population, with the purpose of improving their cardiorespiratory functions and therefore improving their quality of lives.
5. Regular BMI monitoring should be undertaken as an important way to monitor and prevent the occurrence of obesity among female college students.

Contribution to knowledge

1. The result of this study can be used to develop African norm for this particular group.
2. Aerobic dance can serve as exercise programme to manage body composition.

3. Aerobic dance can be used to prescribe exercises to improve cardiorespiratory functions in obese individual.
4. The study reported aerobic dance circuit training to be safe and effective in the management of obesity.
5. The sudy confirmed that use of aerobic dance circuit training can enhance improvement in the cardiorespiratory variables of obese female students.
6. Coaches and other experts in the fitness industry can adopt and adapt the use of aerobic dance circuit training to the already existing training programmes for obesity management.

Suggestions for Further Study

1. Other training programmes such as interval training can be used as aerobic dance.
2. More variables that are not used in this study can be applied to serve as moderating variables.
3. The study can also be carried out on comparative effect of other training programmes on female obesity
4. The research can also be replicated on obese male college students in Oyo State.
5. The research can still be replicated and improved upon using larger sample size at other educational levels and even other zones in the country.

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Appendix 1

Percent Body Fat Standard for Female Children, and Physically Active Adults

	NR	LOW	MID	HIGH	OBESITY
Female					
6-17y	<5	5-10	11-25	26-31	>31
18-34y	<8	8	13	22	>22
35-55y	<10	10	18	25	>25
>55y	<10	10	16	23	>23

Recommended %bf levels for physically active female
-NR = not recommended; %bf = percent body fat
Source: Heyward (2010)

Classification of weight by body mass index (BMI), Waist Circumference and Associated Disease Risk

Risk level by waist circumference					
BMI	Classification	≤102cm	>102cm	≤88cm	>88cm
<18.5	Underweight				
18.5-24.9	Normal				
25.0-29.9	Overweight	Increased	High	Increased	High
30.0-34.9	Class 1 obesity	High	Very High	High	Very High
35.0-39.9	Class 2 obesity	Very High	Very High	Very High	Very High
≥40.0	Class 3 obesity	Extremely high	Extremely high	Extremely high	Extremely high

Source: Adapted from National Heart, Lung and Blood Institute (1998)

Waist-to-Hip Circumference Ratio Norms

Age	Low	Moderate	High	Very High
20-29	<0.71	0.71-0.77	0.78-0.82	>0.82
30-39	<0.72	0.72-0.78	0.79-0.84	>0.84
40-49	<0.73	0.73-0.79	0.80-0.87	>0.87
50-59	<0.74	0.74-0.81	0.82-0.88	>0.88
60-69	<0.76	0.76-0.83	0.84-0.90	>0.90

Source: Adapted from Centers for Disease Control (2006)

Appendix 2

Weight and Height charts for women

WEIGHT lbs	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215
kgs	45.5	47.7	50.0	52.3	54.5	56.8	59.1	61.4	63.6	65.9	68.2	70.5	72.7	75.0	77.3	79.5	81.8	84.1	86.4	88.6	90.9	93.2	95.5	97.7
HEIGHT in/cm	Underweight					Healthy					Overweight					Obese				Extremely obese				
5'0" - 152.4	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
5'1" - 154.9	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	36	37	38	39	40
5'2" - 157.4	18	19	20	21	22	22	23	24	25	26	27	28	29	30	31	32	33	33	34	35	36	37	38	39
5'3" - 160.0	17	18	19	20	21	22	23	24	24	25	26	27	28	29	30	31	32	32	33	34	35	36	37	38
5'4" - 162.5	17	18	18	19	20	21	22	23	24	24	25	26	27	28	29	30	31	31	32	33	34	35	36	37
5'5" - 165.1	16	17	18	19	20	20	21	22	23	24	25	25	26	27	28	29	30	30	31	32	33	34	35	35
5'6" - 167.6	16	17	17	18	19	20	21	21	22	23	24	25	25	26	27	28	29	29	30	31	32	33	34	34
5'7" - 170.1	15	16	17	18	18	19	20	21	22	22	23	24	25	25	26	27	28	29	29	30	31	32	33	33
5'8" - 172.7	15	16	16	17	18	19	19	20	21	22	22	23	24	25	25	26	27	28	28	29	30	31	32	32
5'9" - 175.2	14	15	16	17	17	18	19	20	20	21	22	22	23	24	25	25	26	27	28	28	29	30	31	31
5'10" - 177.8	14	15	15	16	17	18	18	19	20	20	21	22	23	23	24	25	25	26	27	28	28	29	30	30
5'11" - 180.3	14	14	15	16	16	17	18	18	19	20	21	21	22	23	23	24	25	25	26	27	28	28	29	30
6'0" - 182.8	13	14	14	15	16	17	17	18	19	19	20	21	21	22	23	23	24	25	25	26	27	27	28	29
6'1" - 185.4	13	13	14	15	15	16	17	17	18	19	19	20	21	21	22	23	23	24	25	25	26	27	27	28
6'2" - 187.9	12	13	14	14	15	16	16	17	18	18	19	19	20	21	21	22	23	23	24	25	25	26	27	27
6'3" - 190.5	12	13	13	14	15	15	16	16	17	18	18	19	20	20	21	21	22	23	23	24	25	25	26	26
6'4" - 193.0	12	12	13	14	14	15	15	16	17	17	18	18	19	20	20	21	22	22	23	23	24	25	25	26

Source: Connie (2011)

BODY FAT % MEASUREMENT CHART FOR WOMEN

AGE																	
18-20	11.3	13.5	15.7	17.7	19.7	21.5	23.2	24.8	26.3	27.7	29.0	30.2	31.3	32.3	33.1	33.9	34.6
21-25	11.9	14.2	16.3	18.4	20.3	22.1	23.8	25.5	27.0	28.4	29.6	30.8	31.9	32.9	33.8	34.5	35.2
26-30	12.5	14.8	16.9	19.0	20.9	22.7	24.5	26.1	27.6	29.0	30.3	31.5	32.5	33.5	34.4	35.2	35.8
31-35	13.2	15.4	17.6	19.6	21.5	23.4	25.1	26.7	28.2	29.6	30.9	32.1	33.2	34.1	35.0	35.8	36.4
36-40	13.8	16.0	18.2	20.2	22.2	24.0	25.7	27.3	28.8	30.2	31.5	32.7	33.8	34.8	35.6	36.4	37.0
41-45	14.4	16.7	18.8	20.8	22.8	24.6	26.3	27.9	29.4	30.8	32.1	33.3	34.4	35.4	36.3	37.0	37.7
46-50	15.0	17.3	19.4	21.5	23.4	25.2	26.9	28.6	30.1	31.5	32.8	34.0	35.0	36.0	36.9	37.6	38.3
51-55	15.6	17.9	20.0	22.1	24.0	25.9	27.6	29.2	30.7	32.1	33.4	34.6	35.6	36.6	37.5	38.3	38.9
56 & UP	16.3	18.5	20.7	22.7	24.6	26.5	28.2	29.8	31.3	32.7	34.0	35.2	36.3	37.2	38.1	38.9	39.5
			LEAN				IDEAL				AVERAGE				ABOVE AVERAGE		

Source: Jackson & Pollock, (1999)

Appendix 3

Body Mass Index (BMI) International Variations

World Health Organization BMI Cut-off

Category	BMI range (kg/m^2)	BMI Prime
Very severely underweight	less than 15	less than 0.60
Severely underweight	from 15.0 to 16.0	from 0.60 to 0.64
Underweight	from 16.0 to 18.5	from 0.64 to 0.74
Normal (healthy weight)	from 18.5 to 25	from 0.74 to 1.0
Overweight	from 25 to 30	from 1.0 to 1.2
Obese Class I (Moderately obese)	from 30 to 35	from 1.2 to 1.4
Obese Class II (Severely obese)	from 35 to 40	from 1.4 to 1.6
Obese Class III (Very severely obese)	over 40	over 1.6

Source: *World Health Organization. 2006*

Hong KongBMI Cut-off

Category	BMI range (kg/m^2)
Underweight	< 18.5
Normal Range	18.5–22.9
Overweight—At Risk	23.0–24.9
Overweight—Moderately Obese	25.0–29.9
Overweight—Severely Obese	≥ 30.0

Source: *Hospital Authority of Hong Kong (2013)*

Japan BMI Cut-off

Category	BMI range (kg/m^2)
Low	18.5 and below
Normal	from 18.5 to 25.0 (Standard weight is 22)
Obese (Level 1)	from 25.0 to 30.0
Obese (Level 2)	from 30.0 to 35.0
Obese (Level 3)	from 35.0 to 40.0
Obese (Level 4)	40.0 and above

Source: *Ministry of Health, Labor and Welfare in Japan (2013)*

Singapore BMI Cut-off

BMI range (kg/m^2)	Health Risk
18.4 and below	Risk of developing problems such as nutritional deficiency and osteoporosis
18.5 to 22.9	Low Risk (healthy range)
23.0 to 27.4	Moderate risk of developing heart disease, high blood pressure, stroke, diabetes
27.5 and above	High risk of developing heart disease, high blood pressure, stroke, diabetes

Source: *Singapore BMI cut-off figures (2005)*

Appendix 4

Summary of the Body Composition from the baseline and 12th week

Variable		N	Mean	Std. Dev.	Crit-t	Cal-t.	df	P
% bf	Pretest	70	36.8913	4.0993	2.00	3.648	69	0.001
	Posttest	70	24.9619	3.6993				
WHR	Pretest	70	0.8033	6.717E-02	2.00	4.807	69	0.000
	Posttest	70	0.7741	5.570E-02				
WHtR	Pretest	70	0.5241	5.625E-02	2.00	7.669	69	0.000
	Posttest	70	0.4924	5.539E-02				

Appendix 5

Summary of Cardiorespiratory variables from the baseline to the 12^{th} week

Variable		N	Mean	Std. Dev.	Crit-t	Cal-t.	df	P
Systolic BP	Pretest Posttest	70 70	133.6429 130.8286	13.9461 9.2470	2.00	3.026	69	.003
Diastolic BP	Pretest Posttest	70 70	79.7857 77.4286	17.0820 10.5865	2.00	1.437	69	.155
Reserved Heart Rate	Pretest Posttest	70 70	116.0571 117.6286	16.9209 10.0075	2.00	0.723	69	.472
Peak Expiratory Flow Rate	Pretest Posttest	70 70	279.8571 295.5714	77.1502 82.3502	2.00	8.943	69	.000
Vital Capacity	Pretest Posttest	70 70	2084.2857 2178.5714	476.6689 478.9460	2.00	4.602	69	.000
$V0_2max$	Pretest Posttest	70 70	36.1643 36.9971	4.9823 5.1729	2.00	1.220	69	.227
Inspiratory Reserved Volume	Pretest Posttest	70 70	2140.0000 2330.0000	621.4522 695.0863	2.00	4.615	69	.000
P_{mean}	Pretest Posttest	70 70	97.7143 94.5149	14.5806 13.6008	2.00	1.786	69	.078

Appendix 6

INFORMED CONSENT FORM

IRB Research approval number: ID: 5151322

This approval will elapse on: 10/10/2018

EFFECTS OF A 12-WEEK AEROBIC DANCE CIRCUIT TRAINING PROGRAMME ON BODY COMPOSITION AND CARDIORESPIRATORY VARIABLES OF OBESE YOUTH IN OYO STATE

This study is being conducted by Mr. Olusegun Adewale AJAYI of the University of Ibadan.

The purpose of this research is to find out the effect of aerobic dance circuit training programme on obese youth female and to sensitize them towards the use of training programme at a later stage of life.

The researcher will use purposive sampling technique to select participants in this study into 2 groups. Experimental group will be exposed to aerobic dance circuit training programme 20 minutes/session of 3days per week for 12 weeks, (Mondays, Wednesdays and Fridays) while control group will not expose to treatment but be placed on placebo of 20 minutes contact of 3 days per week for 12 week. In total, 120 participants will be recruited for this study in Oyo State.

The goal of this research is to find ways of reducing obesity. It is hoped that the training programme will decrease youth and adolescent obesity but it is not certain.

All information collected in this study will be given code numbers and no name will be recorded. This cannot be linked to you in anyway and your name or any identifier will not be used in any publication or reports from this study.

Your participation in this research is entirely voluntary.

If you choose not to participate, this will not affect your treatment in this study.

You will be compensated for cost of transportation and sport wears but will not be paid any fees for participating in this research.

You can also choose to withdraw from the research at anytime. Please note that some of the information that has been obtained about you before you chose to withdraw may have been modified or used in reports and publications. These cannot be removed anymore. However the researcher promises to make effort in good faith to comply with your wishes as much as it is applicable.

If you suffer any injury as a result of your participation in this research, you will be treated at the University of Ibadan Teaching Hospital and the researcher will bear the cost of this treatment.

The researcher will inform you of the outcome of the research through a news bulletin. During the course of this research, you will be informed about any information that may affect your continued participation or your health.

If this research leads to commercial products, University of Ibadan shall own it. There is no plan to contact any participants now or in future about such commercial benefits.

I have fully explained this research to --- and have given sufficient information, including about risks and benefits, to make an informed decision.

DATE--SIGNATURE-------------------------

NAME--

I have read the description of the research. I have also discussed with the doctor to my satisfaction. I understand that my participation is voluntary. I know enough about the purpose, methods, risks and benefits of the research study to judge that I want to take part in it. I understand that I may freely stop being part of this study at any time. I have received a copy of this consent form and additional information sheet to keep for myself.

DATE: --------------------------------------SIGNATUE: ----------------------------------

NAME: ---

WITNESS' SIGNATURE (if applicable): ---

WITNESS' NAME (if applicable): ---

This research has been approved by the Ethics Committee of the University of Ibadan and the Chairman of this Committee can be contacted at Department of Sociology, Faculty of the Social Sciences, University of Ibadan,

E-mail: **sayjegede@yahoo.com.**

In addition, if you have any question about your participation in this research, you can contact the principal investigation,

Name--- Department-------------------------------Phone---------
-------------------------------- E-mail------------------------------------

You can also contact the Head of the University of Ibadan at ---
----

Appendix 7

PHYSICAL ACTIVITY READINESS QUESTIONNAIRE (PAR-Q)

	QUESTIONS	YES	NO
1	Has your doctor ever said that you have a heart condition and that you should only perform physical activity recommended by a doctor?		
2	Do you feel pain in your chest when you perform physical activity?		
3	In the past month, have you had chest pain when you were not performing any physical activity?		
4	Do you lose your balance because of dizziness or do you ever lose consciousness?		
5	Do you have a bone or joint problem that could be made worse by a change in your physical activity?		
6	Is your doctor currently prescribing any medication for your blood pressure or for a heart condition?		
7	Do you know of any other reason why you should not engage in physical activity?		
	Recreational Questions		
1	Do you partake in any recreational activities		
2	Do you have any hobbies (reading, gardening, washing your parents' cars, exploring the Internet, etc.)?		
	Medical Questions		
1	Have you ever had any pain or injuries (ankle, knee, hip, back, shoulder, etc.)?		
2	Have you ever had any surgeries?		
3	Has a medical doctor ever diagnosed you with a chronic disease, such as coronary heart disease, coronary artery disease, hypertension (high blood pressure), high cholesterol or diabetes?		

Appendix **8**

Procedure for the training programme

1. The training programme took place three times in a week and for twelve (12) weeks.
2. Experimental group (with treatment) were exposed to aerobic dance circuit training exercise on Mondays, Wednesdays and Fridays, 4:00pm to 6:00pm in the evenings, while control group (placebo) on Mondays, Wednesdays and Fridays, 11:30am to 12:30pm.
3. The intervention and measurement took place at the sport ground of each selected schools that were used for the study.
4. The researcher with the help of six (6) trained research assistants administered the treatment and measurements.
5. The following exercise were led by the research assistants at each station:

Small arm circle:

i. Participants start by standing straight with feet shoulder width apart. Arms straight out to the sides to form a T.

ii. Slowly start by making small circular motions with both arms on either side. After a few repetitions of small circles, enlarge the circles and do the same amount of reps.

Small arm circle.

Jogging on the spot

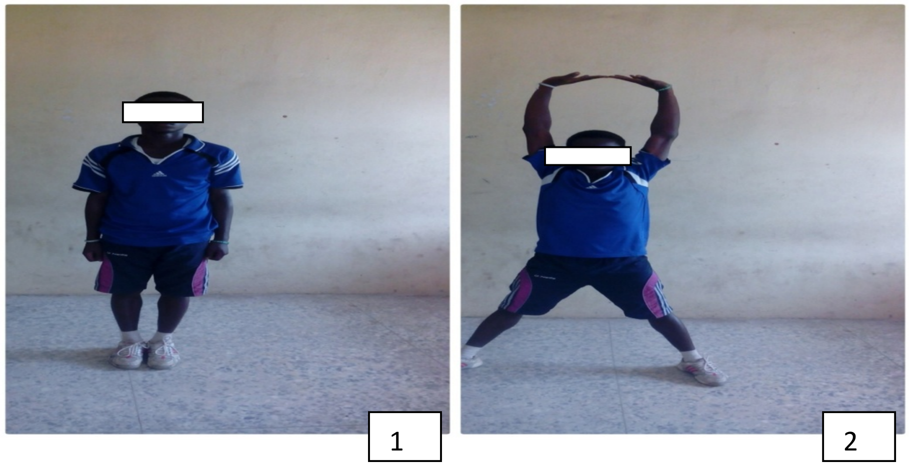
i. From standing position, lift the feet only an inch or two off the ground, hopping from foot to foot.

ii. Move your arms as you jog

jogging on the spot

Jumping Jacks:

i. Participants assume an erect position, with feet together and arms at the side.
ii. Slightly bend the knees, and propel a few inches into the air.
iii. While in air, bring legs out to the side about shoulder width wider.
iv. As moving the legs outward raise the arms up over the head; arms should be slightly bent throughout in air movement.
v. Feet should land shoulder width or wider as the hands meet above the head with arms slightly bent.
vi. Quickly jump back to step 2 and repeat step 3-6.



Jumping Jacks

Tap backs:

i. Participants step the right leg back and swing both arms forward and repeat with the opposite leg in a continuous rhythmic movement.
ii. Look forward and keep hips and shoulders facing forwards.
iii. Don’t allow the front knee extend over the toes as when stepping back.
iv. Switch legs by jumping and keep the knees soft as when landing.
v. Back heel needs to be off the floor at all times.

Tap backs

Lateral bends:

i. Participants, from the standing position, feet shoulder-width apart,
ii. Left arm extended upward and the right arm down with the palm touching the outer right thigh.
iii. Bend trunk to the right by sliding the right hand down the side of the right thigh as far as possible.
iv. At the same time, lift the left side of the body towards the ceiling so that the stretch is felt in the left side above the waist.

Lateral bends

Trunk swings:

i. Participants stand and reach as high as possible; tiptoe and stretch every muscle, then collapse completely
ii. Letting knees flex and trunk, head, and arms dangle.
iii. Set the trunk swinging from side to side by shifting the weight from one foot to the other, letting the heels come off the floor alternately.

Trunk swings

Shoulder Roll:

i. Participants, from the astride position, keep chin tucked in.
ii. Hands by the side at all times
iii. Don't lean back too much
iv. Don't rotate too much
v. Don't spread the legs too far apart

Neck stretch:

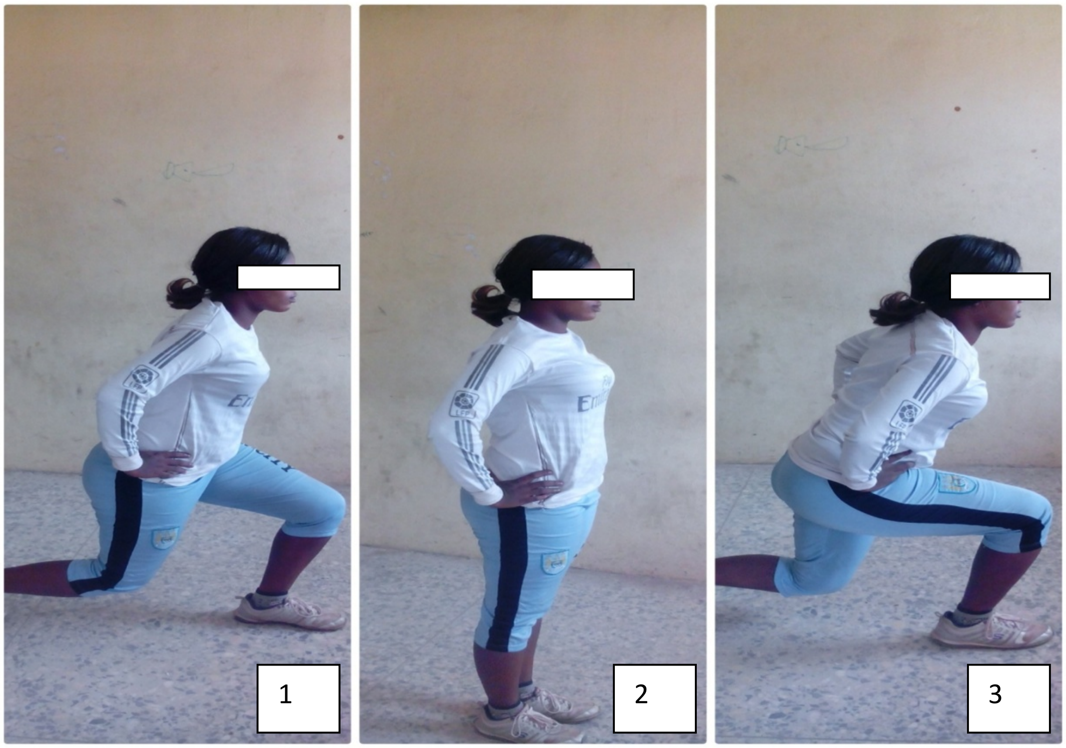
i. From standing position
ii. Slowly and gently tilt the head laterally

Lateral head tilt

Alternate lunges:

i. Participants keep the upper body straight, with shoulders back, relaxed and chin up.
ii. Step forward with one leg, lowering the hips until both knees are bent at about a 90-degree angle.
iii. Front knee is directly above an ankle, not pushed out too far, and make sure the other knee doesn't touch the floor.

iv. Keep the weight on heels when pushed back up to the starting position.



Alternate lunges

Triceps stretch:

i. Participants place the right hand behind the neck

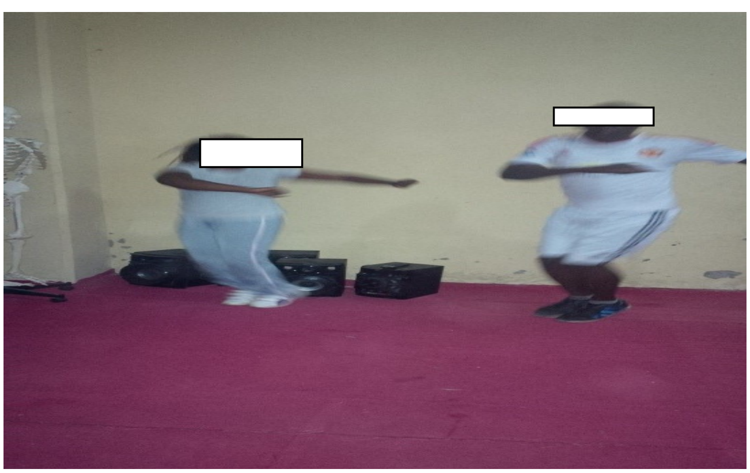
ii. Grasp the right arm above the elbow with the left hand

iii. Gently pull the elbow backward and jack.

Triceps stretch

Trunk swings:

i. Participants stand and reach as high as possible; tiptoe and stretch every muscle, then collapse completely
ii. Letting knees flex and trunk, head, and arms dangle.
iii. Set the trunk swinging from side to side by shifting the weight from one foot to the other, letting the heels come off the floor alternately.



Trunk swings

Standing bobbing:

i. Participants, from the standing position, place the feet astride
ii. Bend at the waist with the knees straight and the arms and head hanging loosely
iii. Bob with palms bouncing the ground.

Standing bobbing

Appendix 9

Schedule for the 12-week aerobic dance circuit training programme (Treatment group)

Week 1 and 2

Frequency of training	3 sessions per week
Warm up	3 minutes
Performance duration at each station	4 minutes
Number of cycles	2
Rest time between stations	1minute

Stations	**Exercise modality**	**Movement Counts per exercise**	**Sets**
1	Arm exercises	10	5
2	Leg exercises	10	5
3	Waist exercises	10	5
4	Arm and leg exercises	10	5
5	Arm, waist and leg exercises	10	5
6	Arm, waist and leg exercises	10	5

Cool down	3 minutes
Desired heart rate	40% of age predicted MaxHR

Week 3 and 4

Frequency of training	3 sessions per week
Warm up	3 minutes
Performance duration at each station	4 minutes
Number of cycles	2
Rest time between stations	1minute

Stations	**Exercise modality**	**Movement Counts per exercise**	**Sets**
1	Arm and leg exercises	10	6
2	Waist exercises	10	6
3	Arm exercises	10	6
4	Leg exercises	10	6
5	Arm, waist and leg exercises	10	6
6	Arm, waist and leg exercises	10	6

Cool down	3 minutes
Desired heart rate	45% of age predicted MaxHR

Week 5 and 6

Frequency of training	3 sessions per week
Warm up	3 minutes
Performance duration at each station	5 minutes
Number of cycles	3
Rest time between stations	1minute

Stations	Exercise modality	Movement Counts per exercise	Sets
1	Arm exercises	12	5
2	Leg exercises	12	5
3	Waist exercises	12	5
4	Arm and leg exercises	12	5
5	Arm, waist and leg exercises	12	5
6	Arm, waist and leg exercises	12	5

Cool down	3 minutes
Desired heart rate	50% of age predicted MaxHR

Week 7 and 8

Frequency of training	3 sessions per week
Warm up	3 minutes
Performance duration at each station	5 minutes
Number of cycles	3
Rest time between stations	1minute

Stations	Exercise modality	Movement Counts per exercise	Sets
1	Arm and leg exercises	12	6
2	Waist exercises	12	6
3	Arm exercises	12	6
4	Leg exercises	12	6
5	Arm, waist and leg exercises	12	6
6	Arm, waist and leg exercises	12	6

Cool down	3 minutes
Desired heart rate	55% of age predicted MaxHR

Week 9 and 10

Frequency of training	3 sessions per week
Warm up	3 minutes
Performance duration at each station	6 minutes
Number of cycles	1
Rest time between stations	1minute

Stations	Exercise modality	Movement Counts per exercise	Sets
1	Arm and leg exercises	15	5
2	Waist exercises	15	5
3	Arm exercises	15	5
4	Leg exercises	15	5
5	Arm, waist and leg exercises	15	5
6	Arm, waist and leg exercises	15	5

Cool down	3 minutes
Desired heart rate	60% of age predicted MaxHR

Week 10 and 12

Frequency of training	3 sessions per week
Warm up	3 minutes
Performance duration at each station	6 minutes 30 seconds
Number of cycles/sets	1
Rest time between stations	1minute

Stations	Exercise modality	Movement Counts per exercise	Sets
1	Arm exercises	15	6
2	Leg exercises	15	6
3	Waist exercises	15	6
4	Arm and leg exercises	15	6
5	Arm, waist and leg exercises	15	6
6	Arm, waist and leg exercises	15	6

Cool down	3 minutes
Desired heart rate	69% of age predicted MaxHR

Appendix 10

Schedule for Lifestyle Education (Control Group)

Week 1 and 2

Topic	Training Objective	Activities	Duration
Nutrition and health	- to identify factors influencing attitudes and practices of obese youth regarding diet	Discuss the definition of nutrition. Explain behaviour and attitudes that are common among the youth based on their eating habits and the health implications	20 minutes

Week 3 and 4

Topic	Training Objective	Activities	Duration
Concept of obesity	- To examine the concept of obesity. - To identify causes of obesity	Discuss the definition of obesity and overweight. Explain factors leading to obesity and its health implication	20 minutes

Week 5 and 6

Topic	Training Objective	Activities	Duration
Healthy lifestyle	- To examine the concept of HELP Philosophy	Discuss Health, Everyone, Lifetime, and Personal philosophy	20 minutes

Week 7 and 8

Topic	Training Objective	Activities	Duration
Exercise	- To examine the importance of exercise	Discuss good reasons why exercise should be important. Explain prominent health problems associated with inactivity	20 minutes

Week 9 and 10

Topic	**Training Objective**	**Activities**	**Duration**
Physical fitness	- To examine the concept of physical fitness. - To identify the components of physical fitness.	Discuss the definition of physical fitness. Explain the two components of physical fitness; health-related and skill-related physical fitness	20 minutes

Week 11 and 12

Topic	**Training Objective**	**Activities**	**Duration**
Body composition	- To examine how to measure body composition .	Explain BMI and WHR, how to measure them and to determine the level of obesity	20 minutes

Appendix 11

Research instruments


VOLDYNE


spiropet
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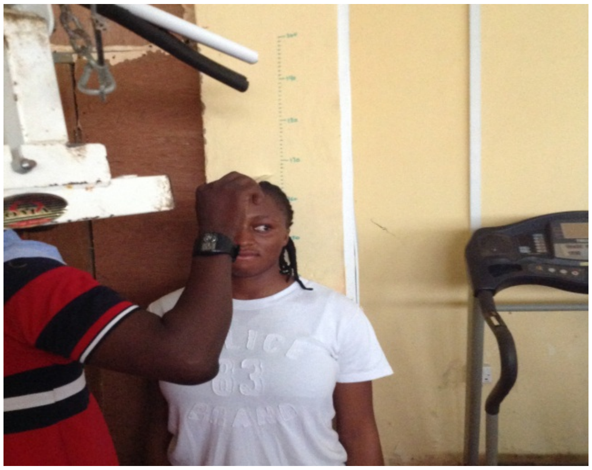
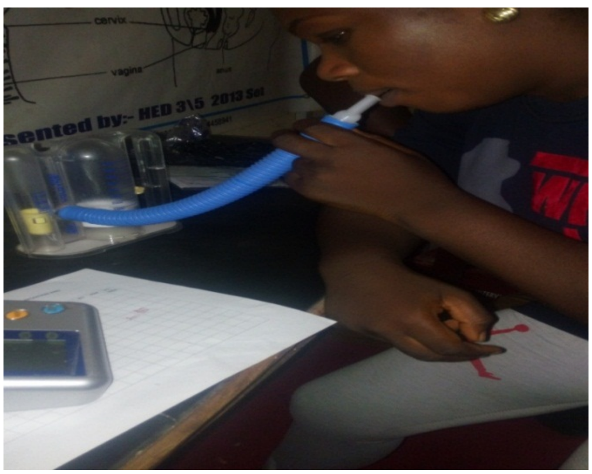
PRESS

Appendix 12

Body composition and cardiorespiratory measurements










Appendix 13

Research Participants

Appendix 14

Appendix 14

Aerobic Dance Circuit Training Programme

Appendix 15

Aerobic dance music

Artist name	Name of the music	Beat per minute (BPM) of the music
Oritsefemi	**Codeine**	**106.0**
D'banj ft. Oritsefemi	**Knocking on my door Remix**	**130.0**
Mayorkun	**Eleko**	**118.1**
Orisefemi	**Oluwa**	**93.5**
Oritsefemi	**Double-Wahala**	**100.0**
Oritsefemi ft davido	**Sexy Ladies**	**128.0**
Reekado-banks	**Ladies and gentle men**	**123.0**
Banky w	**Yes or no**	**98.0**
Banky w	**Strong thing**	**130.0**
Banky w	**Sugar**	**139.0**
Banky w	**Jasi**	**130.0**

Appendix 16
Checklist for data collection

SN	Variables	Baseline	4th week	8th week	12th week
1	**Age**				
2	**Height**				
3	**Weight**				
4	**BMI**				
5	**%bf**				
6	**WHR**				
7	**WHtR**				
8	**HRR**				
9	**Rbp Sys/Diat**				
10	**VC**				
11	**Pmean**				
12	**IRV**				
13	**PEFR**				
14	VO_2max				
15					

Source: self-developed