# EFFECT OF AEROBIC DANCE ON VISCERAL FAT AMONG OBESE FEMALE STUDENTS IN THE UNIVERSITY OF CALABAR, CROSS RIVER STATE, NIGERIA

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**Abstract**
The research investigated the effect of visceral fat among obese female students at the University of Calabar, Cross River State, Nigeria. A one-group pre-test/post-test design was employed, and participants aged 19–25 were purposively selected based on their BMI. Specifically, female students with a BMI ranging from 30.0 to 34.9kg/m2, aged 19 to 25, and students whose visceral fat ranged from 10-14kg were included. Data collection utilized a body composition monitor (model BF 511, made by OMRON, Japan), ensuring all selected participants met the inclusion criteria. These students were assigned to a group-based aerobic dance programme with pre-test values at the baseline. The aerobic dance sessions, lasting 30 to 45 minutes with a cool-down, occurred on alternate days (Mondays, Wednesdays, and Fridays) between 4:30 p.m. and 6:00 p.m. for twelve consecutive weeks. The training intensity ranged from 45-50% of the estimated maximum Heart Rate for the first 4 weeks, increased to 50–55% for weeks 5–8, and further increased to 55–60% from weeks 9-12 of the aerobic dance protocol. Statistical analysis of the collected data, using SPSS version 20 and the independent t-test at a 0.05 alpha level, indicated significant effects of visceral fat (P = 0.000). The study concluded that a 12-week aerobic dance programme had a noteworthy impact on the visceral fat of obese female students at the University of Calabar, Cross River State, Nigeria. Recommendations included encouraging obese female students to engage in regular physical activities, particularly aerobic dance, to mitigate cardiovascular disease risks associated with obesity. Additionally, there was a suggestion for increased awareness and a shift from sedentary lifestyles to an exercise-oriented attitude among obese female students at the University of Calabar.

**Keywords: Aerobic dance, Female students, Obesity, and Visceral fat.**

## Introduction

Visceral fat constitutes an independent risk factor for developing heart disease. Irrespective of other fat deposits, visceral fat is a major risk factor for hyperlipidemia. Visceral fat is body fat that is stored within the abdominal cavity and is therefore stored around several important internal organs such as the liver, pancreas, and intestines (Tamura & Chang, 2021). Visceral fat is sometimes referred to as 'active fat' because research has shown that this type of fat plays a distinctive and potentially dangerous role in affecting how our hormones function. Storing higher amounts of visceral fat is associated with increased risks of several health problems including type 2 diabetes (Emiola, 2019).

Centripetal fat is the adipose tissue of visceral fat (Cadman 2018; Jensen, 2020). Visceral fat, according to Bubnis and Dix (2019), is "belly fat," the white fat that is stored in the abdomen and around all the organs such as the liver, kidney, pancreas, intestine, and heart. He continued that high levels of visceral fat can increase the risk of diabetes, heart disease, stroke, artery disease, and some cancers. Similarly, Frysh (2021) defines visceral fat as the fat that is concentrated around the midsection of the body. It has also been observed that visceral fat typically accounts for 10% of the overall fat; it is stored deep inside the abdomen and in the spaces surrounding the liver, intestine, and other internal organs. Although visceral fats account for a small amount of fat in the body, scientists have observed that they have a great impact on overall health. Frysh, (2021) also continued that visceral fat secretes immune system chemicals called cytokines. These substances cause inflammation, which is a known risk factor for heart disease. Visceral fat secretes retinol-binding protein 4 (RBP4), a molecule that makes it more difficult for the body to use insulin effectively because insulin is a hormonal substance secreted by the pancreas that helps the body use sugar for energy (Joseph, Leong, McKee & Anand, 2017). Depots within the abdomen and chest that are correlated with metabolic abnormalities include omental and mesenteric fat (whose venous drainage is into the portal vein) and perinephric and pericardial fat, which do not deliver blood to the portal vein.

Studies by Ebbert and Jensen, (2013) have been developed regarding whether smaller depots, such as pericardial fat have direct metabolic effects on the heart or whether, like visceral and marbling fat, these are primarily ectopic markers of adipose dysfunction (Elffers, De Mutsert, Lamb, De Roos, Willems van Dijk, Rosendaal, Jukema, & Tropet, 2017).

The direct effects of the obese state on heart function, and how excess body fat might negatively affect cardiac health during the growing years, however, have received less attention. It is well-recognized that cardiac mass and chamber dimensions are increased in obese students, which is reflected in a greater resting stroke volume and cardiac output (Alpert & Alexander, 2019). Given sufficient duration and/or severity of obesity, this hyperkinetic state is supplanted by increasing

evidence of systolic and diastolic myocardial dysfunction, which may progress to overt clinical heart failure (Alpert, 2018). This cardiomyopathy of obesity appears to be independent of the adverse cardiac effects of coronary artery disease, hypertension, and sleep apnea commonly observed in adults with marked obesity. The data indicated trends of diminishing ventricular function in youth related to the level of obesity; however, overt myocardial dysfunction is rare, and reserve capacity with exercise is generally preserved (Silva, Pelroski & Pelegrini, 2014).

Gutin, (2018) reported that among 62 children ages 7 to 13 years, percent body fat correlated negatively with lower mid-wall ventricular shortening fraction (r = -0.37). Mensah (2019), found a significant negative association between mid-wall shortening fraction and central adiposity in black (but not white) subjects in a group of 15-year-old subjects. Chinali, (2016) found a significantly lower left ventricular ejection fraction in 14-20-year-old obese subjects (BMI >95th percentile) compared to a non-obese group. Becoming obese is an anabolic event. Besides the obvious accumulation of excessive body fat, the obese child is characterized by an increase in lean body mass, acceleration of linear growth, enhanced skeletal maturation, and advanced sexual development (Forbes, 2019). An expanded circulatory system reflects this somatic growth, with increased plasma volume, hypertrophy of myocardial fibres, and cardiac chamber enlargement (Sabag, Way, Keating, Sultana, O'Connor, Baker, Chuter, George, & Johnson, 2017).

Friberg, (2017); and Koehler, (2019) reported that state echocardiography studies, supplemented by recent Magnetic Resonance Imaging (MRI) investigations, have consistently indicated similar anatomic features in obese children and adolescents. Larger, thicker hearts are seen in obese subjects compared to non-obese youth (Mehta, 2014; Rabbia, 2017). In these studies, those with mild-moderate obesity typically demonstrate approximately 15-20% greater values of cardiac mass (related to body height or surface area) than lean youth. Although comparisons are treacherous, the magnitude of these differences is somewhat less than the 20-40% described in studies of obese adults (presumably reflecting differences in the duration of obesity) (Alpert & Alexander, 2019).

Body fat serves three important functions in the human body, serves as an insulator for conserving body heat; it is the source of metabolic fuel energy; and as padding for protection (Hamid, Rastegar & Ayoub, 2015). Body fat is essential for physiological homeostasis, and not only as a source of energy but also, to synthesize cell membranes and facilitates intracellular reaction, plays vital role in maintaining healthy skin and hair, insulating body organs against shock, maintaining body temperature, promoting healthy cells functions and serve as energy store for the body (Mengistie, Reddy & Syam 2015). Hence, a healthy body requires a minimum amount of fat for proper function of the body, but too much storage fat above the required amount can cause the rise of metabolic abnormalities, whereas leanness, such as low-fat mass is important in one's physical performance (Adams, Oppong, Worlanyo, Agblo, Owusu, & Moses, 2022).

Visceral fat accumulation is due to a lack of physical exercise and a Westernized diet pattern according to changes in lifestyle (Kwon, Min, Ahn, Seok, Koo, Kim & Han, 2020). Visceral fat is the fat within the abdomen. Central or abdominal excessive fat is an important predictor of increased morbidity and mortality from obesity, diabetes, and coronary heart disease (Sandeep, Gokulakrishnan, Velmurugan, Deepa & Mohan, 2018).

Visceral fat is considered by many to behave as an abnormal fat depot, accumulating triglycerides and associated with metabolic abnormalities that increase cardiovascular disease risk (Ebbert & Jensen, 2015). This implies that visceral fat is unlike the visible fat just under the skin, visceral fat surrounds the vital organs in the abdomen. Obesity is an international health problem for adults and the elderly which has led to the development of type 2 diabetes, hence factors for cardiovascular and related diseases, and is associated with increased cancer risk and renal failure (Chumlea, 2016).

The global increase in obesity has raised interest in the complex causes of excessive weight gain, which can be seen as the consequence of a sustained increase in energy intake relative to energy expenditure that is characterized by the accumulation of excess body fat and can be conceptualized as the physical manifestation of chronic energy excess (Uygur, Ucok, Genc, Sener, Uygur & Songur, 2016). Dance aerobics is a form of aerobic activity that is an extension of floor exercises. This exercise utilizes the same principles and adds an additional cardio element in that extra energy is expended when stepping on and off the riser; it is a versatile training modality that can be made more or less intense by simply changing the height of the step, performing movements through a different range of motion or adjusting the step cadence (American Council on Exercise, 2019).

Visceral fat is a complicated issue that is related to the release of proteins and hormones that can cause inflammation. This inflammation can lead to damage to one's arteries, and liver, and negatively affect how one's body breaks down sugars and fats. Visceral fat accumulation is due to a lack of physical exercise and Westernized diet patterns according to changes in lifestyle (Kwon, Min, Ahn, Seok, Koo, Kim & Han, 2020). This paper therefore investigated the effect of visceral fat among obese female students at the University of Calabar, Cross River State, Nigeria.

**Methods and Material**

This study employed a one-group pre-test/post-test design to assess the impact of an aerobic dance exercise programme on visceral fat variable among female undergraduate and postgraduate students aged 19 to 25 at the University of Calabar. The study population consisted of 40 participants, and the selection process followed a meticulous procedure:

***Informed Consent and Physical Assessment Readiness:*** Participants were provided with an informed consent form and a Physical Activity Readiness Questionnaire (PAR-Q). Only duly filled and signed consent forms were considered, and participants who responded negatively to the PAR-Q, indicating their readiness for physical assessment, were included in the

study.

***Participant Selection through Purposive Sampling***: Purposive sampling techniques were utilized to target female students aged 19–25. The participant's weight (in kilograms) and height (in meters squared) were used to calculate Body Mass Index (BMI). Those with a BMI falling within the range of 30.0 to 34.9 kg/m² were chosen for the study. Ethical approval was secured from the research ethical committee at the School of Postgraduate Studies, Ahmadu Bello University, Zaria, providing the necessary authorization for the research.

***Inclusion Criteria:*** Female students with BMI between 30.0 and 34.9 kg/m², aged 19 to 25 years, whose visceral fat ranged from 10-14kg were included. Participants without underlying health risks who responded negatively to the Physical Activity Readiness Questionnaire (PAR-Q).

***Data Collection:*** Visceral fat measurements were taken using a body composition monitor (model BF 511, made by OMRON, Japan). Four trained research assistants facilitated the data collection process. After turning the machine on, and the appearance of the 0.0 kg was displayed, the participants were asked to step onto the main unit one after the other and place their foot on the foot electrodes with weight evenly distributed. The participants were asked to extend their arms straight and horizontally at 90° to the body, and the elbows were extended straight while pressing their palms firmly on the electrodes, standing with their knees and back straight and looking straight ahead, the participants were instructed to avoid movement during measurement, arms bent, arms too low or high display facing upwards, knees bent and standing on the edge of the unit, the visceral fat button was pressed and the measurement was recorded

***Aerobic Dance Exercise Programme:*** The training sessions occurred in the evening, between 4:30 and 6:00 pm, at the fitness laboratory of the Department of Human Kinetics and Health Education, University of Calabar, Cross River State. The aerobic dance exercise, characterized by dance-inspired movements, was conducted with choreographed routines set to music. The exercise programme encompassed varying intensity levels, including low (45% - 50% HRmax), low to moderate (50% - 55% HRmax), and moderate to somewhat hard (55% - 60% HRmax) levels. Participants engaged in the aerobic dance programme throughout the research study. The utilized training programme schedule is as follows:

**Table 1. Training Programme Schedule**

| Week | Intensity | Warm up/ Stretches | Aerobic session | Cool down | Total time | RPE |
|---|---|---|---|---|---|---|
| **1ST to 4th** | 45% - 50% HRmax | 10 min | 25 min | 10 min | 45 min | Light |
| **5th to 8th** | 50% - 55% HRmax | 10 min | 30 min | 10 min | 50 min | Moderate |
| **9th to 12th** | 55% - 60% HRmax | 10 min | 40 | 10 min | 60 min | Somewhat hard |

Source: Yuyu & Gunen, (2020).

***Statistical Analyses:*** The study employed descriptive statistics, including means, standard deviations, and standard errors of the means, to analyze the variable (visceral fat). A t-test statistic was utilized to assess the significant difference in the effects of aerobic dance between baseline and post-test mean values for the variable. To explore the overall impact of a 12-week aerobic dance intervention, a one-way measure analysis of variance (ANOVA) was conducted. This analysis focused on examining interactions among baseline, 4th, 8th, and post-test values of the variable. In instances where the F statistic indicated significance, a Scheffe post hoc test was employed to pinpoint specific points of difference. Throughout these statistical analyses, an alpha level of 0.05 was set, providing the threshold for determining statistical significance. This criterion guided the decision-making process for accepting or rejecting the null hypothesis.

**Results and Discussion**

Over a 12-week training period, data were gathered to investigate the impact of Aerobic Dance on visceral fat among obese female students at the University of Calabar, Nigeria. The parameters assessed during this training period included only visceral fat. The subsequent presentation outlines the results of the conducted test.

**Sub-hypothesis:** There is no significant effect of aerobic dance on the Visceral Fat of obese female students at the University of Calabar, Nigeria.

*Table 2: One Way ANOVA Statistics on the effects of aerobic dance on Visceral Fat of Obese female students in the University of Calabar, Nigeria*

| Visceral Fat | Sum of Squares | Df | Mean Square | F | p-value | Decision |
|---|---|---|---|---|---|---|
| Between Groups | 2.846 | 3 | .949 | 63.500 | .000 | Rejected |
| Within Groups | 2.331 | 156 | .015 | | | |
| Total | 5.177 | 159 | | | | |

Table 2 shows the one-way ANOVA analysis of the effects of aerobic dance on the Visceral Fat of Obese female students in the University of Calabar, Nigeria. The result revealed that there is a significant effect of aerobic dance on Visceral Fat among obese female students at the University of Calabar, Nigeria. This is because the calculated p-value of 0.000 is lower than the 0.05 alpha level of significance. With this, the null hypothesis which states that there is no significant effect of aerobic dance on Visceral Fat of obese female students in the University of Calabar, Nigeria is rejected.

**Table 3: Scheffe Post Hoc Test on Pairwise comparison of mean levels of Visceral Fat among Obese female students**

| (I) week | (J) week | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| Baseline | week 4 | .80000 | .18553 | .001 | .2756 | 1.3244 |
| | week8 | 1.85000* | .18553 | .000 | 1.3256 | 2.3744 |
| | week12 | 2.95000* | .18553 | .000 | 2.4256 | 3.4744 |
| week 4 | baseline | -.80000 | .18553 | .001 | -1.3244 | -.2756 |
| | week8 | 1.05000 | .18553 | .000 | .5256 | 1.5744 |
| | week12 | 2.15000* | .18553 | .000 | 1.6256 | 2.6744 |
| week8 | baseline | -1.85000* | .18553 | .000 | -2.3744 | -1.3256 |
| | week 4 | -1.05000 | .18553 | .000 | -1.5744 | -.5256 |
| | week12 | 1.10000 | .18553 | .000 | .5756 | 1.6244 |
| week12 | baseline | -2.95000* | .18553 | .000 | -3.4744 | -2.4256 |
| | week 4 | -.1575* | .0273 | .000 | -.235 | -.080 |
| | week8 | -.1000 | .0273 | .005 | -.177 | -.023 |

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

The result of the *post hoc* test revealed that measurement at the onset (baseline) was significantly different from the observation at the termination of the exercise in the 8th and 12th week. also, the 4th week recorded a significant difference from the 12th week.

**Discussion**

This research was conducted with the primary goal of evaluating how aerobic dance influences visceral fat in obese female students at the University of Calabar, Nigeria. Employing a one-way repeated measures ANOVA, the results revealed significant differences in visceral fat (VF) between the two stages examined, leading to the rejection of the null hypothesis. Importantly, the findings indicated a substantial reduction in VF levels after participating in aerobic dance, compared to the baseline measurements.

The result of the one-way repeated measures ANOVA used for the test revealed that the two stages revealed a significant reduction in visceral fat of the participants after the 12th week of the aerobic dance training, the null hypothesis was rejected. Thus, the aerobic dance significantly reduced the visceral fat of the obese female students of the University of Calabar involved in the aerobic dance protocol compared to the baseline. The findings of the present study supported the study of Hwi., *et al* (2015), on the effects of aerobic exercise on abdominal fat, thigh muscle mass, and muscle strength in type 2 diabetic subjects, who stated that aerobic exercise had significant reduction of abdominal fat mass, while high-intensity exercise improves cardiopulmonary function. This finding also supported the work of Joseph, *et al*. (2017), who examined the effects of aerobic training intensity on abdominal visceral fat (AVF) in obese middle-aged women with metabolic syndrome. Training significantly reduced abdominal visceral fat (p=0.010), with no significant changes observed

within the control or low-intensity exercise group. Also, the findings of the present study were in line with the study of Yuyu and Gunen (2020) on the effect of step aerobics on the percent body fat and visceral fat of obese female nurses in specialist hospital Bauchi. As reported by Silva, Petroski, and Pellegrini (2014), aerobic exercise-based intervention promotes positive changes in body composition, such as a reduction in visceral fat, beginning with the lipid profile, increasing high-density lipoprotein, and decreasing triglyceride levels. This study also agreed with Adams, Oppong, Worlanyo, Agblo, Owusu, and Moses (2022), who discovered and reported that regulated aerobic exercise reduced visceral fat and improved sleep quality (p 0.05) in the experimental group at the end of the intervention period. In the control group, there was no significant difference in visceral fat. The trial lasted six weeks and was conducted 3-5 times per week for 45 and 40 minutes per session, with the control group receiving no intervention. This implied that it would be greatly reduced after 8 weeks and 12 weeks, as demonstrated in this study. Similarly, Sabag, Way, Keating, Sultana, O'Connor, Baker, Chuter, George, and Johnson (2017), on the other hand, showed a significant pooled effect size for the meta-analysis comparing aerobic exercise vs. control on visceral adiposity (ES = -0.21, 95% CI: -0.37 to -0.05; P = 0.010). Aerobic dance effectively reduced visceral fat, perhaps even hepatic adipose tissue, in those with obesity-related type 2 diabetes.

**Conclusion**

The study sheds light on the significant positive impact of a 12-week aerobic dance programme on the visceral profiles of obese female students at the University of Calabar, Nigeria. The findings, supported by statistical analyses, reveal a noteworthy reduction in visceral fat (VF) levels compared to baseline measurements. This aligns with existing research, indicating that aerobic dance contributes to lower VF, corroborating similar outcomes observed in various studies focused on different populations and contexts. The study further emphasizes the potential role of aerobic dance as a valuable tool for managing comorbidities associated with conditions like Type 2 Diabetes Mellitus (T2DM) and kidney disorders. The outcomes of this research contribute to the growing body of evidence highlighting the benefits of regular aerobic dance participation. As we conclude, it is essential to recognize the potential of aerobic dance not only in reducing visceral fat but also in promoting overall well-being. Further research and longitudinal studies are encouraged to deepen our understanding and refine recommendations for the integration of aerobic dance into holistic healthcare practices.

*Recommendations*

Sequel to the study's findings and beyond, the following recommendations were proffered:

- **Integration into Health Programmes:** Encourage the integration of aerobic dance programmes into health and wellness initiatives, both at educational institutions and within community health programmes. This could provide a proactive approach to addressing cardiovascular health concerns among various demographic groups.
- **Longitudinal Studies:** Support and conduct longitudinal studies to explore the sustained effects of aerobic dance on visceral fat and cardiovascular health. Long-term investigations will provide a clearer understanding of the durability of the observed benefits and potential implications for chronic disease prevention.
- **Diverse Population Groups:** Extend research efforts to include diverse population groups, encompassing different age ranges, genders, and fitness levels. This would contribute to a more comprehensive understanding of how aerobic dance impacts various demographic profiles, ensuring the generalizability of findings.
- **Multidisciplinary Approaches:** Encourage multidisciplinary collaborations between health professionals, dance instructors, and researchers to design and implement aerobic dance programmes that are not only enjoyable but also tailored to enhance cardiovascular health. Integrating expertise from different fields can lead to more effective and sustainable interventions.
- **Health Education Programmes:** Develop educational programmes that emphasize the cardiovascular benefits of aerobic dance. Promote awareness among healthcare providers, educators, and the general public about the positive impact of regular dance participation on blood pressure, emphasizing its role in preventive health strategies.

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