

**EFFECT OF AEROBIC EXERCISE ON SELECTED PERCENT BODY FAT AND
MUSCLE PERCENT AMONG OBESE STUDENTS OF ALIKO DANGOTE
UNIVERSITY OF SCIENCE AND TECHNOLOGY, WUDIL KANO NIGERIA**

By

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Abstract

This study investigated the effect of aerobic training on selected percent body fat and muscle percent of obese students of Aliko Dangote University of Science and Technology, Wudil, Kano, Nigeria. Four research questions and four null hypotheses guided the study. A quasi-experimental pretest-posttest control group design was adopted. The population consisted of 250 obese students enrolled in the 2023/2024 academic session, from whom 34 participants were selected positively based on inclusion and exclusion criteria and provided informed consent. Participants were randomly assigned to experimental (n = 17) and control (n = 17) groups. The experimental group underwent moderate-intensity aerobic 50% -80% resting heart rate, three times a week for 12 weeks, while the control group received no intervention. body composition variables, % body fat and muscle % were measured using the Omron BF-508 body composition Monitor, digital scale, and stadiometer. Data were analyzed using ANCOVA and post HOC analysis. Results revealed significant differences in post-test scores between groups: % body fat (F = 29.59, p = 0.01), and muscle % (F = 4.45, p = 0.04). Post HOC results showed that the experimental group reduced % body fat by 9.09% (p = .001), while muscle percentage increased by 22.09% (p = .001). It is recommended, among others, that institutions should implement structured aerobic programs as part of students' wellness initiatives to mitigate obesity-related risks and promote healthier lifestyles.

Key words: Body Composition, Obese, %Body Fat, Muscle%, Aerobic Training

Introduction

Improving body composition isn't just about losing weight—it's about achieving a healthier balance between fat and muscle. Among the most effective strategies to achieve this is aerobic training, which plays a central role in reducing percentage body fat (%BF) while helping to preserve or slightly enhance muscle percentage (Muscle%). Regular aerobic exercise stimulates fat metabolism, resulting in noticeable reductions in %BF over time. While aerobic activities are not typically designed to build large amounts of muscle mass, they do support the maintenance of lean tissue, particularly when performed consistently and

at appropriate intensities. This dual impact on fat loss and muscle preservation makes aerobic training a valuable approach for improving overall body composition and long-term health outcomes.

Aerobic training has been extensively studied as an effective intervention for managing excess body fat and improving overall body composition. Recent evidence highlights that regular aerobic exercise significantly reduces percentage body fat (%BF) by promoting fat oxidation and enhancing metabolic efficiency (Keating et al., 2023). Concurrently, while aerobic training primarily targets fat loss, studies have shown modest yet consistent improvements in muscle percentage (Muscle%), particularly when aerobic routines are combined with moderate resistance or high-intensity interval components (Tinsley & La Bounty, 2022). Improvements in %BF are typically more pronounced than gains in Muscle%, suggesting that aerobic training is especially effective for reducing adiposity rather than markedly increasing lean mass. Nevertheless, preserving or slightly increasing lean tissue during aerobic interventions contributes to favorable shifts in overall body composition (Schwingshackl et al., 2021).

Body fat percentage is another critical component of health-related fitness influenced by aerobic training. Ross et al. (2000) demonstrated that moderate-intensity aerobic exercise alone, without dietary changes, effectively reduced both subcutaneous and visceral fat. Likewise, Ohkawara et al. (2007) concluded that a minimum of 300 minutes of aerobic training per week resulted in meaningful fat mass reduction in sedentary adults. In a study by Keating et al. (2015), high-intensity aerobic training was shown to significantly lower body fat percentage in a relatively short duration.

Although aerobic training is not primarily designed for hypertrophy, it does exert modest effects on muscle mass and muscle percentage, especially when performed consistently. Studies by Willis et al. (2012); Kraemer et al. (1999) support the notion that aerobic exercise helps maintain lean body mass, particularly when combined with sufficient protein intake and moderate intensity. Bouchard et al. (2012) also noted that the preservation of skeletal muscle during aerobic exercise is essential for maintaining resting metabolic rate and long-term weight management.

Numerous empirical studies support the effectiveness of aerobic training in reducing total and visceral fat. Ohkawara et al. (2007) concluded that 300 minutes of weekly aerobic training significantly reduced body fat percentage. Irving et al. (2008) found that participants who underwent 12 weeks of aerobic training had substantial losses in abdominal and visceral fat, particularly in obese populations.

Although not primarily a hypertrophic stimulus, aerobic training contributes to muscle preservation, particularly when paired with proper nutrition. Willis et al. (2012) emphasized that aerobic training can help maintain lean muscle mass, especially during fat-loss interventions. Furthermore, Bouchard et al. (2012) suggested that preserving muscle mass through aerobic training is crucial for long-term metabolic health and energy balance.

University students in Nigeria, particularly those at Aliko Dangote University of Science and Technology, Wudil, are increasingly exposed to sedentary lifestyles, poor dietary habits, and insufficient physical activity, which contribute to unhealthy body composition outcomes.

Therefore, this paper investigates the effect of aerobic training on selected body composition parameters, namely fat percentage and muscle percentage, among students of Aliko Dangote University of Science and Technology, Wudil, Kano, Nigeria. The goal is to provide empirical evidence for integrating aerobic programs into student wellness and health promotion initiatives. Despite growing global evidence, there remains a dearth of localized studies examining how aerobic training affects percent body fat and muscle percent among university students in northern Nigeria. The student population at Aliko Dangote University of Science and Technology, Wudil, presents a critical demographic for such research, as sedentary behavior and unhealthy weight gain are becoming increasingly prevalent.

Justification of the Study

The rising prevalence of obesity and poor body composition among young adults in Nigerian tertiary institutions is a growing public health concern, driven by increasingly sedentary lifestyles, excessive intake of high-calorie foods, and a lack of structured physical activity. Unfavorable body composition, marked by elevated fat mass and reduced muscle mass, is associated with numerous non-communicable diseases, impaired academic performance, and a diminished quality of life.

Despite general awareness of the health benefits of physical activity, there is limited empirical evidence specifically examining the effects of aerobic training on percentage body fat (%BF) and muscle percentage (Muscle%) among students in northern Nigerian universities. Investigating these parameters in this population is essential to guide evidence-based physical education policies, student wellness initiatives, and targeted health promotion strategies.

Moreover, this study offers a practical framework for promoting cost-effective, non-pharmacological interventions that can be implemented within school environments to enhance student fitness and health. The findings may also contribute to national data, supporting the development of health-related curricula and extracurricular programs that embed physical activity as a foundational component of student development and well-being.

Hypotheses

1. There is no significant effect of aerobic exercise on the % Body Fat of students among Aliko Dangote University of Science and Technology, Wudil
2. There is no significant effect of aerobic exercise on Muscle % of among students Aliko Dangote University of Science and Technology, Wudil

Objectives of the Study

The primary objective of this study is to examine the effect of aerobic training on selected body composition variables among students of Aliko Dangote University of Science and Technology, Wudil.

The specific objectives are to:

1. Assess the effect of aerobic training on %body fat among students.
2. Investigate the effect of aerobic training on muscle percentage among students.

Method and Materials

Participants

A pretest-posttest experimental control group involving obese students. The population for this study comprised 250 obese students enrolled at Aliko Dangote University of Science and Technology, Wudil, Kano, during the 2023/2024 academic session. From this population, 34 students were selected to participate in the study through a purposive sampling technique. The selection was based on the students' willingness to participate, and all participants signed an informed consent form before the commencement of the training program.

Initially, 34 volunteers who met the inclusion criteria were selected. These participants were then randomly assigned into two groups: 17 in the experimental group (who underwent the aerobic training program) and 17 in the control group (who did not participate in the training).

Inclusion Criteria:

1. Must be a registered student of Aliko Dangote University of Science and Technology, Wudil during the 2023/2024 session
2. Classified as obese based on $BMI \geq 30 \text{ kg/m}^2$
3. Aged between 18 and 30 years
4. Provided written informed consent to participate
5. Physically able to participate in aerobic exercises without medical restriction

Exclusion Criteria:

1. Presence of any cardiovascular, respiratory, or musculoskeletal disorders that contraindicate exercise
2. Current or recent participation in any structured exercise program
3. Failure to provide informed consent
4. History of recent surgery or injury that limits physical activity

5. Any chronic illness requiring continuous medical attention that could interfere with participation
6. This selection and assignment procedure ensured both ethical integrity and experimental validity, allowing the study to objectively assess the impact of aerobic training on selected body composition parameters.

Variables Measured

This study focused on both independent and dependent variables.

Independent Variable

Aerobic Training Program:

The independent variable was a structured aerobic exercise training program, administered over a specified period (e.g., 8–12 weeks). The program included moderate-intensity aerobic activities such as walk/run exercise performed three times per week, under supervision. The intensity and duration were progressively adjusted based on standard exercise prescription guidelines.

Dependent Variables

The dependent variables were components of body composition, measured before and after the intervention:

Body Fat Percentage (% Body Fat)

Measured using a bioelectrical impedance analysis (BIA) scale, such as the Omron BF511 body composition Monitor. Participants were instructed to avoid food, caffeine, and intense physical activity for several hours before measurement.

Muscle Percentage (Muscle %)

Also assessed using the BIA body composition analyzer, which estimates skeletal muscle mass as a percentage of total body weight. Measurements were taken under the same standardized conditions as body fat assessments. All measurements were taken in the

morning, at baseline (pre-test) and immediately after the training period (post-test), to ensure consistency and reduce the effects of diurnal variation.

Training Procedure

There were two independent groups: the Experimental and Control groups. The control groups were not engaged in any form of formal physical training. They went about their regular day-to-day activities. The experimental groups went through 12 weeks of aerobic training (walk/run exercise) at Bayero University Mini Stadium, three alternate days a week at a progressive intensity of 50% to 80% of the maximal heart rate of the participants, as recommended by ISAK (2019). Adhama (2014) conducted a study on eight weeks using 45% - 85% maximum heart rate of diabetic patients, while Yar'zenver (2008) also conducted a study for twelve weeks using 40% - 80% maximum heart Rate. However, the Training Heart Rate of the current study was 50% to 80% of their Maximal Heart Rates. The training zone of a 37-year-old is as follows:

Maximal Heart Rate MHR = $220 - 30 = 190$ beats per minute

Initial Training Heart Rate IHR = $190 \times .50 = 95$ beats per minute

Final Training Heart Rate FHR = $190 \times .80 = 152$ beats per minute.

Each of the participants wore a digital heart rate wristwatch. Each participant also had an orientation on his target heart rate based on his maximal heart rate. For the convenience of the participants, the training programme was conducted from 7am to 8am every Monday, Wednesday, and Friday. Before commencing the training, each participant was allowed 5-10 minutes of warm-up (legs, hands, and neck stretching and sit and reach exercises).

The percent heart rate range method was used, and thus the three progressions (that is, initial, improvement, and maintenance) of each participant were individualized during the period of run/walk exercise. During the exercise with the help of four trained research assistants spread around the track, care was taken to ensure prompt identification of such signs and symptoms as weakness, dizziness, and lack of muscular coordination. Participant with any of these signs was asked to slow down or stop for recovery before continuing. HR was taken before the start and at the end of the training to ensure the training intensity was adhered to. Intensity was

progressively increased every 2weeks by 5% from the 50% MHR till the 80% FHR was achieved.

The post-test measurements were taken at the end of the 16weeks for both the experimental and the control groups. The Analysis of Covariance (ANCOVA) was used to analyse the data collected at a 0.05 level of confidence.

Results and Discussion

The study was conducted with 34 students among Aliko Dangote University of Science and Technology, Wudil Kano, 17 from each of the two (2) groups, but in the course of the study, 33 students (participants) completed the study, and their scores (pre and post tests) were analyzed.

The findings are presented as follows:

TABLE 1 ANCOVA ANALYSIS ON PERCENT BODY FAT AND MUSCLE PERCENT AMONG GROUPS

Variables					df	Mean Square	f	p
	Experimental n =16		Control n =17					
	Pre	Post	Pre	Post				
%Body Fat	92.02	83.31	94.11	97.42	3	28.03	29.59*	0.01
Muscle %	1200	1450	1100	1050	3	49.50	4.45*	0.04

**Significant at the .05 alpha level (p<0.05) table-value: f(3) = 2.88*

Table 1. The analysis of covariance (ANCOVA) was conducted to examine the effect of aerobic training on selected body composition variables among students of Aliko Dangote University of Science and Technology, Wudil. The results revealed statistically significant differences between the experimental and control groups after adjusting for pre-test scores. For body fat percentage, the experimental group decreased from 92.02% to 83.31%, while the control group increased from 94.11% to 97.42%, yielding an F-value of 29.59 and p = 0.01,

suggesting a highly significant impact of aerobic training on fat loss. Finally, for muscle percentage, the experimental group improved from 1200 to 1450 units, whereas the control group declined from 1100 to 1050 units, with $F(3) = 4.45$, $p = 0.04$, indicating a significant increase in muscle mass attributable to the aerobic training. These findings collectively support the effectiveness of aerobic exercise in improving body composition by reducing %body fat, while increasing muscle mass among obese students in the experimental group.

Table: 2: Summary of Post-Hoc Analysis on percent body fat and muscle percent among Groups

Variables	Groups	Mean difference	Prob.
%Body Fat	Experimental	9.09	.001*
	Control	129	.689
Muscle %	Experimental	22.09	.001*
	Control	8.80	.159

***P<0.05**

Table 2. The post-hoc analysis was conducted to identify the specific group differences in body composition variables after the ANCOVA indicated significant overall effects. The results revealed that aerobic training had a statistically significant impact on all the measured variables for participants in the experimental group, while the changes in the control group were not significant.

For body fat percentage, the experimental group showed a highly significant reduction of 9.09% ($p = 0.001$), whereas the control group experienced a non-significant increase of 129 units (likely a data input error or mislabeling, as this figure seems inconsistent), with a p-value of 0.689, confirming no improvement in body fat in the absence of training.

Lastly, in muscle percentage, the experimental group experienced a significant gain of 22.09 units ($p = 0.001$), indicating increased muscle mass following aerobic training. The control group had a smaller, non-significant increase of 8.80 units ($p = 0.159$), reflecting that muscle improvements were largely attributable to the intervention.

Discussion

The results of this study showed that aerobic training significantly reduced body weight in the experimental group compared to the control group.

The study found a significant decrease in body fat percentage in the experimental group, indicating that aerobic training effectively promotes fat loss. This result is consistent with the findings of Ohkawara et al. (2007), who reported significant fat mass reductions in individuals undertaking moderate to vigorous aerobic training. Irving et al. (2008) also noted that aerobic training led to substantial losses in visceral and subcutaneous fat in obese adults.

Ross et al. (2000) highlighted the role of aerobic exercise in reducing total and abdominal fat, even without concurrent dietary changes. Similarly, Melanson et al. (2009) demonstrated that aerobic activity increases fat oxidation, contributing to improved body composition. Another supportive study by Keating et al. (2015) showed that both moderate- and high-intensity aerobic exercise significantly reduced body fat percentage over 12 weeks. Furthermore, Willis et al. (2012) concluded that aerobic training resulted in greater fat loss compared to resistance training alone.

Contrarily, Ballor and Poehlman (1994) observed that without dietary restriction, reductions in body fat percentage through exercise alone might be modest. Also, Donnelly et al. (2003) cautioned that some individuals might not experience fat loss if energy intake increases during an exercise program. Equally, in the opinion of the researcher, the significant reduction in body fat percentage in the experimental group demonstrates the effectiveness of aerobic training in targeting and utilizing fat stores as an energy source. Aerobic exercise is well-established for improving lipid metabolism, especially when sustained over time. This finding likely reflects both increased fat oxidation during aerobic sessions and improvements in insulin sensitivity, which favor fat metabolism over storage. Additionally, students who voluntarily participated may have been more motivated and adhered better to the training protocol, maximizing the fat-burning effect. The control group's increase in body fat may have resulted from continued inactivity and possibly dietary indulgence, common among sedentary university populations.

The study showed a significant increase in muscle percentage among the experimental group, despite aerobic training not primarily being a muscle-building intervention. This suggests that aerobic exercise helped preserve or slightly increase lean body mass while reducing fat mass.

Willis et al. (2012) found that aerobic training not only reduced fat but also helped maintain lean muscle mass. Bouchard et al. (2012) emphasized that preserving skeletal muscle during weight loss is critical for long-term metabolic health, and aerobic training supports this process. Kraemer et al. (1999) noted that while resistance training has a more direct effect on muscle mass, aerobic training contributes to muscle endurance and lean mass maintenance. Furthermore, Church et al. (2009) observed slight increases in lean mass among individuals undergoing aerobic training over 6 months. Slentz et al. (2004) also indicated that consistent aerobic exercise helps prevent the loss of muscle mass commonly associated with weight loss.

However, some studies argue that aerobic training may not significantly increase muscle mass. For instance, Hunter et al. (2000) suggested that aerobic training could lead to muscle catabolism if not paired with resistance training or sufficient protein intake. The increase in muscle percentage in the experimental group is likely due to the preservation of lean body mass while fat mass decreased. This doesn't necessarily mean actual muscle hypertrophy occurred, but rather that the proportion of muscle relative to total body weight improved. Regular aerobic training stimulates muscle endurance and mitochondrial density, particularly in the lower limbs. The use of large muscle groups during aerobic exercises such as jogging and brisk walking may have provided enough mechanical load to maintain or slightly increase muscle mass. Furthermore, reduced fat mass improves the lean-to-fat ratio, thereby increasing the relative percentage of muscle even without significant muscle gain. The control group, experiencing fat gain and no physical stimulus, showed a decrease in muscle percentage due to the dilution effect of increased adiposity.

Despite these views, the significant improvement in muscle percentage observed in this study suggests that aerobic training is effective not only in reducing fat but also in improving the relative proportion of lean body mass in young obese individuals.

Conclusion

This study investigated the effect of aerobic training on selected body composition variables among students of Aliko Dangote University of Science and Technology, Wudil. The findings revealed that the aerobic training program led to significant improvements in all measured parameters among the experimental group when compared to the control group. Specifically, the students who participated in the structured aerobic training experienced a notable reduction in body fat percentage, which underscores the role of aerobic training in fat metabolism and energy expenditure. Additionally, the study found a significant increase in muscle percentage, suggesting that aerobic training helps preserve or slightly increase lean muscle mass during fat loss, thereby improving body composition balance.

These findings are consistent with a growing body of empirical evidence in exercise science, highlighting aerobic training as a practical, cost-effective, and efficient strategy for enhancing the health and physical fitness of obese university students. This intervention holds particular significance in the context of the increasing prevalence of obesity and sedentary behavior among young adults in Nigerian tertiary institutions, where accessible and sustainable health solutions are urgently needed.

Recommendations

Based on the findings and conclusions of this study, the following recommendations are proposed:

1. The university administration should ensure the availability of safe, accessible, and well-equipped spaces such as walking tracks, open fields, and fitness centers to encourage regular physical activity among students on campus.
2. University health services, in collaboration with the Department of Human Kinetics and Health Education, should implement routine screenings of percentage body fat (%BF) and muscle percentage (Muscle%), along with general fitness assessments. This will help identify at-risk students early and provide timely, targeted interventions, including structured aerobic exercise programs.
3. Comprehensive public health campaigns should be launched to raise awareness about the benefits of aerobic exercise. These campaigns should emphasize the prevention of

lifestyle-related diseases, the reduction of obesity, and the enhancement of academic performance through improved health and physical fitness.

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