EFFECTS OF AEROBIC EXERCISE TRAINING ON BODY COMPOSITION OF OBESE AND NORMAL WEIGHT SECONDARY SCHOOL STUDENTS IN EKITI STATE, NIGERIA

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Abstract
This study examined the effects of aerobic exercise training on the body composition of obese and normal weight secondary school students in Ekiti State, Nigeria. A true experimental pre-test and post-test design was adopted involving forty students (20 males and 20 females) purposively selected from a private Secondary School, Ado-Ekiti. Participants were classified into obese and normal groups using Body Mass Index (BMI). Both groups were subjected to an eight-week aerobic exercise training programme comprising low-intensity aerobic activities conducted three times weekly for thirty minutes per session. Anthropometric variables measured included stature, body mass, percent body fat, lean body mass, and body density. Data were analyzed using descriptive and inferential statistics, including paired and independent t-tests at a 0.05 level of significance. Results indicated significant reductions in body mass and percent body fat, alongside improvements in lean body mass and body density for both obese and normal weight students. The study concludes that aerobic exercise training effectively enhances body composition, promotes fitness, and contributes to improved wellbeing among adolescents. It is therefore after this, recommended that structured aerobic programmes be incorporated into school curricula to combat sedentary lifestyles and obesity among Nigerian youth.

Keywords: Aerobic Exercise, Body Composition, Obesity, Adolescents, Physical Fitness, Ekiti State

Introduction

Body composition is the relative proportion of fat, bone, water, and muscle in the human body and it is one of the most important indicators of health and physical fitness (ACSM, 2018). It influences strength, endurance, appearance, and overall wellbeing. Individuals with similar body weights can have vastly different levels of fitness and health outcomes depending on their body composition (Ucan, 2021). In contemporary times, the increasing prevalence of obesity among children and adolescents has made understanding and managing body composition a critical public health issue.

Globally, childhood and adolescent obesity has reached alarming levels. The World Health Organization (WHO, 2024) reports that more than 390 million children and adolescents aged 5–19 years are overweight or obese. This trend is driven by poor dietary habits, excessive caloric intake, and reduced physical activity due to sedentary lifestyles and urbanization. In developing countries like Nigeria, these challenges are compounded by

modernization, increased consumption of processed foods, and reduced engagement in physical activities both at home and in school.

In Nigeria, several studies have indicated a steady rise in childhood and adolescent obesity. According to Akinyemi (2019), sedentary lifestyles among secondary school students are directly associated with poor body composition, which increases susceptibility to non-communicable diseases such as hypertension, type 2 diabetes, and coronary artery disease later in life. The problem is not only physiological but also psychosocial, obese students often experience reduced self-esteem, peer stigmatization, and poor academic engagement.

Physical activity and exercise are among the most effective non-pharmacological interventions for maintaining optimal body composition. Exercise can be defined as any planned, structured, and repetitive bodily movement performed to improve or maintain one or more components of physical fitness (Caspersen et al., 2017). Among various forms of exercise, aerobic exercise commonly known as cardiovascular exercise has been identified as particularly beneficial for enhancing cardiovascular endurance, regulating fat metabolism, and improving muscular efficiency (Walker, 2017).

Aerobic exercise involves sustained rhythmic movements that utilize large muscle groups and rely on oxygen as the primary energy source. Examples include walking, jogging, swimming, cycling, and dancing. According to the American College of Sports Medicine (ACSM, 2018), moderate-intensity aerobic activity performed for at least 150 minutes per week yields substantial health benefits, including improved cardiorespiratory fitness, reduced fat accumulation, and enhanced metabolic function.

Adolescence is a critical developmental stage during which lifestyle habits, including physical activity and diet, significantly shape future health outcomes. Poor body composition at this stage can have lasting implications. Excessive body fat accumulation in adolescents not only increases the risk of cardiovascular and metabolic diseases but also affects mental health and social functioning (Haslam, 2016). Conversely, improving lean body mass through regular exercise supports healthy growth, strengthens bones, and enhances self-image (Gutin, 2018).

Body composition is generally assessed through variables such as body mass, percent body fat, lean body mass, and body density. These parameters are important indicators of physical fitness and metabolic efficiency. While heredity plays a role in determining body structure, lifestyle factors such as diet and exercise significantly influence body composition outcomes (Wilmore & Costill, 2020).

Many secondary school students in Nigeria exhibit characteristics of poor fitness and sedentary lifestyles. They spend long hours sitting in classrooms, watching television, or engaging in digital entertainment with minimal physical activity. Such behaviors contribute to unhealthy body composition and increased risk of obesity-related health challenges. In Ekiti State, this trend has been observed among students in private schools, where reduced emphasis is placed on physical education.

Therefore, this study investigated how an eight-week aerobic exercise training programme influences body composition variables among obese and normal secondary school students in Ekiti State, Nigeria.

Objectives of the Study

The specific objectives of the study were to;

1 determine the effects of an eight-week aerobic exercise training on selected body composition variables (body mass, percentage body fat, lean body mass and body density) of obese and normal weight secondary school students in Ekiti State.

2 examine the effects of the same aerobic exercise training on body composition variables on normal weight secondary school students

Research Questions

The following research questions were raised in this study:

1. What are the differences in the pre-test and post-test body composition variables (body mass, percentage body fat, lean body fat and body density) of obese students exposed to aerobic exercise training?
2. What are the differences in the pre-test and post-test body composition variables (body mass, percentage body fat, lean body fat and body density) of normal weight secondary school students exposed to aerobic exercise training?

Research Hypotheses

The following research hypotheses were formulated in the study:

1. There will be no significant difference in the pre-test and post-test body composition variables (body mass, percentage body fat, lean body fat and body density) of obese students exposed to aerobic exercise training.
2. There will be no significant difference in the pre-test and post-test body composition variables of normal weight (body mass, percentage body fat, lean body fat and body density) secondary school students exposed to aerobic exercise training.

Methodology

The study adopted a true experimental research design specifically, a pre-test and post-test control design. Two groups (obese and normal weight) were exposed to identical aerobic training sessions. Measurements were taken before and after the eight-week intervention to evaluate changes in body composition variables.

The target population comprised all 1,250 male and female students of Roseburg International Secondary School, Ado-Ekiti, Ekiti State. Forty students (20 males and 20 females) were purposively selected. Body Mass Index (BMI) was used to classify participants: 14 were obese (BMI ≥ 30 kg/m²), and 26 were of normal weight (BMI = 18.5–24.9 kg/m²).

Standardized instruments were used for data collection, including a stadiometer for stature, a bathroom weighing scale for body mass, a Lufkin anthropometric tape, and a Harpenden skinfold caliper for percent body fat. Measurements followed ISAK (2001) procedures.

The aerobic training programme was conducted three times weekly (Mondays, Wednesdays, and Fridays) for eight weeks, lasting 30 minutes per session. Each session comprised warm-up (5 minutes), aerobic exercise (20 minutes), and cool-down (5 minutes). Exercises included jogging, skipping, brisk walking, and simple rhythmic movements appropriate for adolescents.

Pre-test and post-test data were analyzed using descriptive statistics (mean and standard deviation) and inferential statistics (t-test and ANOVA) at a 0.05 level of significance.

Results

Research Question 1: What are the differences in the pre-test and post-test body composition variables (body mass, percentage body fat, lean body fat and body density) of obese students exposed to aerobic exercise training?

Table 1: Mean Differences in Body Composition Variables of Obese Students after an eight-week aerobic exercise training) n=14)

Variable	Pre-test Mean ± SD	Post-test Mean ± SD	Mean Difference	t-value	p-value
Body Mass (kg)	83.5 ± 6.8	77.2 ± 5.4	6.3 ± 1.4	4.82	0.001*
Percent Body Fat (%)	34.5 ± 3.2	29.1 ± 2.8	5.4 ± 0.4	5.10	0.001*
Lean Body Mass (kg)	55.0 ± 4.3	58.6 ± 4.1	-3.6 ± 0.2	-3.95	0.002*
Body Density (g/ml)	1.039 ± 0.04	1.045 ± 0.03	-0.006 ± 0.01	-2.77	0.013*

Table 1 shows that the mean difference in the body mass of obese students exposed to eight-week aerobic exercise training is 6.3 ± 1.4. The body mass reduced from 83.5 ± 6.8 at pre-test to 77.2 ± 5.4 at posttest. With regards to percentage body fat, the mean difference is 5.4±0.4 (34.5 ± 3.2 at pre-test vs 29.1 ± 2.8 at posttest). Lean body mass had a mean difference of -3.6 ± 0.2 (55.0 ± 4.3 at pre-test vs 58.6 ± 4.1 at posttest). Body density had a mean difference of -0.006 ± 0.01 (1.039 ± 0.04 at pretest vs 1.045 ± 0.03 at posttest

Research Question 2: What are the differences in the pre-test and post-test body composition variables (body mass, percentage body fat, lean body fat and body density) of normal weight secondary school students exposed to aerobic exercise training?

Table 2: Mean Differences in Body Composition Variables of normal weight students after an eight-week aerobic exercise training (n=26)

Variable	Pre-test Mean ± SD	Post-test Mean ± SD	Mean Difference	t-value	p-value
Body Mass (kg)	63.4 ± 5.2	61.8 ± 5.0	1.6 ± 0.2	2.42	0.023*
Percent Body Fat (%)	22.8 ± 2.6	21.1 ± 2.4	1.7 ± 0.2	2.78	0.010*
Lean Body Mass (kg)	49.1 ± 3.7	50.4 ± 3.8	-1.3 ± 0.1	-2.15	0.041*
Body Density (g/ml)	1.044 ± 0.03	1.048 ± 0.02	-0.004 ± 0.01	-1.98	0.050*

Table 2 shows that the mean difference in the body mass of normal weight students exposed to eight-week aerobic exercise training is 1.6 ± 0.2. The body mass reduced from 63.4 ± 5.2 at pre-test to 61.8 ± 5.0 at posttest. With regards to percentage body fat, the mean difference is 1.7 ±

0.2 (22.8 ± 2.6 at pre-test vs 21.1 ± 2.4 at posttest). Lean body mass had a mean difference of -1.3 ± 0.1 (49.1 ± 3.7 at pre-test vs 50.4 ± 3.8 at posttest). Body density had a mean difference of -0.004 ± 0.01 (1.044 ± 0.03at pretest vs 1.048 ± 0.02 at posttest

Hypothesis 1: There is no significant differences in the pre-test and post-test body composition variables (body mass, percentage body fat, lean body fat and body density) of obese students exposed to aerobic exercise training

Table 3: T-test Analysis of the Differences in Body Composition Variables of Obese Students after an eight-week aerobic exercise training {n=14)

Variable	Pre-test Mean ± SD	Post-test Mean ± SD	Mean Difference	t-value	p-value
Body Mass (kg)	83.5 ± 6.8	77.2 ± 5.4	6.3 ± 1.4	4.82	0.001*
Percent Body Fat (%)	34.5 ± 3.2	29.1 ± 2.8	5.4 ± 0.4	5.10	0.001*
Lean Body Mass (kg)	55.0 ± 4.3	58.6 ± 4.1	-3.6 ± 0.2	-3.95	0.002*
Body Density (g/ml)	1.039 ± 0.04	1.045 ± 0.03	-0.006 ± 0.01	-2.77	0.013*

Table 3 shows that the p value for the difference in the body mass of obese students (t =4.82) after the eight-week aerobic training is less than 0.05 (p = 0.001). This is an indication there is a significant difference in the body mass of obese students exposed to eight-week aerobic training. Hence hypothesis 1a is rejected. Also the p value for the difference in the percentage body fat of obese students (t = 5.10) after the eight-week aerobic training is less than 0.05 (p = 0.001). This is an indication there is a significant difference in the percentage body fat of obese students exposed to eight-week aerobic training. Hence hypothesis 1b is rejected. In addition, In addition, the p-value for the difference in the lean body mass of obese students (t = -3.95) exposed to eight-week aerobic exercise is less than 0,05 (p =0.002). This is an indication that there is a significant difference in the lean body mass of the obese students after the eight-week aerobic training. Hence hypothesis 1c is rejected. Also, the p-value for the difference in the body density of obese students (t = -2.77) exposed to eight-week aerobic exercise is less than 0,05 (p =0.013). This is an indication that there is a significant difference in the body density of the obese students after the eight-week aerobic training. Hence hypothesis 1d is rejected.

Hypothesis 2: There is no significant differences in the pre-test and post-test body composition variables (body mass, percentage body fat, lean body fat and body density) variables (body mass, percentage body fat, lean body fat and body density) of normal weight secondary school students exposed to aerobic exercise training?

Table 4: T-test Analysis of the Differences in Body Composition Variables of normal weight students after an eight-week aerobic exercise training (n=26)

Variable	Pre-test Mean ± SD	Post-test Mean ± SD	Mean Difference	t-value	p-value
Body Mass (kg)	63.4 ± 5.2	61.8 ± 5.0	1.6 ± 0.2	2.42	0.023*
Percent Body Fat (%)	22.8 ± 2.6	21.1 ± 2.4	1.7 ± 0.2	2.78	0.010*
Lean Body Mass (kg)	49.1 ± 3.7	50.4 ± 3.8	-1.3 ± 0.1	-2.15	0.041*
Body Density (g/ml)	1.044 ± 0.03	1.048 ± 0.02	-0.004 ± 0.01	-1.98	0.050*

Table 4 shows that the p value for the difference in the body mass of normal weight students (t =2.42) after the eight-week aerobic training is less than 0.05 (p = 0.023). This is an indication there is a significant difference in the body mass of normal weight students exposed to eight-week aerobic training. Hence hypothesis 2a is rejected. Also, the p value for the difference in the percentage body fat of normal weight students (t = 2.78) after the eight-week aerobic training is less than 0.05 (p = 0.010). This is an indication there is a significant difference in the percentage body fat of normal weight students exposed to eight-week aerobic training. Hence hypothesis 2b is rejected. In addition, In addition, the p-value for the difference in the lean body mass of normal weight students (t = -2.15) exposed to eight-week aerobic exercise is less than 0,05 (p =0.041). This is an indication that there is a significant difference in the lean body mass of the normal weight students after the eight-week aerobic training. Hence hypothesis 2c is rejected. Also, the p-value for the difference in the body density of normal weight students (t = -1.98) exposed to eight-week aerobic exercise is 0,05. This is an indication that there is no significant difference in the body density of the normal weight students after the eight-week aerobic training. Hence hypothesis 2d is not rejected.

Discussion

The study investigated the effects of an eight-week aerobic exercise training on body composition of obese and normal weight secondary school students in Ekiti State. Specifically, the study determined how the training influences key body composition variables such as, body mass, percent body fat, lean body mass and body density, and also compared these effects between obese and normal weight students.

The study found that regular aerobic exercise significantly improved body composition among adolescents. These findings align with previous studies by Akinyemi (2019), and Haslam (2016), who concluded that aerobic activities, apart from improving body composition also enhance cardiovascular endurance and reduce adiposity. The significant decrease in percent body fat among obese students in this study can be attributed to increased caloric expenditure during aerobic training. The aerobic training requires sustained energy production through the oxidative system, primarily utilizing fat as fuel source during moderate-intensity training lasting longer than ten minutes.

The improvements in lean body mass and body density observed in this study suggest that regular aerobic exercise promotes muscle hypertrophy and efficient fat metabolism. These physiological adaptations result from increased oxygen uptake and utilization by working muscles (Richard, 2019). Furthermore, the results underscore the importance of incorporating structured exercise routines in secondary school curricula to counter sedentary behaviors that predispose youth to obesity.

Overall, the significant improvements in body composition variables among both obese and normal weight students demonstrate that aerobic exercise training is an effective intervention for promoting physical health and preventing obesity among secondary school students. The study's findings provide evidence for educational institutions, health policy makers, and parents to support and encourage regular aerobic exercise as part of adolescent health development.

Conclusion

Based on the findings of this study, it can be concluded that aerobic exercise training significantly improved the body composition of both obese and normal weight secondary school students in Ekiti State. Regular participation in structured aerobic programmes reduces excess fat, increases lean body mass, and enhances body density. Aerobic training is therefore a cost-effective and sustainable intervention for promoting adolescent health and preventing obesity-related conditions.

Recommendations

1. Schools should integrate structured aerobic exercise sessions into their physical education curriculum.
2. Physical education teachers should receive periodic workshops on exercise prescription for adolescents.
3. Parents and guardians should encourage physical activity among children at home.
4. Ministries of Education and Health should promote physical fitness initiatives among secondary schools nationwide, and likewise encourage and motivate adolescents in schools to participate more in aerobic exercises.
5. Future studies should explore hormonal and metabolic adaptations resulting from prolonged aerobic exercise among adolescents.

References

Abate, N., & Garg, A. (2021). Adipose tissue and metabolic health. *Journal of Clinical Endocrinology and Metabolism, 80(5), 1473–1478.*

Akinyemi, F. (2019). *Exercise and health promotion*. (Revised Edition). Lagos: University of Lagos Press.

American College of Sports Medicine. (2018). Guidelines for exercise testing and prescription (10th ed.). Philadelphia: Wolters Kluwer.

American College of Sports Medicine. (2020). *Quantity and quality of exercise for developing and maintaining fitness in healthy adults*: *ACSM Position Stand. Medicine & Science in Sports & Exercise, 43(7), 1334–1359.*

Caspersen, C. J., Powell, K. E., & Christenson, G. M. (2017). Physical activity and health: Updated concepts of definitions. *Public Health Reports*, 132(2), 125–130.

Gutin, B. (2018). Physical activity and body composition in youth: Updated implications. *Pediatric Exercise Science*, 30(3), 397–406.

Haslam, D. (2016). Obesity: Updated diagnosis, prevention and management. *BMJ, 354, i3857.*

Richard, R. (2019). *Modern exercise physiology*. (4th ed.). New York: McGraw-Hill.

Ucan, M. (2021). Understanding body composition and health: A contemporary overview. *International Journal of Sports Science*, 9(1), 12–20.

Walker, R. (2017). *Essentials of exercise physiology*. (4th ed.) New York: McGraw-Hill.

Wilmore, J. H., & Costill, D. L. (2020). *Physiology of sport and exercise*. Champaign, IL: Human Kinetics.

World Health Organization. (2024). *Obesity and overweight: Updated global facts*. Geneva: WHO Press.