EFFECTS OF 8-WEEK GEORDIES CIRCUIT TRAINING ON PULMONARY FUNCTION VARIABLES OF OBESE FEMALE UNDERGRADUATES IN TERTIARY INSTITUTIONS IN OYO TOWN

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Abstract

This study examined the effects of an 8-week Geordies circuit training programme on pulmonary function variables of obese female undergraduates in tertiary institutions in Oyo Town, Nigeria. The study adopted a pretest-posttest experimental design. The population for the study was 70 participants who were divided into experimental and control groups respectively. The t-test statistics were used to compare the difference in the results between the experimental and the control group. The findings from the study showed that there was a significant difference between the pretest and posttest scores of *Vital Capacity (Crit-t = 2.00, Cal.t = 4.934, df = 69,p<.05). Also, the findings showed that there was a significant* difference between the pretest and posttest scores *of Peak Expiratory Flow Rate (Crit-t = 2.00, Cal.t = 8.714, df = 69,p<.05). Based on the findings of the study, it is recommended that obese female undergraduates should be encouraged to take part in regular Geordies jogger circuit exercise for improved cardiopulmonary functions.*

Keywords: *Geordies circuit training, Obesity, Vital capacity, Peak expiratory flow rate*

Introduction

Body Composition illustrates the different components that, when taken together, make up a person`s body weight. Body composition describes the percentages of fat, bone and muscle in the human body which helps in assessing the health and the general fitness of an individual. The World Health Organization, WHO (2016) posited that obesity is a condition where the body accumulates excess fat to the level that affects its health). Obesity has become a global phenomenon and poses threats to the health of the afflicted. It is associated with an increased rate of several health issues such as pulmonary, metabolic, and cardiovascular diseases and triggers hypertension. Obesity

affects the quality of life, leads to mortality and morbidity which is significantly associated with sedentary life style. Several studies across the globe have affirmed a significant rise in the obese population due to decrease in regular physical activities and excessive intake of food.

WHO (2022) reported that more than 1 billion people worldwide are obese; 650 million adults, 340 million adolescents including tertiary institution students, and 39 million children, it was also estimated that by 2025, approximately 167 million people including adults and children will become less healthy because they are overweight or obese. WHO (2024) in another publication posited that 79% of adults with overweight and obesity will live in Low- and Middle-Income Countries (LMICs) by 2035.; 88% of children with overweight and obesity will be living in LMICs by 2035 and that the number of adults living with obesity will rise from 0.81 billion in 2020 to 1.53 billion in 2035.

The percentage of fat (%fat) in the body is known through a Body Mass Index (BMI), and the BMI is determined by dividing a person's weight in kilogrammes by the square of his or her height. For a man to function well and live healthy, it is mandatory to engage in regular structured exercise such as the Geordies circuit training which can help improve the heart pulmonary functions such as the vital capacity, peak respiration and other pulmonary variables responsible for good respiration. Circuit exercise training (CET) is a type of combination training that combines aerobic w orkouts with resistance training for several joints.CET, which combines strength and end urance training, may be more advantageous than programs that focus solely on one kind of exercise, according to research. (Jeneviv, Ujunwa, Obinna, et.al, 2023).

Salome, King and Benerd (2010) affirmed that the most consistently reported effect of obesity on lung function is a reduction in the Functional Residual Capacity (FRC). In obese, the reduction in the downward movement of the diaphragm, as a result of increased abdomen mass is likely to decrease Total Lung Capacity (TLC) by limiting the room for living expansion or inflammation. This is an alternative to the deposition of fat in pleural spaces and might directly reduce lung volume by reducing the volume of the chest cavity. Cardiorespiratory endurance is an essential aspect of health-related fitness. It refers to the capacity of the heart, lungs, and blood vessels to supply sufficient oxygen (O_2) and nutrients to the muscle cells during activity. Within these muscle cells, nutrients are converted into energy in the presence of oxygen, enabling the muscles to sustain physical activity for extended periods without excessive fatigue (Cheng, 2019). Furthermore, obesity impairs respiratory functions by inducing airway hyper-responsiveness in adults.

Peak Expiratory Flow Rate (PEFR) as a pulmonary variable is the maximum flow generated during expiration performed with maximal force and starting after full inspiration. PEFR is the most commonly used method to monitor lung function. It is the Maximal expiratory flow rate achieved with a maximally forced effort from a position of maximal inspiration and is expressed in lit /min. It is measured with an instrument known

as a Peak flow meter. (Nicholas, 2012). PEFR is a convenient tool for estimating pulmonary function, monitoring the respiratory status of obese individuals and predicting the risk of asthma, which can be easily measured with a peak flow meter. Peak Expiratory Flow Rate (PEFR) is the maximum flow generated during expiration performed with maximal force and starting after full inspiration (Nicholas, 2012). PEFR is a convenient tool for estimating pulmonary function, monitoring the respiratory status of obese individuals and predicting the risk of asthma, which can be easily measured with a peak flow meter.

Vital Capacity (VC) which is equally a functional variable of respiration is the totality of air that can be vehemently respired, after utmost inspiration average value of 3 to 4 litres for women, and 4 to 5 litres for men. The larger the long capacity, the more the air (0_2) taken by individuals. This implies that as the lung capacity increases, the lung endurance equally increases which allows individuals perform physical activity longer for a period of time without feeling tired (Luke et.al, 2020). Also, Tanzila and Febriani (2019) posited that the vital capacity of human lungs always around 4600 ml and several studies showed that the vital capacity of the lungs of adult men tends to be 20-25% higher than that of adult women with a commonly used tool to measure the vital capacity of the lungs is a spirometer.

*Okely, Kontsevaya, and Abdeta (2020) posited that i*ndividuals should engage in at least 150-300 minutes per week of moderate exercises such as bicycle light effort or 75-150 minutes per week of regimented exercise such as hiking, circuit training, etc. Engaging in exercise will have a positive effect on the functioning of the body and enhance good body image as well as good respiratory function. A person's general health and physical performance may suffer as a result of obesity's association with altered pulmonary functions, such as lower lung capacity, decreased inspiratory reserve, and poor respiratory efficiency. While several exercise intervention programmes have been proposed to reduce these risks, the focus was on the elderly leaving a dearth of information among the younger ones. Hence; the need to examine the effect of an 8-week Geordie's Joggers Circuit Training on Vital capacity and Peak expiratory flow rate in obese female undergraduates.

Statement of the Problem

Obesity among young adults, particularly female undergraduates in Nigeria, has emerged as a major public health concern. Its rising prevalence is largely linked to sedentary lifestyles, poor dietary practices, and limited particippation in exercise and physical activity. Beyond its association with cardiovascular risks and metabolic disorders, obesity also impairs pulmonary function, leading to reduced lung capacity and diminished respiratory efficiency. Although structured exercise programs are widely acknowledged for their positive impact on respiratory health, there is limited research in Nigeria addressing pulmonary function improvement among obese female undergraduates. While previous studies on Geordies circuit training have primarily

focused on muscular endurance and overall fitness, little is known about its effect on pulmonary functions. This gap warrants the need for the present study in Oyo Township.

Research Hypotheses

1. There will be no significant main effects of treatment on Vital Capacity (VC) between the control and experimental groups.
2. There will be no significant main effects of treatment on Peak Expiratory Flow Rate (PEFR) between the control and experimental groups.

Methodology

The pretest-posttest experimental research design was used for this study. It involves careful measurement of the participants which was made before treatment was given (pretest) and subsequently, another measurement (posttest) was made. The observed differences between the two measurements were then taken as the effect of the treatment given earlier on. The populations for this study were tertiary institutions' obese female undergraduates in Oyo Town. Eighty (80) obese female youths took part in this study, ten (10) could not continue due to increased level of intensity as regards exercise principles of loading, meanwhile, only 70 were able to finish to the end. A purposive sampling technique was used to select the participants for the study because the peculiar characteristics required a BMI ≥25.0 as the yardstick to qualify. The participants were selected from tertiary institutions in Oyo town which comprised Emmanuel Alayande University of Education, Federal College of Education (Special), Federal Survey School, and Ajayi Crowther University, Oyo respectively. This restriction helped to minimize to the barest 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) the experimental and the control group. The experimental group were assigned to 8 weeks of Geordies Joggers circuit training sessions in Emmanuel Alayande College of Education gymnasium while the control group were placed on placebo (20 minutes contact/week lesson of healthful lifestyle education) in Federal College of Education (Special).

Inclusion Criteria

The Undergraduate female students in colleges of education and university (NCE and B.S.Eds.) in Oyo town. The Participants had no medical reports contra-indicating exercise participation and participants who were not engaged in any exercise programme four weeks before, during and after the recruitment of this study and also obese female undergraduates with BMI ≥25.0 to determine the level of obesity.

Exclusion Criteria

Participants with cardiorespiratory disease and other metabolic conditions, with heart rate above 100 bpm-pretest, a tendency towards fainting or dizziness were dropped out participants.

Research Instruments

The following research instruments were used to collect data for the study at the Emmanuel Alayande University of Education, Exercise Physiology Laboratory (Pre and Post data): Spirometer for measuring pulmonary functions (FVC, FEV1, IRV, ERV) and anthropometric measurement (BMI, body fat percentage).

Training Programme

Item	Details
Programme	Geordies Jogger Circuit Training Programme
Duration	8 weeks
Frequency	3 days per week
Session length	20 mins /day (3 sets per session)
Total time per day	30 mins
Session breakdown	Warm- up; 5mins, main training 20mins, cool-down; 5mins

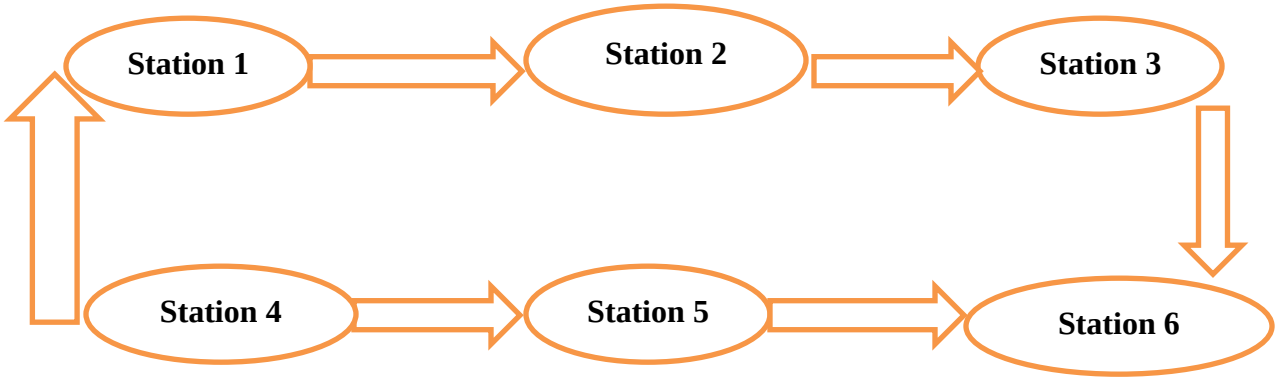


Fig 2: Adapted from Active School (2012)

For an outline of the programme design, a series of six rows, each consisting of five stations and a jogging station. Five trained research assistants were placed at each station to demonstrate the required movements. The following exercises were performed at each station and changed every week to avoid exercise monotonous:

Station 1: standing jump
Station 2: kick butty
Station 3: tap back
Station 4: jumping jack
Station 5: alternate toe touch
Station 6: jogging

The participants were distributed to each station; five (5) participants were at each station. The extra group are the joggers, who jogged once around the 40-meter (length) by 20-meter (breadth) perimeter of the circuit area, keeping together. When the joggers return to the start location "change" is called. All groups rotate at station 1. A new group becomes the joggers at station 1 and the joggers join the physical activity circuit at station 2. A five-second break was allowed for movement between stations and a rest of 5minutes between sets.

Data Collection

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

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

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

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

Height (cm): The participant heights in centimetre were measured while standing erect looked straight ahead with 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 centimetre.

Vital Capacity: In the erect position, the participants held the dry pocket spirometer; made a maximal inspiratory effort with lips tightly closed around the mouthpiece of the portable spirometer and exhaled forcefully and continuously through the mouthpiece into the spirometer. This was repeated 3 different times and recorded in litres (Spirometer and Flow Volume Measurement Standards and Guidelines 1998)

Peak Expiratory Flow Rate (PEFR): In erect position, the participants held the peak flow meter in their hands; take a deep inspiration; expired with the mouth piece placed in the mouth without air leakage and blew out forcefully into the mini-wright peak flow meter. This was repeated 3 different times and recorded in litters.

Results

Demographic Characteristics of Respondents

Table 1: Weight of Respondents in Kilograms

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

Information on table 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 pretreatment measurements of all the participants.

Table 2: Heights of Respondents in Centimetres

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

Information on table 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.

Table 3: Distribution of the participants by Class of obesity

Class of obesity	Frequency	Percentage	Norms	Interpretations
Class 1 obesity	45	64.3	25.0-30.0	Average
Class 2 obesity	12	17.1	30.0-35.0	Fatter than average
Class 3 obesity	12	17.1	35.0-40.0	Fat
Class 4 obesity	1	1.5	40.0-above	Overfat
Total	**70**	**100.0**		

Using the classification of Japan (2013), table 3 shows that 45(64.3%) of the participants were class 1 obese which was at an average level compared to the norms, 12(17.1%) class 2 obese were fatter than average level, 12(17.1%) class 3 obesity were fat compared to the standard norms while 1(1.5%) class 4 obesity was categorized as over fat as described above. The above table revealed that all the participants were above the recommended normal height and weight expected of their age.

Table 4a: Analysis of Vital Capacity

Variable		N	Mean	Std. Dev.	Crit-t	Cal-t.	df	P
Vital	Pretest	70	2193.2655	485.7679				
Capacity	Posttest	70	2185.7621	478.7482	2.00	4.934	69	.000

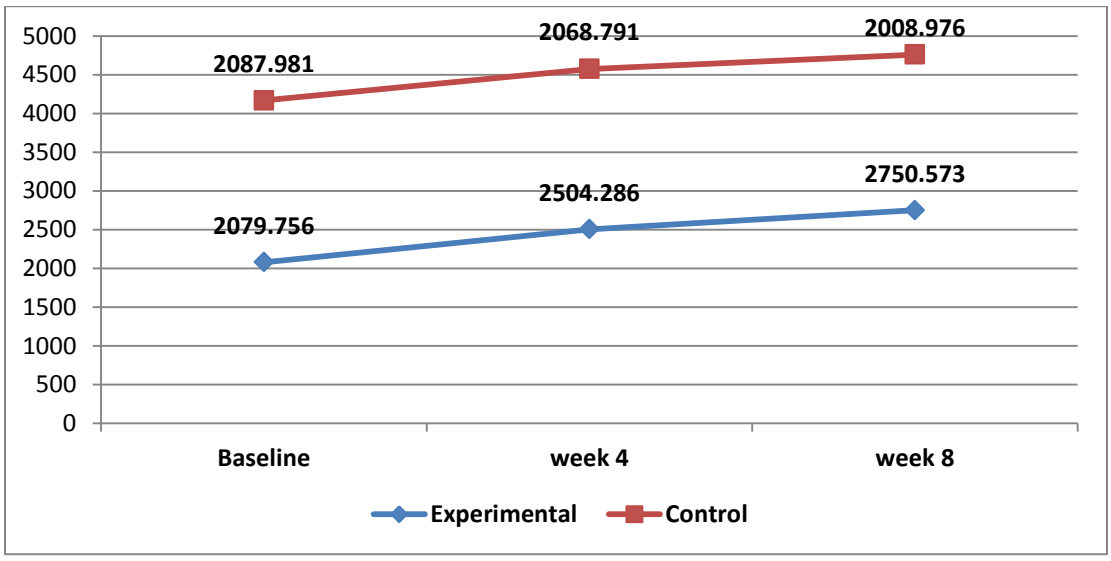
Information in Table 4a shows that there is a significant difference between the pretest and posttest scores of Vital Capacity. Vital Capacity (Crit-t = 2.00, Cal.t = 4.934, df = 69,p<.05).The hypothesis is rejected;

Table 4b: The average Vital Capacity of obese female college students per week

VC	Baseline	week 4	week 8
Experimental	2079.756	2504.286	2750.573
Control	2087.981	2068.791	2008.976

Table 4b shows the average VC of experimental and control group participants taken per week. The value shows that experimental participants' VC increased from week 4 to week 8 following Geordie jogger circuit training.

Figure 1: Line Graph Showing the Mean Scores of VC of the Respondent in Experimental and Control Groups in the Baseline, 4th week and 8th week



The line graph reveals that there was a slightly significant effect of treatment on experimental group VC from the baseline to week 4 and pick up from the baseline to week 8.

Table 5a: Analysis of Peak Expiratory Flow Rate (PEFR)

Variable		N	Mean	Std. Dev.	Crit-t	Cal-t.	df	P
Peak Expiratory Flow Rate	Pretest	70	287.6580	75.1502	2.00	8.714	69	.000
	Posttest	70	278.7364	81.4730				

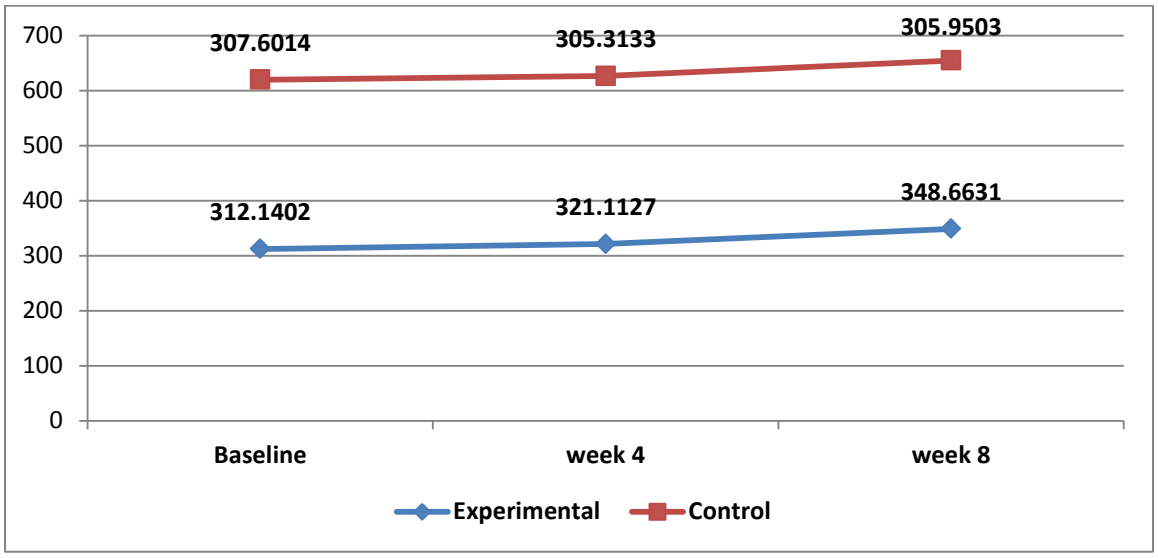
Information in Table 5a shows that there was a significant difference between the pretest and posttest scores of Peak Expiratory Flow Rate (PEFR). Peak Expiratory Flow Rate (Crit-t = 2.00, Cal.t = 8.714, df = 69,p<.05). The hypothesis is rejected.

Table 5b: The average PEFR of obese female college students per week

PEFR	Baseline	week 4	week 8
Experimental	312.1402	321.1127	348.6631
Control	307.6014	305.3133	305.9503

Table 5b shows the average PEFR of experimental and control group participant taken per week. The value shows that experimental participants PEFR slightly increased from the Baseline to the week 4 and more in week 8 of Geordies jogger circuit training.

Figure 2: Line Graph Showing the Mean Scores of PEFR of the Respondents in Experimental and Control Groups in the Baseline, 4th week and 8th week



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

Discussion

The study examined the effects of 8-week Geordies circuit training on pulmonary function variables of obese female undergraduates in tertiary institutions with the view to promote the fitness and overall health of undergraduate students in the study area. The results revealed that there was a significant difference between the pretest and posttest scores of Vital Capacity (VC) variable of pulmonary function of the sampled participants. This result corroborates with the findings of Harpreet, (2022) who found out in a study that a 12-week circuit training programme had significantly increased improvement on Vital capacity of basketball players. Though the study had a span of 12 weeks compared to this study which spanned 8 weeks, there is a similarity in the finding because Geordies circuit training and the general principle of exercise warrant that after an intense exercise, the maximum amount of air that can be inhaled or exhaled from the lung will be increased compared to inactivity. In the same vein, this study is in accordance with the findings of Lardika and Gazali (2020) that circuit training had important relationship in the Vital Capacity of the lung; and that of Munadi, Rachmad, et.al (2024) who posited that to improve athletes lung capacity, one of the means of doing so is to subject them to circuit training aerobic exercise. Finally on the vital capacity, the result of this study also align with Prem, Selvakumar and Divya (2022) who asserted in their study that a pattern of change improvement was found in the participants used for their study on respiratory efficiency of lung functions (VC) and static respiratory muscle strength by 12 weeks practice of circuit training. Though the changes was not intermittent but gradual as the training programme became intense.

The findings from this study also showed that was a significant between the pretest and posttest scores of Peak Expiratory Flow Rate (PEFR). This result aligns with the findings of Sanket, Ruchi, Avni, Mitali, and Ananya, (2024) in their study that means PEFR significantly increased after the intervention programme of circuit training. This is likely due to the muscle strengthening exercise prescribed which improves the diaphragm to create pressure during respiration. Similarly, the result was equally in line with the findings of Yohana, Endang, Muflihatul, and Yosef, (2022) in their study which spanned for 8 weeks on high intensity circuit training (HICT) of 12 movements, the intervention programme showed a significant increase in the PEFR of the participants in the pretest and posttest group. To buttress this, during CT exercise, demands for ventilation will increase and the signals are sent to the respiratory muscle to increase ventilation which in turn increase the power of respiratory muscles.

Conclusion

The 8 weeks Geordies Jogger circuit training programme had significant changes in the values of pulmonary function variables of obese female undergraduates in tertiary institutions in the study area.

Recommendations

It was recommended that obese female undergraduates should:

a. Endeavour to take part in regular Geordies jogger circuit exercise for improved health benefits.

b. 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 and enhance better functional pulmonary which is key in maintaining the longevity of endurance in sports performance and reduce fatigue in dealing with daily routine activities
c. Geordies jogger circuit training exercise can usually be accommodated with less stress by people of all ages and fitness levels. This is one of the unique characteristics of Circuit Training, in that the same step can be modified by the participants to meet the needs of their workout. Also, Regular BMI monitoring should be undertaken as an important way to monitor and prevent the occurrence of obesity among female undergraduates.

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