THE EFFECTS OF AEROBIC CAPACITY TRAINING ON THE ANTHROPOMETRICS, CARDIORESPIRATORY AND CARDIOVASCULAR ENDURANCE OF SELECTED SENIOR SECONDARY SCHOOL STUDENTS IN AGBOR TOWN

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Abstract

The study was designed to study the effects of aerobic capacity training on the anthropometrics, cardiorespiratory and cardiovascular endurance of selected senior secondary school students in Agbor Town. 28 male students were selected for the study with the random sampling technique through balloting. The experimental groups (14) in number trained three times a week (Mondays, Wednesdays and Fridays for cooper 12- minutes ran test for 12 weeks, while the control group (14) in number were not subjected to any training. Anthropometry and skinfold caliper were used to measure body diameters and skinfolds respectively, from which the participants' anthropometrics; gross body weight, sum of body diameters, lean body weight, and body density as well as percent body fats were calculated. The pre and post-training mean scores for selected anthropometric, cardiorespiratory and cardiovascular variables were recorded. Means, standard deviation and student t-test formed the statistical tools for the study and the 0.05 level of significance tools for the study and the 0.05 level of significance. The results of the study revealed that the aerobic capacity training had no significant effect on all the participants' anthropometrics, whereas their cardiorespiractory and cardiovascular endurance fitness was significantly altered following the physical training. The control group experienced no significant changes by caused they were not exposed to the 12- minute test, indicating that training protocol is recommended as an effective training tool for improving human aerobic fitness.

The urge to excel is a common phenomenon to sports practitioners, and this is based on the fact that high level performance is acclaimed with great joy and interest by many individuals and the society at large. This much desired excellence in sports performance does not just come, but it influenced by several factors, among which are training, conditioning and trial competitions (O' Shea, 2010).

Various training methods have been devised and adopted in the realm of sports, and they all have their individual merits and demerit, but a wise application of these methods calls for adoption of the most appropriate and effective technique in preparation for the execution of a given sports competition (Odedeyi & Babalola, 2012).

Physical fitness is the body's ability to function effectively and effectively, and it consist of health-related physical fitness and skill-related physical fitness, which have at least elavent components, each of which contributes to total quality of life. Physical

fitness also includes metabolic fitness and bone integrity. Physical fitness is associated with a person's ability to work effectively, enjoy leisure time, be healthy resist hypokinetic diseases, and meet emergency situations (Corbin, Welk, Corbin & Welk, 2014). It is related to, but different from, health, wellness, and the psychological, sociological, emotional, and spiritual components of fitness. Although the development of physical fitness is the results of many things, or optimal physical fitness is not possible without regular exercise.

Through active participation of secondary school students in physical activities, they will learn to stay healthy all times and fight sedentary ailments. Not physically fit encourages hypokinetic diseases such as, high blood pressure, heart diseases, cancer and lung ailments. The eradication of fatness and obesity amongst including respiratory ailments will be eliminated from students as a result of exercise (American College of Sports Medicine, 2012). The benefits of aerobic exercises and fitness include: improved circulation and respiration, reduced risk of heart diseases, improved fat metabolism, reduced tension and stress, reduced body weight and strengthened bones ligaments, Smith (2018) as cited by Ighomo (2015). Other benefits also include improved tendons, improved vitality, reduced fatigue, personality changes, enhanced self concept and body image and emotional stability and longevity.

Aerobic means in the presence of oxygen, so aerobic training means training with exercise that enhances aerobic capacity. Anthropometrics means the measurement of the size and proportion of the human body and its parts and capacities. Anthropometry is embedded in body composition which is a health-related components of physical fitness (Corbin et al, 2004). Cardio-respiratory is a term relating to the action of both heart and lungs, while cardiovascular endurance on the other hand, is the ability of the heart, lungs, and blood vessels to deliver oxygen to our body tissues. The more efficiently our body delivers oxygen to its tissues, the lower our breathing rate is (http://www.quora.com) cardiovascular endurance). Cardiorespiratory and vascular endurance also belongs to the health-related components of physical fitness.

Purpose of the Study

The purpose of this study was to investigate the effects of aerobic capacity training on the anthropometrics cardiorespiratory and cardiovascular endurance of secondary school students.

Significance of the Study

This research study which is scientific in nature will serve as a basis for revealing the weaknesses and strengths as a basis for revealing the weaknesses and strengths of the training and testing protocols so that modifications based on the discovered lapses have to be affected and subjected to further studies thereafter.

Additionally, it is expected to be of immense value to coaches, trainers and exercise physiologist as well as physiotherapist, regarding aerobic capacity exercises as effective protocol of physical fitness, promoting health and wellness, and enhancing performance in sporting activities.

Statement of the Problem

Recent finding according to World Health Organization (W.H.O.) have revealed that lots of youth these days are equally dying of high-blood pressure and heart

related/respiratory disease, and this have called for great concern regarding the reduction of such fatality, in other to prevent more deaths.

More also, there has been no known reported empirical study carried and reported on the effect of aerobic capacity training on the anthropometrics cardiorespiratory endurance of senior secondary school students in Agbor town. So the findings of this empirical study will be a base for reporting the effects of aerobic capacity training on the anthropomoetrics, cardiorespiratory and cardiovascular endurance of senior secondary school students in Agbor town.

Hypotheses

Main Hypotheses

1. There would be no significant effect of aerobic capacity training on the anthropometrics of senior secondary school students.
2. There would be no significant effect of aerobic capacity training on the cardiorespiratory and cardiovascular endurance of senior secondary school students.

Specific Hypotheses

1. There would be no significant effect on the gross body weight of senior secondary school students offering aerobic capacity training.
2. There would be no significant effect on the body diameters of senior secondary school students after aerobic capacity training.
3. There would be no significant effect on the lean body weight of senior secondary school students after aerobic capacity training.
4. There would be no significant effect on the body density of senior secondary school students after aerobic capacity training.
5. There would be no significant effect on the percent body fats of senior secondary school students after aerobic capacity training.
6. There would be no significant effect on diastolic blood pressure of senior secondary school students after aerobic capacity training.
7. There would be no significant effect on systolic blood pressure of senior secondary school students after aerobic capacity training.
8. There would be no significant effect on the resting heart rate of senior secondary school students after aerobic capacity training.
9. There would be no significant effect of aerobic capacity training on senior secondary school students' maximum oxygen consumption ($MaxVo_2$).

Methodology

Study Design: The study design for the study was the randomized control pre-test and post-test experimental design.

According to Smith (2018) this type of empirical experimental research fulfills all the conditions of pure experimental reach. The students were randomly assigned into an experimental and a control group in order to eliminate sample bias and ensure equivalent groups with similar value on the anthropometrics, cardiorespiratory and cardiovascular of the testees.

Sample: Twenty-four (24) senior secondary schools students with twelve each from two secondary schools in Agbor town were used for this study. The students were randomly

assigned through the balloting process. They were all male students that were randomized into 12 experimental and 12 control groups. Their ages ranged between 14 and 18 years, with a mean age of 16.7 years. The subjects filled an informed consent form after given an orientation on the research requirement and involvement.

Testing Instruments/Facility

The following instrument/facility were utilized for the study:

- Bathroom scale
- Stethoscope
- Sphygmomanometer
- Large skinfold caliper
- Stop watches
- Fabric socks
- Standiometer
- Broad blade sliding caliper
- Training shoes – Tennis canvas
- Short and T-shirts

The facility used is a 400 meters track. The track was graduated into sixteen and twenty-five meters portions; and this is to ensure for accurate assessment of the distance covered by the subjects.

Training Protocol

Jogging: The students were made to participate in jogging exercise as the aerobic training in order to elicit physiological effects regarding the variable to be measured.

Test Station

All tests and trainings were carried out at the Agbor township

Testing Procedures and Jogging Protocol

Before the training commenced, the students conditioned their legs with 3- day walking. They walked for 20 minutes a day for the first day (Monday), then increased to 30 minutes on Wednesday and on Friday, they walked for 50 minutes. This got them physically ready for the 12 weeks jogging training.

Jogging Protocol (A 12 – Minute Run Test)

The training programme consisted of 12 weeks of intensive aerobic training. The students trained three times a week on Mondays, Wednesdays and Fridays and before the training commenced the pre-test values of the selected variable for them were collected. Each student ran as far as possible during a 12 – minute period maintaining a relatively steady pace throughout and they were encouraged to increase their speed during the latter past. The number of laps completed and recorded, and the actual distance covered within the 12 – minute period were calculated. The 12- minute field test, have correlated well with laboratory determined values for physiological factors or measures, such as maximal oxygen consumption ($MaxVo_2$) according to Getchell (1979).

Anthropometric Measures

Age was recorded to the nearest year. Height was measured on the standiometer, and the gross body weight was taken with a bean scale in kg. The broad sliding caliper was used for the measurement of the various body diameters, while the large skinfold caliper was used in measuring skinfold measurement in millimeter. The body diameters measurement were taken at the following eight sides are recommended by Wilmore (2004).

- Biacromial
- Bi- liac
- Bitrochanler
- Elbow (Right and left)
- Wrist (Right and left)
- Knee (Right and left)
- Ankle (Right and left)
- Chest width

Measurements were taken in centimeters and in duplicates, and whenever the difference between two measurements exceeded one percent of the initial value, a third measurement was taken. The mean of the duplicate measures was calculated. Measurement of subcutaneous adiposity taken from the skinfolds and the sum of the eight body diameter measurements formed the basis on which percent body fat, body density and lean body weight were determined.

Desired Weight Computation

Computation of Body Density (Db): Sloan and Weir (2010) equation for body density (Db) used in the present study is presented here:

Db = 1.1043 – (0.00131x subscapula) = (0.001327xthigh)

Computation for present body fat (% body fat): Percent body fat (% body fat) was computed using Brozek (2013) equation.

$$\% \text{ body fat} = \frac{4.750}{\text{Body Density (Db)}}$$

Computation for lean body weight (LBN): Each subject's lean body weight (UBN) was determined from the sum of the eight diameters using the formula by Wilmore (2004).

$$\text{LBN} \quad \frac{8 \text{ diameter}}{101} \times \text{height (dm)}$$

Cardiorespiratory/cardiovascular

The already grouped students was subjected to a pre and post test training assessments. The test were all conducted at approximately the same time using identical equipment. The physiological variables of concern during the aerobic capacity training were:

- Maximum oxygen consumption ($MaxVo_2$)
- Diastolic blood pressure
- Systolic blood pressure

- Heart Rate (HR) exercise recovery

These served as the predictors of the respondents' cardiorespiratory and cardiovascular endurance.

Blood Pressure: Data on blood pressure were collected using sphygmomanometer and stethoscope and recorded in millimeters of mercury (MMHg). Systolic blood pressure and diastolic blood pressure were measured following a 5- minute seated rest preceding a 12 – minute jog.

Heart Rate (HR): Heart rate was monitored from the chest manually, using both stethoscope and stopwatch for regulating time. Resting heart rate was measured following a 5- minute seated rest proceeding a 12 – minute jog. Recovery heart rate was measured after a 10- minute seated rest following a 12 – minute run test. The beats were counted for 10 seconds and 10 second heart beat was multiplied by 6 to determine the pulse. The heart rate was recorded in beats per minute.

Data Analysis: The t-test was used as the only statistical tool in analyzing the collected data for the study.

Results/Analyses of Data

Table 1: The Pre-test and Post-test Anthropometric Measures for the Experimental Group

Variables	**N = 14** **Pre-values**	**Post-value**	**Pre-Post Mean Difference**	**Tabular 't'**	**Calculation 't'**
Gross body Weight (kg)	$\overline{X}$50.4 4.6	X50.4 4.6	00	2.069	0.000
Body diameter	$\overline{X}$204 SD8.1	X205 SD7.2	+1	2.069	0.08
Lean body Weight	$\overline{X}$49.5 SD5.4	X49.9 SD5.3	+0.4	2.069	0.41
Body density	$\overline{X}$1.072638		+0.0021	2.069	0.002
Percent body Fat	X1.074704 $\overline{X}$11.8 1.5	X11.2 0.8	-0.6	2.069	0.061

Gross Body Weight

Results in table 1 revealed that the prevalence mean of 50.4± 4.6 of the experimental group for gross body weight has the same as that of the post-value mean. The control groups' pre-value mean for gross body weight of 47.± 3.5 remain the same according to table 2.

Hypothesis 1: There would be no significant effect on the gross body weight of senior secondary school students for aerobic capacity training.

The computed t-test for the experimental group in table 1 of 0.000 at 0.05 level of significance, while the tabular value is 2.069. The control group did not also show any

training effect. The implication of this is that, the null hypothesis of no significance difference is upheld.

Table 2: Descriptive statistics of Pre-test and post-test Anthropometric Measures for the Control Group

Variables	N = 14 Pre-values	Post-value	Pre-Post Mean Difference	Tabular 't'	Calculation 't'
Gross body Weight (kg)	$\overline{X}$47.1 SD3.5	$\overline{X}$47.1 3.5	00	2.069	0.00
Body diameter	$\overline{X}$199 SD4.1	$\overline{X}$199 4.1	00	2.069	0.00
Lean body Weight	$\overline{X}$48.6 SD5.4	$\overline{X}$48.6 SD5.3	00	2.069	0.00
Percent body Fat	$\overline{X}$12.1 SD0.16	$\overline{X}$12.1 0.16	0.2	2.069	0.052
Body density	1.106	1.106	0	2.029	000

Sum of Body Diameter

The pre-value mean sum of body diameters for the experimental group in table 1 was 204± 8, while the post-value mean of 205 ± 7.2 was obtained. Therefore has a decrease of 1kg which shows that the training had little effect on the students.
The control group (table 2) showed no difference between the pre and post values.

Hypothesis 2: There would be no significant effect on the body diameters of senior secondary school students after aerobic capacity training.
Table 1 shows that the computed t-test of 0.08 was not statistically significant when compared with the tabular value of 2.069 at 0.05 level of significance. The control group in table 2 show an insignificant t- value of 0.00, and there the null hypotheses of no significance holds.

Lean Body Weight

The pre-value mean for the experimental group in table 1 for lean body weight was 49.5± 5.4 as against the post-value mean of 49.9± 5.3. The control group (table 2) showed no training effect.

Hypothesis 3: There would be no significant effect on the lean body weight of senior secondary school students after aerobic capacity training.

The calculated t – test of 0.41 for the experimental group was found to statistically non-significant at the tabular value of 2.009 was greater than it. The control group (table 2) showed no difference between pre and post-values, therefore, the null hypothesis is upheld.

Body Density: The pre-value mean was 1.072638± 0.003, while the post-value mean was 1.074704, which shows little improvement of +0.0021. In the control group (table 2), body density was not altered since the pre and post-value mean value remain same.

Hypothesis 4: There would be no significant effect on the body density of senior secondary school students after aerobic capacity training.
Table 1 and 2 shows that the computed t- test values of 0.002 and 0.00 for the experimental and control groups respectively, were not statistically significant with the tabular value of 2.069. Therefore, the null hypothesis is accepted.

Percent Body Fat: Table 1 shows the percentage of body fat for pre-value mean as 11.8±1.5, while that of the post-value mean was 11.2± 0.8. The training effect reduced the percentage of their body fat by -0.6, while the control 0.2 in difference between pre and post-test values.

Hypothesis 5: There would be no significant effect on the percent body fats of senior secondary school students after aerobic capacity training.

Results in table 1 revealed that the computed t-test of 0.061 on percentage body fat for the experimental group was not statistically significant when compared to the tabular value of 2.069. The calculated t-test of 0.057 for the control group was also not significant, therefore, the null hypothesis of no significant difference is upheld.

Hypothesis 6: There would be no significant effect on systolic blood pressure of senior secondary school students after aerobic capacity training.

Table 3: Experimental and Control Groups Pre-test and Post-test Diastolic Blood Pressure Changes

Group	**variables**	**N=14 Pre-values**	**Post-value**	**Dif. $\overline{X}$**	**Tabular "t"**	**Calculated "t'**	**Inference**
Experimental	Diastolic BP (mmHg)	$\overline{X}$76 SD3.9	$\overline{X}$75 4.0	-1	2.069	0.05	Null hypothesis Accepted
Control	Diastolic BP (mmHg)	$\overline{X}$75 SD4.0	$\overline{X}$75 4.0	0	2.069	0.00	Null hypothesis Accepted

Results in table 3 shows that the experimental pre-value mean was 76 mmHg ±3.9, while the post-value mean was 25± 4.0 respectively, and the pressure yielded a reduction of -1. There was no mean difference for the control group. In connection with hypothesis 6, the null hypothesis of no significant difference is accepted since the calculated t-test was lesser than the tabular value i.e., 0.05< 2.069.

Table 4: Experimental and Control Groups Pre-test Systolic Blood Pressure Changes

Group	variables	N=14 Pre-values	Post-value	Dif. $\overline{X}$	Tabular "t"	Calculated "t'	Inference
Experimental	Diastolic BP (mmHg)	$\overline{X}$117s SD60	$\overline{X}$108 SD13.0	-9	2.069	0.294	Null hypothesis Accepted
Control	Diastolic BP (mmHg)	$\overline{X}$116 SD14.1	$\overline{X}$116 141	0	2.069		Null hypothesis Accepted

The results in table 4 revealed the experimental pre-value mean of 117± 6.0 for systolic blood pressure differs from the post-value means of 108± 13.0. There was an alteration of -9 after aerobic capacity training.

Hypothesis 7: There would be no significant effect on the systolic blood pressure of senior secondary school students after aerobic capacity training.

The calculated t-test of 0.294 for the systolic blood pressure is lesser than the tabular value of 2.069 at 0.069 at 0.05 level of significance, indicating that the null hypothesis is accepted. The control groul did not record any significant difference either.

Table 5: Experimental and Control Groups Pre-test and Post-test Heart Rates (HR)

Group	variables	N=14 Pre-values	Post-value	Dif. $\overline{X}$	Tabular "t"	Calculated "t'	Inference
Experimental	Heart Rate (Beats/Min)	$\overline{X}$67.1 SD5.5	$\overline{X}$65.3 3.8	-1.8	2.069	0.07	Null hypothesis Accepted
Control	Heart Rate (Beats/Min)	68.2 SD4	68.1 5.7	-0.1	2.069		Null hypothesis Accepted

Table 5 revealed that, the experimental pre-value mean of 67.1± 5.5 and the pre-values mean of 65.3± 5.7, show a slight difference of -1.8 beats per minute. The control group on the other hand, showed no difference in mean between both tests.

Hypothesis 8: There would be no significant effect on the resting heart rate of senior secondary school students after aerobic capacity training.

The experimental group calculated t-test of 0.07 was lesser in value than the tabular value, signifying a no significant effect at 10.05 significant level, indicating the acceptance of the null hypothesis. The control group did not also show any significant level.

Table 6: Longitudinal Evaluation of Cardiorespiratory Fitness/Endurance of Male Participants

Fitness Category	12-Minutes run 400m (Laps) Norm	12-Minutes 400m (Laps) Obtained
Super	18.0 17.5 17.0	14.4 F 17.0 W 16.3 M — 12th week
Excellent	16.5 16.0 15.5	15.9 F 15.2 W 15.0 M — 11th week
Good	15.0 14.5 14.0	14.6 F 13.9 W 13.2 M — 10th week
Average	13.5 13.0 12.5	12.6 F 12.2 W 11.4 M — 9th week
Fair	11.5 11.0 10.5	10.9 F 10.5 W 10.00 M — 8th week
Poor	10.5 10.0 9.5	9.96 F 9.95 F 8.60 M — 7th week
Very poor	9.0 8.5 8.0	8.01 F 8.00 W 7.96 M — 6th week 7.45 F 7.00 W 6.92 M — 5th week 6.71 F 6.65 6.16M — 4th week 6.00 F 5.94 W 5.91 M — 3rd week 5.72 F 5.52 W 5.40 M — 2nd week 4.36 F 4.32 W 4.29 M — 1st week

Results of Cooper Test 12-minute run

Table 6 reflects Getchell's (1979) 12- minute run (400m) norm being compared with the 12- minutes run (400m) values obtained in the present study. The first test for the week which serves as the pre-test value shows that the participants' fitness level of (4.29) was very poor. The participant could only attain a value of (9.96) a little above (9.5) which is the minimum value for very poor fitness category only during the 7th week of training. A little above (10.9) the minimum poor category of fitness (9.5) was attained during the first training of the 8th week. The participants reached a fair fitness level of (11.0-120) during the 9th week when they operated between (11.4 – 12.6). An average fitness of 13.2 – 14.6) as against (12.5 – 13.5) was attained only during the 10th week of training. The participant were able to reach a good fitness level during the 11th week of training when they attained the range of (15.0 – 15.9) as against the accepted range of (14.0- 15.0). The last fitness level which served as the post-training value the participants were able to attain a fitness value of 17.4, which is within the excellent category of fitness. At the last Wednesday and Friday they got to the super level with fitness value of (17.0 – 17.4)

Discussion of Result

The discussions of the study was centered on the anthropometric measures and as well as the cardiovascular and cardiorespiratory variables whose results were analysed.

Gross Body Weight: There was no change in the gross body weight for this study and it was probably due to the mode of the training with respect to the age of the participant. Fox and Mathews (1981) and Agwabike and Oboh (2005) also reported insignificant changes in the same variable.

Sum of Body Diameters: The participants initially loosed weight but gained more weight as the research progressed. This result of no significant difference was in line with a pilot study done by Ighomo (2005), but was at variance with those of Agwubike and Oboh (2005) and Smith (2013).

Body Density: The aerobic capacity training did not significantly alter the body density of the participants. This result is in conformity with those reported by Nwankwo (1984) and Ababe (1984) as well as Donnel (2000).

Lean Body Weight: The result revealed that there was no significant difference in the participant's lean body weight as a result of the aerobic capacity training, therefore, did not agree with results obtained by Fox and Matthews (1981) and Archiem (1991). This was probably due to the tested variables.

Percent Body Fats: Although the study reported a slight change in the percent body fats of the participants, but it was not found significant at 0.05 level of significant. The result was at variance with those of Agwubike and Oboh (2005) and Agwubike (2002). The finding of Oboh (2006) is in consonant with the findings of this study.

Blood Pressure: The diastolic and the systolic blood pressure were assessed for the participants after the aerobic capacity training. Both blood pressure systems showed no significant level at 0.05 level of significant. Both results failed to agree with the findings of Oboh (2006) Agwubike (2002), Agwubike and Oboh (2005).

Heart Rate: The heart rates for the experimental participant increase no significantly as indicated by the acceptance of the null hypothesis of no significant. The control group did not show any appreciable significant level too.

Cardorespiratory and cardiovascular endurance was determined before and after a 12 week aerobic capacity training programme by estimating the maximal oxygen consumption ($MaxVo_z$) of the participants through the distance covered during te 12 – minute run test which the Getchell's normative fitness categories assessed. The intensity, duration and the frequency of exercise are essential components in stimulating cardiorespiratory adaptation, in response to training. Therefore, this study showed significant alteration of the participants' cardiorespiratory and cardiovascular endurance fitness. Since the control group that was not subjected to any aerobic capacity training showed no changes in the fitness test, the changes experienced by those in the experimental group may be attributable to training effect.

Summary and Conclusion

This study was conducted to find out the effects of aerobic capacity training on the anthropometrics, cardiovascular and cardiovascular endurance of selected senior secondary school students in Agbor town. The findings of this study revealed that all the null hypotheses generated under anthropometrics were accepted based on their non-significant differences. This indicates that the aerobic capacity training did not significantly alter the participant's anthropometrics, which means that it is not a suitable approach for altering anthropometrics. Aerobic capacity training on the other hand appears to be a suitable approach for improving an individual's cardiorespiratory and cardiovascular endurance fitness.

Recommendations

The following were the recommendations proffered consequent upon the findings of this study:

1. Aerobic capacity training is a very useful tool in enhancing cardiorespiratory and cardiovascular endurance of youth's fitness level.
2. Aerobic capacity training is not suitable for anthropometric fitness for secondary school students.
3. A combination of other training protocol should be added to test for students anthropometric measures.
4. Further research should be conducted on the aerobic capacity training programme with extended period in weeks to discover the optimum duration at which participants' body components and other physiological variables would be significantly altered.

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