Physiological Effect of a 10-Week Aerobic Exercise Programme on Female Hypertensive Members in Imo State, Nigeria

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Abstract: The purpose of this study was to determine the impact of a 10-week aerobic exercise programme on resting systolic blood pressure, resting heart rate and respiratory rate of female hypertensive members of Recreation Clubs in Owerri Municipal Council of Imo State. The study was guided by three research questions and three corresponding null hypotheses. The study adopted randomized pretest–posttest control group design. In this multivariable trials; 108 female hypertensive members constituted the population of the study, and 50 volunteers (30 experimental, 20 control) were used as the sample size of the study. A Sphygmomanometer model DM-500 was used to measure blood pressure, while standardized Stethoscopes models LG300 and HG900 were used to measure heart rate and respiration rate, respectively. The study examined the fundamental assumptions of homoscedasticity (using Levene's Test), normality (using the Shapiro-Wilk and Kolmogorov-Smirnov tests), and homogeneity of regression slopes (using the ANCOVA model's interaction term), all of which were met; hence, ANCOVAwas confidently employed for the analysis. For the research questions, mean and standard deviation were used to analyze the data, and ANCOVA was used to test the hypotheses at a 5% significant level. After the 10-week aerobic exercise programme, the results showed notable gains. Resting heart rate dropped from 99.60 bpm to 92.37 bpm (mean difference = 7.23 bpm, $p < 0.05$), respiratory rate dropped from 20.43 breaths per minute to 18.43 breaths per minute (mean difference = 2.00 breaths per minute, $p < 0.05$), and resting systolic blood pressure dropped from 149.13 mmHg to 139.23 mmHg (mean difference = 9.9 mmHg, $p < 0.05$). These findings support aerobic exercise's potential involvement in lowering cardiovascular risk by demonstrating that it is a successful non-pharmacological strategy for controlling important physiological markers of hypertension. This study contributes to the increasing amount of data demonstrating the benefits of aerobic exercise for lowering blood pressure and enhancing cardiovascular health.

Keywords: Physiological variables, Aerobic exercise programme, resting systolic blood pressure, resting heart rate, resting respiratory rate, female hypertensive members.

1. Introduction

The human body's physiological parameters, including heart rate, respiratory rate, and systolic blood pressure, are important markers of cardiopulmonary health. People may be more susceptible to major health consequences, such as hypertension, stroke, kidney failure, or even death, if these indicators are higher or lower than normal [1].

The force of circulating blood against blood vessel walls is known as blood pressure (BP). It is commonly expressed in millimeters of mercury (mmHg) and expressed as systolic pressure over diastolic pressure. Adults typically have a resting blood pressure of 120/80 mmHg. A systolic measurement of 140 mmHg or more is regarded as abnormal and suggestive of hypertension, a condition linked to increased cardiovascular risk and premature mortality [2]. Systolic blood pressure is the peak pressure in the arteries during heart contraction. Over a billion people worldwide suffer from hypertension, which is a serious global health burden that greatly increases the risk of cardiovascular illness and death [3]. Since poor lifestyle choices and physical inactivity are known causes of high blood pressure, changing one's lifestyle is essential to prevention and management techniques [4].

The number of heart-beats per minute (bpm) is known as the heart rate. Adults typically have a resting heart rate between 50 and 100 beats per minute. Higher resting heart rates may be connected to an increased risk of cardiovascular disease, while lower resting heart rates are often linked to improved cardiovascular fitness [5]. In order to meet the body's need for oxygen and nutrients to reach functioning muscles, the heart rate rises during physical exercise. Regular exercise lowers resting heart rate and increases cardiac workload capacity by strengthening the heart muscle over time, allowing it to pump blood more effectively with fewer beats per minute.

The number of breaths taken in a minute is referred to as respiratory rate. A normal range for healthy persons at rest is 12–20 breaths per minute [6]. Variations outside of this range could be a sign of poor metabolic or respiratory health. The body's increased need for oxygen during physical activity causes the respiratory rate to rise. By facilitating gas exchange, this elevated breathing rate helps muscles get more oxygen and remove carbon dioxide more efficiently [7]. By strengthening lung function and the synchronization of the cardiovascular and respiratory systems, regular exercise can eventually increase respiratory endurance and efficiency.

High blood pressure, or hypertension, is still one of the most prevalent and dangerous cardiovascular diseases in the world [8]. It is characterized by persistently high blood pressure readings that are higher than advised limits, and it raises the risk of coronary heart disease, stroke, renal disease, and premature death by a considerable margin. Since many people with hypertension have no symptoms, it is frequently referred to as a "silent killer." Dietary adjustments, weight control, stress reduction, and regular exercise are all effective management techniques.

Aerobic exercise is defined as prolonged physical activity that increases breathing and heart rate while using large muscle groups in a rhythmic manner for a prolonged amount of time [9]. Brisk walking, jogging, cycling, swimming, and organized fitness classes are examples of common forms. Frequent aerobic exercise increases cardiac output, enhances oxygen utilization, and lowers peripheral resistance in blood vessels, all of which increase the heart's and lungs' efficiency. This results in better respiratory function and cardiovascular health, as seen by decreases in resting heart rate and blood pressure [10]. Increased mitochondrial density, greater endothelial function, and improved autonomic balance are just a few of the cardiovascular system adaptations that aerobic exercise promotes. Over time, these adaptations lead to decreased blood pressure and improved heart and lung function.

As a first-line lifestyle strategy for controlling hypertension, moderate-intensity aerobic exercise is consistently recommended by clinical and public health guidelines [11]. When sustained over time, regular aerobic exercise has been demonstrated to significantly reduce cardiovascular risk by lowering both systolic and diastolic blood pressure in individuals with hypertension by about 5–7 mmHg [12]. Regular aerobic exercise also promotes enhanced metabolic health, stress reduction, and healthy weight management, all of which enhance cardiovascular function and general quality of life.

Aerobic exercise's combined effects on blood pressure, heart rate, and respiratory rate in hypertensive persons show a comprehensive improvement in cardiopulmonary regulation. Reduced sympathetic nervous system activity, increased baroreceptor sensitivity, and greater vascular compliance are some of the processes that drive exercise-induced drops in resting blood pressure [13]. Increases in respiratory capacity indicate better oxygen delivery and consumption, whereas decreases in resting heart rate indicate increased cardiac efficiency. All of these answers show how planned aerobic exercises are useful non-pharmacological methods for controlling high blood pressure and enhancing cardiovascular health.

1.1 Objective of the Study

The primary objective of this study was to examine the physiological effects of a 10-week aerobic exercise programme on systolic blood pressure, heart rate, and respiratory rate in female hypertensive members of Recreation Clubs in Owerri Municipal Council, Imo State. Specifically, the study aimed to assess the impact of the 10-week aerobic exercise programme on:

- The resting systolic blood pressure of female hypertensive members of Recreation Clubs in Owerri Municipal Council;
- The resting heart rate of female hypertensive members of Recreation Clubs in Owerri Municipal Council;

- The resting respiratory rate of female hypertensive members of Recreation Clubs in Owerri Municipal Council.

1.2 Research Questions

- To what extent does a 10-week aerobic exercise programme influence the resting systolic blood pressure of female hypertensive members in Recreation Clubs within the Owerri Municipal Council of Imo State?
- To what extent does a 10-week aerobic exercise programme affect the resting heart rate of female hypertensive members in Recreation Clubs within the Owerri Municipal Council of Imo State?
- What impact does a 10-week aerobic exercise programme have on the resting respiratory rate of female hypertensive members in Recreation Clubs within the Owerri Municipal Council of Imo State?

1.3 Research Hypotheses

At 5% level of significance, these null hypotheses were tested

H_{O1}: There is no significant influence of a 10-week aerobic exercise programme on the systolic blood pressure of female hypertensive participants.

H_{O2}: There is no significant effect of a 10-week aerobic exercise programme on the heart rate of female hypertensive participants.

H_{O3}: There is no significant impact of a 10-week aerobic exercise programme on the respiratory rate of female hypertensive participants.

2. Related Work/Literature Review

The effects of aerobic dance on systolic blood pressure in stage one hypertensive adults in Uganda were carried out by [14]. The goal was to find out how a 12-week aerobic dance program affected the systolic blood pressure (SBP) of persons with stage one hypertension. An experimental research design was used in the study. Of the 58 adults with stage 1 hypertension who were randomly assigned to the experimental and control groups, 36 finished the program. A mercury sphygmomanometer was used to assess SBP both before and after the program. While the control group carried on with their normal activities, the experimental group trained three times a week for 45 minutes each session at a moderate level. SPSS V.20 was used to analyze the data. The mean differences between the two groups were compared using a two-tailed t-test. Statistical significance was defined as a p value of less than 0.05. According to the findings, the experimental group's baseline mean SBP was 143.83±6.382 mm Hg, whereas the control group's was 137.61±6.400 mm Hg. The experimental group's mean SBP dropped to 136.33±9.191 mm Hg after a 12-week aerobic dancing program, while the control group's climbed to 139.56±9.954 mm Hg. This suggests that the 12-week aerobic dance program decreased the experimental group's SBP by –7.50 mm Hg, while the control group's SBP increased slightly by 1.50 mm Hg. Following a 12-week aerobic dancing program, the results were statistically significant ($p<0.002$). The aerobic dancing program successfully controlled the SBP of persons with stage 1 hypertension, according to the study's findings. The study suggested that as a non-pharmacological approach to hypertension control protocols, stakeholders and policymakers in Uganda should think about implementing aerobic dancing.

According to [15] who conducted a study at a school in Chitungwiza, Zimbabwe, investigating the effects of an 8-week aerobic dance exercise program on weight loss in overweight children aged 10 and 11. The main goal was to determine whether an aerobic dancing program could help overweight kids between the ages of 10 and 11 lose weight. Fifty kids were split up into two groups: the experimental group and the control group. A bathroom scale was used to measure weight, a stadiometer was used to measure height, a stopwatch was used to measure time, and an aerobic dancing program was employed as an intervention. According to the findings, the patients' weight decreased only slightly over the 8-week aerobic dancing intervention. During the eight-week aerobic exercise program, the subjects' weight loss and BMI showed very little variation. The study also found that there was a favorable prediction for the ongoing impact of aerobic dancing exercise on weight loss, even though the marginal improvements during the intervention were not significant. According to the study, children's aerobic dance workouts require a suitable aerobic dance model in order to influence body composition in terms of weight loss. The results of the study also showed that weight reduction interventions need to be carried out consistently over an extended period of time, and studies should focus on figuring out how to measure weight reduction in children and young people using waist circumference percentiles in addition to BMI percentiles.

According to [16] who conducted a comprehensive evaluation of randomized controlled trials conducted over the previous ten years to examine the effects of aerobic exercise on health management in older individuals with hypertension. In order to systematically assess the impact of aerobic exercise on important health management metrics like blood pressure, heart rate, and cardiorespiratory fitness in older hypertension patients, the study was built on the PICO paradigm. From April 2014 to April 2024, a comprehensive search of randomized controlled trials was conducted across four Chinese language databases (CNKI, VIP, Wanfang, and Sinomed) and four English language databases (Web of Science, PubMed, Cochrane, and Embase). Data analysis was done using StataCorpStata v.18.0. The mean difference was used to represent continuous variables in a random-effects meta-analysis, and a 95% confidence interval was used to represent each effect size. There were nine randomized controlled studies totaling 484 individuals. The results of the meta-analysis showed that aerobic exercise participants significantly decreased their heart rate (SMD = – 1.78, 95% CI = – 3.31 to – 0.24, P = 0.024), diastolic blood pressure (SMD = – 0.48, 95% CI = – 0.75 to – 0.21, P = 0.001), and systolic blood pressure (SMD = – 0.93, 95% CI = – 1.48 to – 0.39, P = 0.001), as well as cardiorespiratory health (SMD =0.71, 95% CI =0.24 to 1.18, P = 0.003). According to the study's findings, older patients with hypertension who are 60 years of age or older should perform 120–150 minutes of low-to-moderate-intensity aerobic exercise per week, aiming to maintain a maximum heart rate of 40–75% or a maximum oxygen consumption of 40–60% (20–30 minutes per day, five days a week, or 75–150 minutes of exercise only once or twice a week). People must, however, evaluate their personal health, change their schedules accordingly, and progressively increase the amount of time and intensity of their exercise. In order to minimize implementation and measurement bias, future randomized controlled trials should employ central randomization with blinded assessment.

The effects of a 12-week aqua fitness program on the physical fitness of women over 60 were studied by [17]. Using the Senior Fitness Test to gauge gains in physical capabilities, they concentrated on assessing the program's efficacy. Thirty volunteers who were 60 years of age or older participated in an experimental study design. There were 15 participants in each of the two groups: the experimental group and the control group, workouts for aqua fitness were given to the control group, whereas isometric (combined) and aqua fitness workouts were given to the experimental group. The Senior Fitness Test was used to evaluate dynamic balance, agility, endurance, lower and upper limb muscle strength, and lower and upper body flexibility. Both before and after the course, assessments were carried out. Combining workouts (aqua fitness and isometric exercises) significantly impacted the group's dynamic balance, agility, endurance, lower and upper limb muscular strength, lower body flexibility, and upper body flexibility on the right side. Only aqua fitness workouts had a substantial impact on lower body flexibility, endurance, and upper limb muscle strength, but no significant impact on other variables. The effects of aqua fitness exercises and combined workouts on lower limb muscle strength, upper limb muscle strength, lower body flexibility, upper body flexibility, and endurance did not differ significantly between the groups. Only dynamic balance and agility showed significant differences between the two water fitness and combination exercise groups. The study found no significant difference between the two groups, even though the combination program (aqua fitness and isometric exercises) improved older persons' physical fitness more than aqua fitness alone. As a result, the study's findings demonstrated how water fitness might help older adults maintain their physical fitness and overall health.

3. Materials and Methods

Experimental Methods

The randomized pretest-posttest control group designwas adopted for this study, a robust experimental approach widely used in behavioral sciences research. This design involves two groups: an experimental group that receives the intervention (Aerobic exercise program) and a control group that does not. By randomizing the assignment of participants to each group, the study minimizes the influence of confounding variables, ensuring that any observed differences are directly attributed to the intervention. The random assignment helps eliminate biases that may arise from pre-existing differences between participants. The design also allows for comparison between the groups' pretest and posttest measures to assess the effect of the Aerobic program on systolic blood pressure, resting heart rate and respiratory rate. This approach is particularly suitable for evaluating the effectiveness of health interventions, such as the Aerobic exercise program, on physiological parameters like systolic blood pressure, heart rate and respiratory rate [18].

Procedure

The study focused on female hypertensive members of the Recreation Clubs in Owerri Municipal Council, Imo State, as the target population. According to the Recreation Club Record, the total number of hypertensive females in the clubs was 108. From this population, 50 hypertensive female volunteers were selected through a random sampling process. Before beginning the study, all participants were required to sign a Physical Activity Readiness Questionnaire (PAR-Q) to ensure they were fit for the physical activities involved in the Aerobic exercise program. The participants were then randomly assigned to either the experimental group (30 participants) or the control group (20 participants) through balloting without replacement. The experimental group participated in the Aerobic exercise program, while the control group did not receive any intervention. This randomization process ensured that both groups were comparable at the outset of the study. Throughout the study, the participants' resting systolic blood pressure, resting heart rate and respiratory rate were measured at two key points: prior to the intervention (pretest) and after the intervention (posttest). The pretest and posttest measurements enabled the assessment of any changes that occurred as a result of the intervention.

Design

The study employed a randomized pretest-posttest control group design, which is effective for isolating the effects of an intervention by comparing the changes in the experimental group with the control group. The pretest measurements of resting systolic blood pressure, resting heart rate and resting respiratory rate provided baseline data for both groups. After the intervention, the posttest measurements were taken to assess any changes that could be attributed to the Aerobic exercise program. The primary objective of the study was to evaluate whether the Aerobic exercise program had a statistically significant impact on the resting systolic blood pressure, resting heart rate and resting respiratory rate of hypertensive females. To achieve this, the analysis focused on comparing the changes between the experimental and control groups. Analysis of Covariance (ANCOVA) was used to test the hypotheses at a 5% significance level, allowing for the comparison of the treatment effects while controlling for any potential confounding variables. This design provided a clear, controlled method to examine the effect of the Aerobic exercise program on the selected physiological outcomes.

4. Results and Discussion

Before testing the hypotheses, the basic assumptions of normality, Homoscedasticity and Homogeneity of Regression Slopeswere checked as follows:

4.1.1 Test of Normality Assumption

This test was carried out using the Kolmogorov-Smirnov and Shapiro-Wilk techniques as displayed in Table 1.

Table 1: Test for Normality Result Summary

		Kolmogorov-Smirnov			Shapiro-Wilk		
	Group	Statistic	Df	p-value	Statistic	df	p-value
HR Before	Experimental	0.093	30	0.200*	0.957	30	0.259
	Control	0.143	20	0.200*	0.955	20	0.457
HR After	Experimental	0.111	30	0.200*	0.964	30	0.390
	Control	0.143	20	0.200*	0.955	20	0.457
SBP Before	Experimental	0.088	30	0.200*	0.971	30	0.576
	Control	0.135	20	0.200*	0.947	20	0.318
SBP After	Experimental	0.084	30	0.200*	0.981	30	0.856
	Control	0.134	20	0.200*	0.947	20	0.330
RR Before	Experimental	0.117	30	0.200*	0.961	30	0.321
	Control	0.175	20	0.108	0.936	20	0.199
RR After	Experimental	0.139	30	0.146	0.951	30	0.178
	Control	0.140	20	0.200*	0.939	20	0.225

The null hypothesis of normality satisfaction is not rejected for either test because all of the test p-values are greater than 0.05, indicating that the normality assumption is not significantly refuted. This implies that a normal distribution is followed by the data for all variables (HR, SBP, RR, before and after for both experimental and control groups). The study can thus infer from these findings that every variable in both the experimental and control groups has a normal distribution. Since all of the p-values are higher than 0.05, which suggests that there isn't any strong evidence to contradict the normalcy assumption, the null hypothesis of normality satisfaction is not rejected for each test. This suggests that the data for all variables (HR, SBP, RR, before and after for both experimental and control groups) follow a normal distribution. Based on these results, it is determined that each variable in the experimental and control groups has a normal distribution.

4.1.2 Test of Homoscedasticity Assumption

This test was carried out using the Levene's technique, and the assumption suggests that the variance of the dependent variable is the same across the levels of the independent variable. Thus, the results are summarizedas displayed in Table 2.

Table 2: Test for Homoscedasticity Result Summary

	Group	N	Mean	SD	p-value for Levene's Test for Equality of Variances
HR Before	Experimental	30	99.6000	11.14048	0.787
	Control	20	96.5000	10.37456	
HR After	Experimental	30	92.3667	11.46053	0.709
	Control	20	96.5000	10.37456	
SBP Before	Experimental	30	149.1333	4.54657	0.236
	Control	20	145.3500	9.59317	
SBP After	Experimental	30	139.2333	5.30246	0.142
	Control	20	145.2500	9.55249	
RR Before	Experimental	30	20.4333	1.90613	0.209
	Control	20	22.3500	2.25424	
RR After	Experimental	30	18.4333	1.73570	0.188
	Control	20	22.2000	2.41922	

For all variables (HR, SBP, and RR, both before and after measurements), the p-valuesfor Levene's Test are greater than 0.05. This means that the assumption of equal variances (homogeneity of variances) is not violated for any of the variables. Therefore, the study could confidently proceed with ANCOVA, as the homoscedasticity assumption is satisfied.

4.1.3 Test of Homogeneity of Regression Slopes Assumption

This test was carried out in order to examine the interaction term between the group variable (e.g., Group: Exercise vs. Control) and the covariate (e.g., SBP Pretest, HR Pretest and RR Pretest) must be tested. The summary result is shown in Table 3.

Table 3: Test for Homogeneity of Regression Slopes Result Summary

Dependent Variable	Source	F	p-value	PES	Interpretation
SBP Posttest	Group	0.281	0.599	0.006	No significant effect of Group on SBP Posttest.
	SBP Pretest	343.972	0.000	0.882	No significant interaction between Group and SBP Posttest
	Group* SBP Pretest	0.008	0.931	0.000	No significant interaction between Group and SBP Pretest. The relationship between SBP Pretest and SBP Posttest is the same across both groups, satisfying the homogeneity of regression slopes assumption.
HR Posttest	Group	7.704	0.008	0.143	Significant effect of Group on HR Posttest.
	HR Pretest	3597.921	0.000	0.987	HR Pretest is a significant predictor of HR Posttest.
	Group* HR Pretest	0.336	0.565	0.007	No significant interaction between Group and HR Pretest. The relationship between HR Pretest and HR Posttest is the same across both groups, satisfying the homogeneity of regression slopes assumption.
RR Posttest	Group	2.879	0.096	0.059	No significant effect of Group on RR Posttest.
	RR Pretest	398.985	0.000	0.897	RR Pretest is a significant predictor of RR Posttest.
	Group* RR Pretest	0.041	0.841	0.000	No significant interaction between Group and RR Pretest. The relationship between RR Pretest and RR Posttest is the same across both groups, satisfying the homogeneity of regression slopes assumption.

After determining that the interaction term for Group * RR Pretest is non-significant, the results in Table 3 demonstrate that the homogeneity of regression slopes assumption is met for all three dependent variables (SBP Posttest, HR Posttest, and RR Posttest). The related Posttest values are significantly predicted by the SBP Pretest, HR Pretest, and RR Pretest, suggesting that baseline data are crucial in understanding the variation in post-exercise outcomes. The HR Posttest is significantly impacted by the Group variable, whereas the SBP and RR Posttests are not much impacted. The study hypotheses and the related research questions were then accomplished after the three fundamental ANCOVA assumptions were met.

Research Question 1

To what extent does a 10-week aerobic exercise programme influence the resting systolic blood pressure of female hypertensive members in Recreation Clubs within the Owerri Municipal Council of Imo State?

Table 4: Descriptive Analysis for Resting Systolic Blood Pressure (n = 30)

Test	n	$\bar{x}$	SD	MD
Pre-test	30	149.13	4.55	
Post-test		139.23	5.30	9.9

Key: n = Number of Participants, $\bar{x}$ Mean, SD = Standard Deviation, MD = Mean Difference

The results for the first research question are displayed in Table 4. The outcome shows that the treatment group's resting systolic blood pressure mean and standard deviation were 149.13 ± 4.55 prior to treatment and 139.23 ± 5.30 following treatment, with a mean deviation of 9.9. This result shows that the hypertensive individuals' systolic blood pressure actually decreased by 9.9 mmHg as a result of the treatment.

Testing of Hypothesis One

H_{O1}: There is no significant influence of a 10-week aerobic exercise programme on the systolic blood pressure of female hypertensive participants.

Table 5: **ANCOVA Summary on the Effect of Aerobic Exercise on Resting Systolic Blood Pressure (n = 50)**

Source	SS	DF	MS	F	Sig.	PES
CM	2749.139	2	1374.569	275.640	.000	.921
I	1.688	1	1.688	.339	.563	.007
Pretest	2314.735	1	2314.735	464.169	.000	.908
Group	**1068.031**	**1**	**1068.031**	**214.170**	**.000**	**.820**
E	234.381	47	4.987			
T	1006078.000	50				
CT	2983.520	49				

CM=Corrected model, CT=Corrected total, T=total, E=error, I=intercept, PES=Partial Eta Squared

The 10-week aerobic exercise program has a statistically significant impact on resting systolic blood pressure (SBP), according to the results in Table 5. Since the Group's p-value is 0.000, less than 0.05, H_{O1}, which indicated no significant effect, is discarded. As a result, SBP is significantly impacted by the aerobic exercise regimen. The group's partial eta squared (PES) is 0.820, meaning that a significant amount (82%) of the variation in SBP after exercise can be explained by the program. Furthermore, with a very large effect size (PES = 0.908), the Pretest score (SBP Before) is likewise a significant predictor of SBP After, indicating that baseline SBP has a considerable impact on post-intervention SBP. Overall, the findings support the conclusion that the 10-week aerobic exercise program is beneficial by showing that it successfully lowers the resting systolic blood pressure of female hypertension participants.

Research Question 2

To what extent does a 10-week aerobic exercise programme affect the resting heart rate of female hypertensive members in Recreation Clubs within the Owerri Municipal Council of Imo State?

Table 6: Descriptive Analysis for Heart Rate (n = 30)

Test	n	$\bar{x}$	SD	MD
Pre-test	30	99.60	11.14	7.23
Post-test		92.37	11.46	

Key: n = Number of Participants, $\bar{x}$ Mean, SD = Standard Deviation, MD = Mean Difference

The outcome for the second research question is displayed in Table 6. According to the results, the treatment group's heart rate mean and standard deviation were 99.60 ± 11.14 before treatment and 92.37 ± 11.46 after treatment, with a mean deviation of 7.23. Following a 10-week aerobic exercise program, participants' heart rates decreased by 7.23 beats per minute (bpm), demonstrating the effectiveness of the treatment training.

Testing of Hypothesis Two

H_{O2}: There is no significant effect of a 10-week aerobic exercise programme on the heart rate of female hypertensive participants

Table 7: **ANCOVA Summary on the Effect of Aerobic Exercise on Heart Rate (n =50)**

Source	SS	Df	MS	F	Sig.	PES
CM	5990.486	2	2995.243	2055.324	.000	.989
I	13.565	1	13.565	9.308	.004	.165
Pretest	5785.473	1	5785.473	3969.968	.000	.988
Group	**621.859**	**1**	**621.859**	**426.717**	**.000**	**.901**
E	68.494	47	1.457			
T	448047.000	50				
CT	6058.980	49				

Table 7's ANCOVA results for Hypothesis 2, which examines whether a 10-week aerobic exercise program has no discernible impact on resting heart rate (HR), offer convincing proof of the program's effectiveness. The aerobic exercise program has a substantial impact on resting heart rate, as evidenced by the Group's p-value of 0.000, which is less than 0.05. Consequently, the null hypothesis (H_{O2}), which proposed no effect, is disproved. This indicates that the study's female hypertension participants' resting heart rates are considerably impacted by the aerobic exercise regimen. With a large effect size of 0.901 for the Group's Partial Eta Squared (PES), the exercise program accounts for 90.1% of the variation in resting heart rate following the intervention. This is a significant effect, indicating that heart rate is significantly impacted by the exercise regimen. With a PES of 0.988, the Pretest score for resting heart rate prior to the exercise program likewise significantly affects the post-intervention heart rate, indicating that the variance in post-program heart rate is primarily explained by baseline heart rate. In conclusion, the findings demonstrate a robust and noteworthy impact of the aerobic exercise regimen on resting heart rate, suggesting that the program is successful in lowering participants' heart rates. H_{o2} is thus disregarded, and the study comes to the conclusion that the exercise regimen significantly affects the female hypertensive participants' resting heart rates.

Research Question 3

What impact does a 10-week aerobic exercise programme have on the resting respiratory rate of female hypertensive members in Recreation Clubs within the Owerri Municipal Council of Imo State?

Table 8: Descriptive Analysis for Respiratory Rate (n = 30)

Test	n	$\bar{x}$	SD	MD
Pre-test	30	20.43	1.91	2.00
Post-test		18.43	1.74	

Key: n = Number of Participants, $\bar{x}$ Mean, SD = Standard Deviation, MD = Mean Difference

The results for the third research question are displayed in Table 8. According to the results, the treatment group's respiratory rate was 20.43 ± 1.91 before treatment and 18.43 ± 1.74 after treatment, with a mean deviation of 2.00. Following a 10-week aerobic exercise program, participants' respiratory rate values decreased by 2.00 breaths per minute (bpm), demonstrating the effectiveness of the treatment training.

Testing of Hypothesis Three

H_{O3}: There is no significant impact of a 10-week aerobic exercise programme on the respiratory rate of female hypertensive participants

Table 9: ANCOVA Summary on the Effect of Aerobic Exercise on Respiratory Rate (n =50)

Source	SS	Df	MS	F	Sig.	PES
CM	345.24	2	172.617	343.972	.000	.936
I	.071	1	.071	.141	.0709	.003
Pretest	174.980	1	174.980	348.682	.000	.881
Group	**38.709**	**1**	**38.709**	**77.134**	**.000**	**.621**
E	23.586	47	.502			
T	20249.000	50				
CT	368.820	49				

Table 9's ANCOVA results for Hypothesis 3, which examines whether a 10-week aerobic exercise program has no discernible impact on resting respiratory rate (RR), shed light on how the exercise program affects respiratory rate. The Group factor's p-value is 0.000, which is less than 0.05. This suggests that the resting respiratory rate of female hypertensive participants is significantly impacted by the aerobic exercise program. The null hypothesis (H_{O3}), which contends that the fitness regimen has no impact, is thus disproved. This indicates that the respiratory rate is significantly impacted by the workout regimen. The Group variable's Partial Eta Squared (PES) is 0.621, indicating a moderate effect size. This indicates that 62.1% of the variation in the resting respiratory rate following the exercise program can be explained by the program. Although not as great as the effects observed for other factors like blood pressure and heart rate, this is nevertheless a significant influence. Furthermore, with a PES of 0.881, the baseline respiratory rate is a strong predictor of the post-intervention respiratory rate, and the pretest score for respiratory rate before to the exercise program also strongly predicts the post-intervention respiratory rate.In conclusion, the results demonstrate a significant impact of the aerobic exercise program on the participants' resting respiratory rate, suggesting that the exercise program is successful in changing their respiratory rate. The study comes to the conclusion that the exercise program significantly affects the resting respiratory rate of female hypertensive participants, rejecting H_{03}.

5. Conclusion

In conclusion, the findings of this study underscore the significant benefits of the 10-week aerobic exercise program on the resting systolic blood pressure, resting heart rate and respiratory rate of female hypertensive members in the Recreation Clubs of Owerri Municipal Council, Imo State. The program resulted in a marked decrease in resting systolic blood pressure from 149.13mmHg to 139.23mmHg, with a mean difference of 9.9 mmHg, which was statistically significant ($p < 0.05$). Again, there is a decrease in resting heart rate, from 99.60bpm to 92.37bpm, with a mean difference of 7.23bpm, which was statistically significant ($p < 0.05$). Similarly, the program led to a reduction in respiratory rate, from 20.43 breaths per minute to 18.43 breaths per minute, with a mean difference of 2.00 breaths per minute, which was statistically significant ($p < 0.05$). These findings suggest that aerobic is an effective non-pharmacological intervention for managing key physiological markers associated with hypertension. The significant decrease in the three physiological variables supports its role in reducing cardiovascular risk. This study contributes to the growing body of evidence supporting the use of aerobic exercises in the management of hypertension and related health issues.

6. Future Scope

While this study demonstrated significant improvements in the physiological variables, future research could explore the following areas to deepen the understanding of aerobics' effects on hypertension:

- Longer Duration and Follow-Up: Conducting studies with extended intervention periods (e.g., 12 weeks or more) and incorporating follow-up assessments could help determine the long-term effects of Aerobic on physiological variables, including whether the benefits are sustained over time.
- Larger and Diverse Sample: Expanding the study to include a more diverse group of participants, such as different age groups, genders, and individuals with varying levels of hypertension, would allow for more generalized findings.
- Combination with Other Interventions: Future studies could investigate the synergistic effects of combining Aerobicwith other interventions, such as dietary changes, medication, or other physical exercises, to assess its effectiveness as part of a holistic approach to hypertension management.
- Mechanisms of Action: More in-depth research into the biological mechanisms underlying the observed reductions in the physiological variables could provide

valuable insights into how Aerobicinfluences the autonomic nervous system and cardiovascular function.

- Comparison with Other Exercises: Further studies comparing the effects of Aerobic with other well-established exercise programs, such as Aerobictraining, on hypertensive individuals could clarify its relative effectiveness in managing heart rate and respiratory health.

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