EFFECT OF AEROBIC DANCE ON GLUCOSE LEVELS AMONG OBESE FEMALE STUDENTS AT THE UNIVERSITY OF CALABAR, CROSS RIVER STATE, NIGERIA

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Abstract
The research investigated the effect of glucose levels among obese female students. A one-group repeated measures design was employed, and participants aged 19–25 were purposively selected based on their BMI. Specifically, female students with a BMI ranging from 30.0 to 34.9kg/m2, aged 19 to 25, and students whose glucose levels ranged from 117-137mg/dL [6.5-7.6mmol/L] were included. Data collection utilized a Glucose meter (Accu-Chek, Aviva Plus, Japan), ensuring all selected participants met the inclusion criteria. These students were assigned to a group-based aerobic dance programme with pre-test values at the baseline. The aerobic dance sessions, lasting 30 to 45 minutes with a cool-down, occurred on alternate days (Mondays, Wednesdays, and Fridays) between 4:30 p.m. and 6:00 p.m. for twelve consecutive weeks. The training intensity ranged from 45-50% of the estimated maximum Heart Rate for the first 4 weeks, increased to 50–55% for weeks 5–8, and further increased to 55–60% from weeks 9-12 of the aerobic dance protocol. One-way ANOVA was used as the statistical analysis of the collected data, using SPSS version 20 and the independent t-test at a 0.05 alpha level, indicated significant effects of glucose level (P = 0.001). The study concluded that a 12-week aerobic dance programme had a significant effect on the glucose levels of obese female students. Recommendations included encouraging obese female students to engage in regular physical activities, particularly aerobic dance, to mitigate cardiovascular disease risks associated with obesity. Additionally, there was a suggestion for increased awareness and a shift from sedentary lifestyles to an exercise-oriented attitude among obese female students.
Keywords: Glucose levels, Aerobic dance, Female students, and Obesity.

Introduction

Diabetes is a chronic health problem with devastating, yet preventable consequences. It is characterized by high blood glucose levels resulting from defects in insulin production, insulin action, or both.(Centers for Disease Control and Prevention [CDCP], 2017). Globally, the rate of type 2 diabetes was 15.1 million in 2000,(Zimmet,Alberti& Shaw, 2012) the number of people with diabetes worldwide is projected to increase to 36.6

million by 2030 (Hossain,Kawar&Nahas, 2017). In 2017, 23.6 million people, or 7.8% of the United States population had type 2 diabetes. Of these, 90-95% of these cases were adults with type 2 diabetes. Type 2 diabetes impacts men and women proportionately; there are over 12 million men with diabetes and 11.5 women with diabetes. In adult patients, 6.6% were non-Hispanic White, 11.8% were non-Hispanic Black, 10.4% were Hispanic, and 7.5% were Asian (CDCP, 2017). This rate was expected to increase greatly over the next half-century. Along with the increase in the incidence of diabetes, both individual and societal expectations concerning the management of diabetes have also increased, with many reports from The Centers for Disease Control (CDC), United States Department of Health and Human Services (USDHHS), and the 2 National Institutes of Health (NIH) urging patients to "Take Charge of Your Diabetes"5 and "Conquer Diabetes" (DRWG, 2019). One of the main goals of USDHHS's report, Healthy People, is to improve the quality of life for persons with diabetes (USDHHS, 2020). Taking control of diabetes to improve quality of life has put the spotlight on the need for additional support and education for patients with type 2 diabetes. Although new treatments and technology have aided in controlling the disease in many individuals, the challenges of diabetes self-management are overwhelming for most.

Blood glucose level is chiefly controlled by insulin and glucagon hormones, but other hormones play many roles. A defect in insulin secretion results initially in Impaired Glucose Tolerance (IGT) and causes hyperglycemia (Abel, Peroni & Kim 2017). Eventually, most cases of Impaired Glucose Tolerance (IGT) will progress toward overt diabetes mellitus, a condition where the blood glucose level exceeds the reabsorption threshold of the kidneys and glucose is excreted in the urine. Hyperglycemia causes microvascular and macrovascular damage in several organs and is a powerful risk predictor for cardiovascular disease morbidity and mortality (Abel, Peroni & Kim 2017).

Glucose level: also known as blood sugar level, it is the measure of glucose concentrated in the blood of humans and other animals. Approximately 4 grams of dissolved glucose, a simple sugar is present in the blood plasma of a 70kg human at all times. It comes from the food we eat, and it is also formed and stored inside the body. It is the main source of energy for the cells of our body (Emiola, 2019).

High glucose levels can damage the vessels that supply blood to vital organs, which can increase the risk of heart disease and stroke, kidney disease, vision problems, and nerve problems. Hyperglycemia (high blood sugar) not treated, can cause toxic acids, called ketones, which build up in the blood and urine, this condition is called ketoacidosis and it has the following symptoms: Fruity-smelling breath, dry mouth, abdominal pain, nausea, and vomiting, shortness of breath, confusion, and loss of consciousness. High glucose levels, if not controlled can lead to heart disease or heart attack, stroke, kidney damage (nephropathy), nerve damage (neuropathy), eye damage (retinopathy), stomach problems

(gastroparesis), skin problems (dermatitis), and even death.Yan, Prista, Ranadive, Damasceno, Caupers, Kanaley, and Fernhall, (2014), stated that aerobic exercise had significantly lower blood plasma glucose levels. Ivy, (2017) also stated that exercise training may improve control over hepatic glucose production and exerts pronounced effects on substrate utilization and insulin sensitivity. Pedersen and Saltin, (2016) confirmed that exercise showed significant effects on the improvement of insulin sensitivity and reduction of blood glucose. Yan *et al*, (2014) also stated that exercise intervention to type 2 diabetes improved glucose control over 12 weeks. Gould, Graham-Brown, Watson, Viana, and Smith(2014), agreed that regular aerobic training enhances insulin sensitivity in the exercising muscle and enhances muscle contraction-induced glucose uptake, and subsequent reduction in blood glucose. Snowling and Hopkins (2016) stated that aerobic exercise has small to moderate beneficial effects on glucose control in T2DM patients and small beneficial effects on some related risk factors for complications of diabetes. Gulve, (2018) also stated that aerobic exercise is recommended for its beneficial effects on glucose control as well as its ability to retard the progression of other co-morbidities common in patients with diabetes, such as cardiovascular disease, and that the capability of aerobic exercise to improve glycaemic control in diabetes is well documented.

In light of the above, this study, therefore, was conducted to find out the Effects of Aerobic Dance on glucose levels among Obese Female Studentsat the University of Calabar, Nigeria.

Methodology

This study employed a one-group repeated measures design to assess the impact of an aerobic dance exercise programme on glucose levels among obese female undergraduate and postgraduate students aged 19 to 25 at the University of Calabar. The sample consisted of 40 participants:

Informed Consent and Physical Assessment Readiness: Participants received an informed consent form and a Physical Activity Readiness Questionnaire (PAR-Q). Only duly filled and signed consent forms were considered.

Participant Selection through Purposive Sampling: Random sampling techniques was used for obese female students aged 19–25 years. The participant's weight (in kilogrammes) and height (in meters squared) were used to calculate Body Mass Index (BMI). Those with a BMI falling within the range of 30.0 to 34.9 kg/m² were chosen for the study. Ethical approval was secured from the research ethical committee at Ahmadu Bello University, Zaria, providing the necessary authorization for the use of human subjects.

Inclusion Criteria: Female students with a BMI between 30.0 and 34.9 kg/m², aged 19 to 25 years, whose glucose level ranged from 117-137mg/dL [6.5-7.6mmol/L]. Participants without underlying health risks who responded negatively to the Physical Activity Readiness Questionnaire (PAR-Q).

Data Collection:Glucose level measurements were taken using a **Glucose meter (Accu-Chek, Aviva Plus, Japan)**. Four trained research assistants facilitated the data collection process. A small drop of blood from the participants was obtained by pricking the thumb of the subjects with a lancet which was placed on a disposable test strip that the meter read or calculated the blood glucose level in units of mg/dl, (ie milligrams per deciliter).

Aerobic Dance Exercise Programme: The training sessions occurred in the evening, between 4:30 and 6:00 pm, at the fitness laboratory of the Department of Human Kinetics and Health Education, University of Calabar, Cross River State. The aerobic dance exercise was characterized by dance-inspired movements with choreographed routines set to music. The exercise programme encompassed varying intensity levels, including low (45% - 50% HRmax), low to moderate (50% - 55% HRmax), and moderate to somewhat hard (55% - 60% HRmax) levels. Participants engaged in the aerobic dance programme throughout the research study. The utilized training programme schedule is as follows:

Table 1.Training Programme Schedule

Week	Intensity	Warm-up/ Stretches	Aerobic session	Cool down	Total time	RPE
1ST to 4th	45% - 50% HRmax	10 min	25 min	10 min	45 min	Light
5th to 8th	50% - 55% HRmax	10 min	30 min	10 min	50 min	Moderate
9th to 12th	55% - 60% HRmax	10 min	40	10 min	60 min	Somewhat hard

Source: Yuyu&Gunen, (2020).

Statistical Analyses: The study employed descriptive statistics, including means, standard deviations, and standard errors of the means, to analyze key variables—systolic blood pressure and diastolic blood pressure. A t-test statistic was utilized to assess significant differences in the effects of aerobic dance between baseline and post-test mean values for these variables. To explore the overall impact of a 12-week aerobic dance intervention, a one-way measure analysis of variance (ANOVA) was conducted. This analysis focused on examining interactions among baseline, 4th, 8th, and post-test values of the variables. In instances where the F statistic indicated significance, a Scheffe post hoc test was employed to pinpoint specific points of difference. Throughout these statistical analyses, an alpha level of 0.05 was set, providing the threshold for determining

statistical significance. This criterion guided the decision-making process for accepting or rejecting the null hypothesis.

Results

Over a 12-week training period, data were gathered to investigate the effect of Aerobic Dance on the glucose levels among obese female students at the University of Calabar, Nigeria. The parameters assessed during this training period included only glucose levels. The subsequent presentation outlines the results of the conducted test.

Table 2: Result of Demographic Characteristics of Participants

VariablesWeeks	N	Mean	Std. Dev.
Glucose Level (mmol/l)	Baseline	406.695	.1934
	Week 4	406.488	1.164
	Week 8	406.430	7.605
	Week 12	406.330	5.963

Source: Test conducted in 2023 by the researcher

Sub-hypotheses: There is no significant effect of aerobic dance on the glucose level of obese female students at the University of Calabar, Nigeria.

Table 3: One Way ANOVA Statistics on the effects of aerobic dance on Glucose Level of Obese female students at the University of Calabar, Nigeria

Glucose Level	Sum of Squares	Df	Mean Square	F	p-value	Decision
Between Groups	2.846	3	.949	63.500	.000	Rejected
Within Groups	2.331	156	.015			
Total	5.177	159				

Table 3 showed that there is a significant effect of aerobic dance on Glucose Levels among obese female students at the University of Calabar, Nigeria. This is because the calculated p-value of 0.000 is lower than the 0.05 alpha level of significance. With this, the null hypothesis which states that there is no significant effect of aerobic dance on the Glucose Level of obese female students at the University of Calabar, Nigeria was rejected.

Table 4: Scheffe Post Hoc Test on Pair wise comparison of mean levels of Glucose Level among Obese female students

(I) week	(J) week	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Baseline	week 4	.2075	.0273	.000	.130	.285
	week8	.2650	.0273	.000	.188	.342
	week12	.3650*	.0273	.000	.288	.442
week 4	baseline	-.2075*	.0273	.000	-.285	-.130
	week8	.0575	.0273	.003	-.020	.135
	week12	.1575*	.0273	.000	.080	.235
week8	baseline	-.2650	.0273	.000	-.342	-.188
	week 4	-.0575	.0273	.003	-.135	.020
	week12	.1000	.0273	.005	.023	.177
week12	baseline	-.3650*	.0273	.000	-.442	-.288
	week 4	-.1575*	.0273	.000	-.235	-.080
	week8	-.1000	.0273	.005	-.177	-.023

*. The mean difference is significant at the 0.05 level.

The result of the *post hoc* test revealed that the difference in Glucose Level was significant between baseline and 12th week, also 4th week recorded a significant difference with the 12th week. Between the 8th and 12th week, no significant difference was observed in the Glucose Level.

Discussions

This research was conducted with the primary goal of evaluating how aerobic dance influences glucose levels among obese female students at the University of Calabar, Nigeria. Employing a one-way repeated measures ANOVA, the results revealed significant differences in the glucose levels between the two stages examined, leading to the rejection of the null hypothesis. Importantly, the findings indicated a substantial reduction in glucose levels after participating in aerobic dance, compared to the baseline measurements.

The result of the one-way repeated measures ANOVA used revealed that a significant reduction in the glucose level of the participants after the 12thweek of the aerobic dance training, the null hypothesis was rejected. Thus, the aerobic dance significantly reduced the glucose levels of the obese female students involved in the aerobic dance compared to the baseline. The findings of the present study supported the report of Umeh, Umeh, Mshelia, Qossim, and Olajide, (2021), on the effect of step aerobics training on blood glucose levels and cardiorespiratory parameters of overweight and obese adults, who

found that decrease in blood glucose level (post-training) of overweight adults was statistically significant compared to the pre-step aerobics training ($P< 0.05$). This reduction could be as a result of the utilization of glucose as fuel for the exercising muscles. Also, the study is in line with another study by James, (2016), on the effects of aerobics on type 2 diabetes, blood glucose levels of patients having type 2 diabetes. That, aerobics is a powerful exercise for both mental and physical health. This also prevents the individual from various cardiac problems. The findings were also supported by Pearson., Laurora, Chu, and Kafonek (2016), who stated that aerobic dance had significantly lowered blood plasma glucose levels. The findings also supported Rabbia (2017) and Uygur*et al*., (2016), that physical activity exerts pronounced effects on substrate utilization and insulin sensitivity, which in turn potentially lowers blood glucose. Also, the study complements the findings of Fortney and Gary, (2018) that moderate-intensity dance has shown effects on the improvement of insulin sensitivity. The study also supported the findings byPearson,*et al* (2016), that adding a structured aerobic dance intervention to type 2 diabetes treatment improved glucose control over 12 weeks. These findings are in line with Rabbia, (2017) that dance training may improve control over hepatic glucose production and exerts pronounced effects on substrate utilization and insulin sensitivity. The study is also in line with Mayen *et al*., 2016). However, this finding did not support Flegal (2017), on the effects of aerobic training on kidney function among type II diabetes mellitus patients in the Kano metropolis, Nigeria, that blood sugar was not found to decrease significantly by the aerobic exercise which may be connected to either intensity or duration of the exercise.

Conclusions

The study had significant positive effect of aerobic dance programme on the glucose profiles of obese female students. This aligns with existing research, indicating that aerobic dance contributes to lower glucose levels, corroborating similar outcomes observed in various studies focused on different populations and contexts. This underscored the versatility of aerobic dance in influencing glucose levels. While some dissenting studies were noted, the overall consistency of our findings with a body of literature supports the efficacy of aerobic dance in positively impacting glucose level metrics.

The study further emphasizes the potential role of aerobic dance as a valuable tool for managing comorbidities associated with conditions like Type 2 Diabetes Mellitus (T2DM) and kidney disorders. These insights align with broader perspectives on the preventive and rehabilitative aspects of aerobic dance, offering a holistic approach to improving cardiovascular health.The outcomes of this research contribute to the growing body of evidence highlighting the benefits of regular aerobic dance participation. As we conclude, it is essential to recognize the potential of aerobic dance not only in reducing

glucose levels but also in promoting overall well-being. Further research and longitudinal studies are encouraged to deepen our understanding and refine recommendations for the integration of aerobic dance into holistic healthcare practices.

Recommendations

Sequel to the study findings and beyond, the following recommendations given:

1. The aerobic dances training should be recommended to obese students as it was cheap, easy to construct and managed and does not require space and sophistication.
2. There is need for more enlightenment for obese female students and reorientation from sedentary type of living to an exercise attitude.
3. Obese female students should engage in regular physical activity, especially aerobic dance to minimize the trauma of cardiovascular disease risk of obesity.
4. Group-Based aerobic dance should be sustained to lower the metabolic risk factors like glucose level in tertiary institutions in Cross River State, Nigeria.

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