

**CHANGES IN THE OXYGEN UPTAKE OF FEMALES
FOLLOWING A TWELVE WEEK PROGRAMMED
AEROBIC DANCING**

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ABSTRACT

The study investigated the effect of an aerobic dance programme on the aerobic capacity of female undergraduates of Olabisi Onabanjo University Ago-Iwoye Nigeria. A pre test-post test control group experimental research design was adopted for the study. Forty female undergraduates of the university were the subjects. They were randomly distributed into two equal groups of experimental and control subjects. Aerobic dance was the independent variable while oxygen uptake was the dependent variable. Oxygen uptake was measured at pre test and post test in both experimental and control group subjects. A hypothesis was set for the dependent variable with the probability level of $p < 0.05$.

The collected data were treated with descriptive statistics, as well as analysis of covariance (ANCOVA). The result of the study showed that the aerobic dance programme caused significant increase in the maximal oxygen uptake of the female undergraduates ($p < 0.05$).

It is concluded that the aerobic dance programme effected significant improvement in the oxygen utilisation capacity of the subjects. It is recommended as a beneficial physical fitness training modality for females who wish to improve there cardio respiratory fitness level.

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Key words: Oxygen uptake, Aerobic dancing, Aerobic capacity.

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INTRODUCTION

Aerobic dance amongst other forms of aerobic activities have been identified as a complete physical fitness programme, (Sorenson, 1979). It creates room for physical exercise as well as fun, because it offers the chance of dancing freely in individual styles, feelings about music are also physically expressed by laughing, jumping, yelling, jogging, kicking, stretching, sliding and swinging. Aerobic dance can serve as a basic fitness conditioner, provided one follows designed and set guidelines, setting aside 30 - 45 minutes per session at least twice a week. Aerobic dance has also been described as high calorie burners, because they demand a lot of energy. Sorenson asserted that enthusiasts burn about 300 calories in a moderate 45minutes class, which she said is equivalent to bicycling for 45 minutes at 7miles per hour. She also asserted that as much as 500 calories are burnt during a vigorous 45minute class, which compared well with swimming for one hour at 30 yards per minute. In simple terms, aerobic dance could be described as continuous movement, done at a prescribed pace requiring the body to utilize increased amount of oxygen over an extended period of time. Igbanugo (1984) asserted the following improved cardiovascular conditions in female aerobic dancers; decreased resting heart rate, increased physical working capacity(PWC), and an increased maximal oxygen consumption of the subjects after a twelve week exercise training programme. The concern of this paper is to highlight the physical fitness benefits of programmed aerobic dancing, especially as submitted by results of carefully conducted experimental researches. This may elicit in the physical fitness enthusiast an interest to adopt it as a safer and more “friendly” exercise modality in the attempt to improve on individual wellness and healthful living through regimented physical exercise.

Aerobic Exercises and General Fitness

As early as 1969 Cooper had confirmed that aerobic exercises would be effective if the exercises are vigorous enough to produce a sustained heart rate of 150 beats per

minute, but still demanding oxygen, the exercise must be continued considerably for longer than five minutes. Oduya(1989) painted the picture of the preference for aerobic exercises in the United States of America/USA) as he said:

“Men and women/ old and young, the septuagenarian, the octogenarian can be seen pumping oxygen into their body systems everywhere, by jogging, walking, cycling and playing of games”.

He described the participation as voluntary and with dedication; it is like health freely offered on the platter of gold and a life one that cannot be cast overboard. He said everyone is freely engaged in jogging at individual pace, in the land of opportunity, liberty and plenty. Aerobic exercises are widely patronized by all Americans, and it is discovered that aerobic dancing actually is a vogue in the country, as it is evidenced by the magnitude of research work done on it in the USA.

Cooper further listed the following exercises as having comparable aerobic training effects when combined or performed singularly; Running one mile in less than 8 minutes, swimming 24 laps in less than 15 minutes, stationary running for a total of 12mins 30secs, hand ball played for a total of 35 minutes. He was optimistic that for the health of the body, the listed aerobic conditioners would produce quicker effects; he believed aerobic exercises are the only ones that would facilitate the overall health of the body,

Aerobic Dance and Cardiorespiratory Fitness

Igbanugo(1984) observed a 64% increase in maximum oxygen uptake in female aerobic dance adherents following twelve weeks of programmed aerobic dancing, her subjects had very low initial levels of fitness. Otherwise this percent increase was higher than the reported values submitted earlier by (Rockefeller and Burke, 1979, 13%; Eisenman and Golding, 1975, 8%; Cunningham and Hill, 1975, 26%). Blessing et al (1987) reported remarkable increase in some cardio respiratory variables in college age females following 10 weeks of aerobic dance. The experimental group particularly recorded 16.2%, 13.1% and 13.4 % increase in the Maximal Ventilation (VE_{max}), Maximal Respiratory Exchange Ratio, and Oxygen Uptake (V_{O₂} max) in l/min and relative to body weight. The control group recorded 2.0%, 1.6%, and 0.01% m

respectively in the same variables. The maximal heart rate decreased significantly in the experimental group but not in the control group. For either group, no significant changes were found in maximal respiratory exchange ratio (RER max). Changes in resting heart rate, and systolic and diastolic blood pressures were not significantly different in the experimental and control groups.

METHODS:

The Sample of Subjects

The research sample size was forty subjects, twenty were made up of experimental subjects and another twenty were control subjects. All the subjects volunteered, they gave consent to participate fully in all their respectively assigned phases of the research. However, they were randomly distributed into two equal groups of experimental subjects and control subjects.

Description of the Twelve-Week Aerobic Dancing Programme

The training effect of a physical conditioning programme starts to manifest after the eight week of consistent and intensified training, and by the twelfth week, a complete manifestation of the exercise effect of such fitness programme should be evident to afford a gauging of the effectiveness of the programme on the participants, and possible certification. After this certification, the participants may go on to an individualized fitness-training programme to sustain the gains of the programmed physical conditioning programme.

In this study, a programmed aerobic dance class was designed for female undergraduates of Olabisi Onabanjo University, Nigeria. In an attempt to be unique, indigenous contemporary music and dances were adopted in this study. All the 20 experimental subjects were taught how to do these dances correctly during special dance training classes. The design followed the basic principles of aerobic exercise programming. The programmed aerobic dancing fitness programme had the sessions conducted three times in a week on separate (alternate) days of the week, each training session was conducted between the hours of 6pm and 7pm and lasted a total of 45 minutes duration per session. The first 10 minutes of a session is devoted to warm-up

exercises with musical accompaniments, which would incorporate stretching, curling, walking and low impact hopping activities. For the actual stimulus (dance) session, 6 varieties of dance forms of contemporary origination was performed, each form lasting 5 minutes to make a total of 30 minutes of stimulus period. The last 5 minutes of the session was devoted to cool down activities conducted to low tempo music, also incorporating the same activities performed during the warm-up session.

Each workout was carefully paced to ensure inclusion of optimal varieties of dance forms covering basic muscle groups, and also providing aerobic exercises of sufficient intensity to stimulate the cardio respiratory systems of the participant. The dancing is arranged in a fashion that will afford different segments of the anatomy to benefit from the activity. The dance progressed from the least to the most vigorous dance, so that the dance workout increases gradually until a peak is reached. There is provision for stoppages during which the participants monitor their pulse to regulate Target Training Heart Rate (TTHR) and Exercise Intensities. An appropriate pre-recorded audiotape was provided with the desired musical sequence for each dance session. The dance forms are also pre-arranged to ensure a blend with the music as well as enable a smooth transition from one dance form to the other.

Instrumentation:

Bicycle Ergometer:

A mechanically braked (Solar brand) bicycle ergometer was used in this study for exercise testing at pre testing and post testing. It was also used to induce work to maximal effort in the subject.

Stethoscope: The Riester type was used to monitor the subjects' heart rate, when estimating the aerobic capacity (maximum oxygen uptake) of the subjects.

Body Weight Scale: A Hanson manufactured body weighing device was used to obtain subjects body weight. The precision of this device was ensured by manipulating the adjuster turner each time before use. Body weight was measured in Kilogrammes(kg).

Measurement of Aerobic Capacity (Maximum Oxygen Uptake).

The maximal values of oxygen uptake were obtained by the indirect method designed by Astrand (1960). The procedure involved making heart rate observations under steady state conditions during continuous work lasting 5 to 6 minutes on a bicycle ergometer.

The bicycle ergometer seat was adjusted to a height that produced a slight bend at the knee joint while the ball of the foot rested on the pedal. Initially the subject rode on the bicycle at zero workload for one minute. Exercise workload was then set at 450kpm, this produced a mean sub maximal heart rate of 146.95bpm for all the subjects observed in this study both experimental and control. The Astrand's (1960) chart for women was then used to indicate the maximum oxygen uptake in liters per minute for each subject. Values obtained were then adjusted for body weight, by multiplying the values in liters per minute by 1000 and dividing the product by each subject's body weight in kilogrammes. Final scores were then recorded in ml/kg/min.

HYPOTHESIS:

The subject's maximum oxygen uptake will not be significantly affected by the twelve week aerobic dance programme.

RESULTS:

The Physical Characteristics of the Subjects;

The descriptive statistics showing the means, range for the age and body weight of the subjects are presented on table 1 below.

Table 1 Mean, Standard deviation and Range of Subjects Age and Body weight.

Experimental Group

			<i>Pre-test</i>		<i>Post-test</i>		
	Variable	Mean	(±)SD	Range	Mean	(±)SD	Range
1.	Age	20.5	1.53	17-23	20.5	1.53	17-23
2.	Body Weight	62.5	12.57	45-91	58.3	12.46	41-87

Control Group

			<i>Pre-test</i>		<i>Post-test</i>		
	Variable	Mean	(±)SD	Range	Mean	(±)SD	Range
1.	Age	20.45	2.22	17- 24	20.45	2.22	17-24
2.	Body Weight	59.70	8.75	45-75	59,65	8.70	45 – 76

The Age:

The descriptive statistics presented on table 1, indicate a pre-test mean age of 20. 5± 1.53 years. At post-test, none of the subjects, either experimental or control, had increased in the number of years (age). The same age means as in pre-test were therefore obtained for the two groups at post-test, see table 1.

The Body Weight

For the body weight, the experimental group subjects recorded a mean value of 62.0 ± 12.57 kilogrammes, with a range of 45 to 91 kilogrammes, at pre-test. This result indicate a general reduction of body weight in the experimental group subjects, following participation in the aerobic dance programme. The descriptive statistics presented on table 1, indicate for the control group subjects, pre-test mean body weight of 59.70 ±

8.75 kilogrammes, with a range of 45 - 75 kilogrammes. A similar post-test mean recorded by the control group subjects, when compared with the value at pre-test, the body weight of the control group subjects ranged between 45 and 76 kilogrammes at post-test.

The Maximum Oxygen Uptake (Max VO₂):

The pre-test maximum oxygen uptake for subjects in the control Group has a mean of 42.178 ± 4.476ml/kg/min, individual raw scores in the group ranged between 36.11 and 54.54ml/kg/min. At post- test, the scores for the group ranged between 36.92 and 52.72ml/kg/min, and the obtained mean was 42.604 ± 4.452ml/kg/min. The pre-test mean maximum oxygen uptake for the experimental group subjects is 41.010 ± 7.231ml/kg/min, with a range of 25.27 to 53.30ml/kg/min. The post-test mean maximum oxygen uptake for the group was 46.829 ± 7.202ml/kg/min, with a range of 31.00 to 61.90ml/kg/min. Table 2 below presents the descriptive statistics for the maximum oxygen uptake for both groups.

Table 2.

The Mean, Standard Deviation and Range of the subjects VO₂ Max(ml/kg/min)

Experimental Group

Variables	Pre-test			Post-test		
	Mean	(±)SD	Range	Mean	(±)SD	Range
VO ₂ Max	41.010	7.231	25,27-53.50	46.829	7.202	31.0-61.9

Control Group

Variables	Pre-test			Post-test		
	Mean	(±)SD	Range	Mean	(±)SD	Range
VO ₂ Max	42.178	4.476	36,11-54.54	42.604	4.452	36.92-52.72

Table 3

Covariance Analysis for Maximum Oxygen Uptake (Vo₂ Max) ml/kg/min
Post – Test Max VO₂
By Groups (1, 2)
With Pre-Test Max VO₂

Source of Variation	Sum of Squares	DF	Mean Square	F	Significance of F
Covariate Pre-test (Max VO ₂)	1025.725	1	1025.725	158.900	0.000
Main Effects Groups (1,2)	276.159	1	276	42.781	0.000
Explained	1301.884	2	650.942	100.841	0.000
Residual	238.841	37	6.455		
Total	1540.75	39	39.506		
40 cases were processed (20 Experimental; 20 Control).					
Group - (1) (2)					

*Significant at 0.05 level

The significance of the difference between the groups was determined for Max VO₂ in ml/kg/min. The ANCOVA F test computed for this purpose gave an F ratio of 42.781, this was statistically significant at 0.05 level of significance, see table 3. The hypothesis of no significant effect of the training on subjects VO₂ Max was rejected.

DISCUSSION

Aerobic training programmes are basically for the improvement of the Oxygen Utilization capacity of the participant, and for experimental purpose, the Maximum Oxygen-Uptake is essentially monitored in studies involving the application of aerobic exercises as the training modality. In this study, the Astrands (1960) method was employed at the estimation of this variable, the procedure involved making heart rate observations under steady state conditions during continuous work lasting 5-6 minutes

on a bicycle ergo meter. The Astrand's (1960) chart for women was then used to indicate the maximum oxygen up-take in liters per minute for each subject.

A Pre-test Post-test Control Group experimental research design was employed to measure the oxygen uptake of the participants in the research. Following twelve weeks of intensive aerobic dancing posttest measurements indicated that the subjects in the experimental group showed individual improvement in maximum oxygen uptake, they generally recorded higher maximum oxygen uptake values at post test when compared with their pre-test scores. On table 2 it can be seen that the mean maximum oxygen uptake for experimental group at pre-test was 41.010 ± 7.231 , this value is lower than the mean post-test score of 46.829 ± 7.202 recorded by the group. The subjects in the control group did not show marked differences in their pre-test and post-test maximum oxygen uptake, table 2. They recorded a pretest mean maximum oxygen uptake of 42.178 ± 4.476 , and a similar post-test mean value of 42.604 ± 4.452 . Maximum oxygen uptake was measured in millimeter per kilogramme of body weight per minute (ml/kg/min).

Table 3 shows the summary of the ANCOVA F test done for maximum oxygen uptake. Covariates (pre-test scores) for both groups were adjusted for the post-test scores, the ANCOVA F test gave an F value of 42.781 which was significant at 0.05 level of significance. The hypothesis of no significant effect of the training on subjects maximum oxygen uptake was therefore rejected.

The findings in this study implied that the twelve-week aerobic dance, effected significant improvement in the experimental subjects' aerobic capacity and respiratory efficiency. It also implied that the experimental group subjects would be able to process more oxygen for energy production for a given workload. Following 10 weeks of aerobic dance, Blessing et al, (1987) reported a significant increase in the maximum oxygen uptake of the experimental group; they recorded an increase of 13.1%. Their control group subjects did not show a significant increase in maximum oxygen uptake, as they recorded a 1.6% increase. Igbanugo (1984) reported a 64% significant increase in maximum oxygen uptake (21.19ml/kg/min to 34.81ml/kg/min), in female college students, following a twelve week aerobic dance programme. This percent increase is relatively higher compared with that of Blessing et al, (1987). Also in 1987, Gillet and

Eisenman recorded an almost 100% increase in aerobic capacity ($\dot{V}O_2$ max), in middle aged women of 35 to 57 years. Their finding was a result of the women's participation in an intensity controlled aerobic dance exercise programme, which was of 16 weeks duration. Radmila et al (2006) investigated the effects of aerobic dance on the cardiovascular fitness and body composition of 46 women aged 20 – 25, at the end of their study they observed an increase in the average value of maximal oxygen up take from 39.00 ± 2.63 to 41.8 ± 2.59 ml/kg/min. For this study an increment in the experimental subjects aerobic capacity (maximum oxygen uptake) was also observed, from a value of 41.010 ± 7.231 at pre test to 46.829 ± 7.202 ml/kg/min at post test.

The outcome of this present study is in line with that of the previously done studies referred to. It could then be generally stated that aerobic dancing is a useful exercise and training mode for improved aerobic status.

CONCLUSION

The maximum oxygen uptake of the female undergraduates were considerably increased by the twelve-week aerobic dance programme.

Implication of the Study to Wellness:

1. Implication for Corporate Performance:

The result obtained from this study showed that aerobic dancing as an exercise modality is invaluable in the development of a person's cardio-respiratory capacity. In this study, aerobic capacity was improved, indicated by an increase in the maximum oxygen uptake, for a given workload. Physical fitness instructors (consultants) are hereby advised to incorporate aerobic dancing into their total fitness training programme for improved performance at secular work.

2. Implications for Personal Practice:

Aerobic dance as a training modality as it is observed in this study is safe and easy to perform, Hence it's general acceptability by the participants. In the process of having fun, even at a given workload, $\dot{V}O_2$ was improved, this ensured adequate oxygen consumption by working organs such as the heart, lungs, skeletal muscles and the

brain, which if they do not receive adequate supply of oxygen would cause quick fatigue and development of hypo kinetic diseases (Non Communicable Diseases).

Aerobic dance is thus useful to those who want to exercise personally with minimal supervision, and yet obtain desirable changes in personal fitness status.

3. Implication for Exercise Prescription:

Aerobic dance as an exercise training modality, follows set guidelines for it to effect the desirable changes in the user. The guidelines are technical but simple enough for everybody to understand and follow, they involve the monitoring of the pulse at specific part of the body regions, at regulated intervals during the aerobic dance session. Desired weekly training or target heart rates are set for individuals; these are strictly adhered to, by a consistent monitoring of the pulse. This prevents the participant from over exertion or under exertion, it does again ensure proper progression in exercise. Thus it is possible for an aerobic dance, enthusiast to exercise privately, but religiously following prescriptions, in terms of, duration, intensity and form, given by an expert. In this study, the general regulations guiding the development of aerobic dance programmes were adopted in the design of the twelve-week aerobic dance programme.

4. Implication for Theory

This research has contributed to information available on aerobic dance and the effect on Aerobic Capacity. Specifically it has helped to show how female undergraduates in a Nigerian University responded to aerobic training, an information which was only available from studies done in US, European and Asian subjects before this study was conducted. It is now possible to compare the physiological response of a Nigerian female population to aerobic dancing, with that of similar American and European female population.

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