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Acute effect of aerobic dance exercise on blood pressure of normotensive pregnant Nigerian women

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ABSTRACT

Exercise has been shown to reduce blood pressure (BP) in hypertensive patients. However, studies reporting reduced BP from chronic exercises might disregard an acute effect exercise could have on BP. Aerobic dance is one of the commonly recommended exercises for pregnant women without complications. The study aims to determine the acute effect of aerobic dance exercise of moderate intensity, on the BP of normotensive pregnant women. Pre-test/post-test research design involving 24 pregnant women of not less than 12 weeks gestation who volunteered from among women attending antenatal clinic at the Federal Medical Centre, Owerri, Nigeria. The women were screened and met the inclusion criteria, had their Systolic and Diastolic blood pressures (SBP and DBP) measured before participating in an exercise. The SBP and DBP were measured again at the end of the exercise and finally after 30 min rest. Data was analysed using Repeated ANOVA. SBP changed significantly between pre-exercise and 30 min post exercise rest but not between Pre-exercise and after 30 min exercise. DBP decreased significantly from pre-exercise to 30 min post exercise rest but not between after 30 min exercise and 30 min post exercise rest. In conclusion, moderate intensity aerobic dance exercise did not precipitate adverse acute cardiovascular response. Aerobic dance may be effective in management of hypertension in pregnancy.

Keywords: Aerobic dance, blood pressure response, antenatal exercise, acute effect.

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INTRODUCTION

Fear of possible adverse effects has remained one of the major obstacles to exercise participation among pregnant women despite assurances from various research outcomes in this area. As the number of pregnant women who want to participate in sports activities continues to increase, questions about the safety and benefit of maternal exercise for the mother and fetus become more important (Perales et al., 2015).

Several researchers suggested that there is a training effect from participating in an ongoing exercise program and that exercise may help to maintain work efficiency at pre-pregnancy levels despite the demands of the pregnancy (Carpenter et al., 1988; Shrock, 2008; Danforth, 1967). Exercise has been shown in numerous studies to be safe in pregnancy, and is recommended by the American College of Obstetrics and Gynecology (ACOG) as part of routine prenatal care. However, aerobic exercise can be viewed by patients to be difficult to perform during pregnancy, particularly when the patient is obese and at later gestations. Exercise is a stressor, likewise pregnancy and it is a common fear among healthcare providers that exercising in pregnancy may increase the stress experienced by pregnant women.

Exercise is recommended for pregnant women who exhibit none of the conditions contradicting exercising in pregnancy as stipulated in ACOG guideline (Artal and O'Toole, 2003) for exercising in pregnancy. Exercise have been shown to improve maternal cardiovascular function, control weight gain and fat retention, improve insulin resistance, curb onset of gestational diabetes, improve blood glucose level in gestational diabetes (Daniel et al., 2014) and reduce postpartum depression. It is important to note that different individuals respond differently to exertion and response could also depend on the exercise mode and intensity, as well as duration. When pregnant women exercise, cardiovascular and respiratory responses naturally increase. Systolic blood pressure rises from 30 to 40 mmHg, whereas the diastolic blood pressure rises only 10 mmHg with exercise (Shrock, 2008). However, the BP is expected to reduce gradually to pre-exercise value following rest. The importance of physical exercise in promoting a reduction in resting BP levels is well established in the academic literature (Nascimento et al., 2017; Blumenthal et al., 2000) and is a phenomenon known as post-exercise hypotension (PEH) [Kenney and Seals, 1993]. PEH could occur due to alterations in diverse mechanisms such as reduced peripheral vascular resistance and/ or cardiac output (Hara and Floras, 1995; Halliwill, 2001; Rueckert et al., 1996), increased vasodilator bioavailability (Halliwill, 2001; Lockwood et al., 2005; Higashi et al., 1999), reduced sympathetic nerve activity, increased parasympathetic modulation and improved baroreflex sensitivity (Pober et al., 2004; Halliwill et al., 2013). In a meta-analysis of normotensive and hypertensive patients, Fagard (2006) showed a 3.3-mmHg decrease in SBP, and 3.5 mmHg for DBP. Such reductions in chronic levels are often more discreet, but very important clinically, where a 2-mmHg reduction may decrease the risk of myocardial infarction by about 6%, and the risk of developing coronary artery disease by 4% (Chobanian et al., 2003).

It should also be noted that some activities carry more risk than others (Daniel, 2008) and discomfort from exercise increases as gestational age increases. It is very important to choose safe exercises for pregnant women in order to avert all potential harms arising from exercise, on either the mother or the fetus (Carpenter et al., 1990).

Some researchers have reassured pregnant women that engaging in antenatal exercises may not precipitate preterm labour and delivery, (Daniel et al., 2015) but few work have been done in the area of studying the acute effect of some of the commonly recommended exercises on the cardiovascular system of these pregnant women.

Aerobic dance is one of the exercises assumed to be very safe for pregnant women and so is about one of the most recommended exercise by healthcare provider during antenatal health talk. Aerobic dance could be seen and perceived as safe but there is also need to find out if it really has any significant benefit on the cardiovascular system of the women. It is also necessary to rule out any possible adverse effect on the mother and fetus from participating in this mode of exercise.

This study monitored the acute response of the blood pressure of normotensive pregnant women to aerobic dance exercise and recovery pattern of same women after termination of the exercise.

MATERIALS AND METHODS

Study design and subjects

This is a pretest/posttest study design in which a total of 33 pregnant women attending antenatal clinic at the Federal Medical Centre, Owerri, Nigeria indicated interest to participate in the study. The subjects volunteered to participate without any form of inducement or persuasion. They were screened for any of the conditions contraindicating participation in antenatal exercises as stipulated in ACOG (Artal and O'Toole, 2003). As outlined by ACOG, these conditions include heart disease, toxemia, ruptured membranes, risk of premature labor, intrauterine growth retardation, poor weight gain, vaginal or uterine bleeding, anemia, hypertension, and fetal distress. Consultation with health care providers or some degree of caution is necessary for expectant women with respiratory conditions such as asthma or orthopedic conditions such as back and hip pain or joint problems. Screening was carried out using Physical Activity Readiness Medical Examination questionnaire. Twenty nine (29) of them met the inclusion criteria and were recruited for the study. They were required to read and sign inform consent form after being adequately informed of the purpose and procedure of the study. Only women who were pregnant and not less than 16 weeks of gestation were allowed to participate in this study. This is to rule out complications of first trimester such as nausea and vomiting and possible abortion as a result of stress of the exercise. Both primaparous and multiparous mothers were allowed to participate in the study. None of the subjects was previously involved in any form of exercise programme as that was one of the inclusion criteria.

Blood pressure of participants were measured and documented prior to commencement of Exercise programme using NZ 009 Arm Automatic blood pressure monitor, after 10 minutes rest in upright sitting position. Participants were put through a warm up exercise in form of low intensity aerobic dance to a beat of a slow music. The warm up exercise was maintained at intensity of 11 to 12 on Borg Scale of Perceived Exertion. After 5 min warm up, the music was changed to a faster track of a pre-recorded beat that made the women dance at an intensity corresponding to13 to 14 on the Borg Scale of perceived exertion. The dance pattern was demonstrated by the coach who is a trained Physiotherapist and Exercise Physiologist. They sang along as they danced, as a familiar music tone was used. The participants danced for 20 min and then, the music was switched back to the slow music as cool down for 5 min.

The blood pressure was taken again and documented at the end of the 30 min dance exercise. Participants were allowed to rest for 30 min and then the final reading of their blood pressure was taken. All statistical analyses were performed on IBM compatible microcomputer, using the statistical package for social science (SPSS) (window version 17.0 Chigaco IL.USA). One way Repeated ANOVA was employed to analyse the data. Descriptive statistics of Means and Standard Deviation were computed and presented in the result section of this article. The probability level was set at 0.05.

RESULTS

Five (5) of the women could not complete the study as they could not participate in the aerobic dance to the end of the 30 min and so their data were not included in the analysis as their data were incomplete. Data from 24 participants who completed the 30 min exercise programme were analysed.

Table 1 shows information regarding to the demographic characteristics of the participants. The information shown are; maternal age, height, weight,

Table 1. Demographic information of participants.

	Minimum	Maximum	Mean	Std. Deviation	N
Maternal age	20	36	28.67	3.50	24
Gestational age (weeks)	17	40	29.88	5.77	24
Pregnancy Body Mass Index (BMI)	20.0	45.0	29.19	5.86	24
Maternal weight	55.00	121.00	80.21	16.08	24
Maternal height	1.54	1.92	1.66	.08	24

BMI, gestational age.

Table 2 shows the mean and standard deviation of the systolic blood pressure, showing SBP increasing from 116.62 ± 11.82 mmHg pre exercise value to 122.75 ± 14.84 mmHg after 30 min of exercise and then reducing to 109 ± 10.79 mmHg after 30 min post exercise rest.

A One-way repeated ANOVA was conducted to determine if there was statistically significant difference in the SBP of the pregnant women following a 30 min aerobic dance exercise. There were no outliers and data was normally distributed as assessed by Shapiro-Wilk test (P>.05). The assumption of sphericity was not violated as assessed by Mauchly's test of sphericity, $X^2(2) = 5.076$, P = .079.

The SBP was statistically significantly different at the different times of recording; Pre Exercise, After 30 minutes Exercise and After 30 min post exercise rest., F(2,46) = 15.67, P < .0005 (Table 3).

Post hoc analysis with Bonferroni adjustment revealed the SDP was statistically non significantly increased from pre exercise to after 30 min exercise [6.13 (95% CI, 0.634 to 12.88) mmHg, P = .085] but decreased statistically significantly from after 30 min exercise to after 30 min post exercise rest [12.83 (95% CI, 17.25 to 8.42) mmHg, P = .001] and from pre exercise to after 30 min post exercise rest [6.708 (95% CI, 13.03 to 0.39) mmHg, P = .035] (Table 4).

The mean and standard deviation of the diastolic blood pressure showed slight increase in the DBP from 68.54 ± 9.56 mmHg pre exercise to 68.58 ± 9.99 mmHg after 30 min of exercise which is non-significant, and then decreased to 64.54 ± 6.41 mmHg after 30 min post exercise rest (Table 5).

A one-way repeated ANOVA was conducted to determine if there was statistically significant difference in the DBP of the pregnant women following a 30 minutes aerobic dance exercise (Table 6). There were no outliers and data was normally distributed as assessed by Shapiro-Wilk test (P > .05). The assumption of sphericity was not violated as assessed by Mauchly's test of sphericity, $X^2(2) = 2.041$, P = .360.

There was statistically significant changes in the DBP of the women from the pre-exercise through 30 min exercise to after 30 min post exercise rest, F(2, 46) = 3.39, P = .04.

Post hoc analysis with Bonferroni adjustment revealed there was statistically no significant change in the DBP from pre-exercise to after 30 min exercise, with increase of about 0.042 (95% CI, -4.92 to 4.84) mmHg, P = 1.000 (Table 7). There was also no statistically significant change in the DBP from after 30 min exercise to after 30 min post exercise rest, 4.042 (95% CI, .940 to 9.024) mmHg, P=.142. There was however, a statistically significant decrease in the DBP from pre-exercise to after 30 min post exercise rest, 4.000 (95% CI, .139 to 7.861) mmHg, P = .041.

Table 2. Descriptive statistics of systolic blood pressure (SBP).

Parameter	Mean	Std. deviation	N
Pre-exercise	116.62	11.817	24
After 30 min exercise	122.75	14.836	24
After 30 min post exercise rest	109.92	10.786	24

Table 3. One–way repeated ANOVA of the SBP.

Source	SS	df	MS	F	Sig.
Sphericity assumed	1977.69	2	988.85	15.67	.001
Error	2902.31	46	63.09		

Table 4. Bonferroni post-hoc test for SBP.

I	J	Mean difference (I-J)	Std. error	Sig.	95% CI	
					Lower bond	Upper bond
1	2	-6.13	2.62	.085	-12.88	.634
	3	6.71	2.45	.035	.039	13.03
2	1	6.13	2.62	.085	-634	12.88
	3	12.83	1.71	.000	8.42	17.25
3	1	-6.71	2.45	.035	-13.03	-3.85
	2	12.83	1.71	.000	-17.25	-8.42

Table 5. Descriptive statistics of diastolic blood pressure (DBP).

Parameter	Mean	Std. deviation	N
Pre-exercise DBP	68.54	9.564	24
Within exercise after 30 min exercise	68.58	9.987	24
30 min post exercise rest	64.54	6.413	24

Table 6. One–way repeated ANOVA of the DBP.

Source	SS	df	MS	F	Sig.
Sphericity assumed	258.69	2	129.34	3.39	.042
Error	1753.97	46	63.09		

Table 7. Bonferroni post-hoc test for DBP.

I	J	Mean difference (I-J)	Std. error	Sig.	95% CI	
					Lower bond	Upper bond
1	2	-.042	1.89	1.000	-4.923	4.840
	3	4.00	1.50	.041	.139	7.861
2	1	.042	1.89	1.000	-4.840	4.923
	3	4.04	1.93	.142	-.940	9.024
3	1	-4.00	1.50	.041	-7.861	-139
	2	-4.04	1.93	.142	-9.024	.940

DISCUSSION

No previous study to our knowledge has been carried out to see the acute effect of exercise on the blood pressure of normotensive pregnant women. Previous studies concentrated on chronic effect of exercise on blood pressure and most of them reported decrease in BP after some weeks or months of exercise programme (Carpiro-Rivera et al., 2016). Our study looked at the acute effect of exercise in pregnant women.

The data from our study showed that there was an increase in the SBP, which was not statistically significant, following 30 minutes aerobic dance exercise. However, there was significant decrease in the blood pressures after 30 min rest following termination of exercise. The increase in SBP was not statistically significant but the decrease after 30 min rest was significantly below the pre exercise and after 30 min exercise values. We also recorded a significant decrease in the diastolic BP after 30 min rest, post exercise, (P=.041.), when compared to the pre exercise value. The recovery pattern of the women was normal and tallies with findings of a meta-analysis by Carpio-Rivera et al. (2016).

Other studies have also found decreased BP levels after a single aerobic exercise session for hypertensive patients (Pescatello et al., 2007; Park et al., 2006; Quinn, 2000). There is a wide range of magnitude (between −2 and −12 mmHg) and duration (between 4 and 16 h) of PEH, which is probably due to individual characteristics and different aerobic exercise protocols (e.g., intensity and duration) (Cardoso et al., 2010). BP reduction is also found in follow-up studies (Pinto et al., 2006; Moreira et al., 1999). A study hypothesized that short-term sessions of aerobic exercise of mild, moderate and high intensities can promote PEH as a primary outcome; furthermore, follow-up aerobic exercise training for 8 weeks can reduce the BP levels.

We recorded a decrease of 6.7 mmHg in the SBP and epidemiological studies indicate that a decrease of 2 mmHg in the SBP is likely to reduce the mortality associated with stroke by 6% and coronary heart disease by 4%, whereas a reduction of 5 mmHg is likely to reduce the risk of these diseases by 14 and 9%, respectively (Chobanian et al., 2003). Therefore, the reduction of 6.7 mmHg recorded in this study suggests the possibility of aerobic dance exercise as a preventive measure and non-pharmacological treatment of hypertension. There should however be caution on the exercise intensity and duration especially for hypertensive pregnant women as this study was carried out only on women with normal BP.

A study by Papp et al. (2013) on the effect of 8 weeks of Yoga exercise on the blood pressure of healthy men and women however showed no improvement on the BP of the participants. It should be noted that the post exercise hypotension which is an acute effect of exercise is lost over time (Carpio-Rivera et al., 2016). This may explain the no effect recorded by Papp et al. (2013).

CONCLUSION

Our study recorded an increase in the SBP and DBP following 30 min of exercise, which later decreased below pre-exercise values, after 30 min rest. Our findings are in line with other studies on effect of exercise on BP, though no previous study was found on the acute effect of exercise in pregnant women. We therefore concluded that moderate intensity aerobic dance has a post exercise effect of reducing the blood pressure in pregnant women and so may be effective in controlling blood pressure in pregnancy. We suggest further study on the effect of aerobic dance in women with gestational hypertension.

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