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Original Research Article

Evaluation of some cardiovascular parameters of apparently healthy pregnant women in gas flaring communities: A baseline study in Bayelsa State, Nigeria

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Abstract

The study investigated the impact of gas flares in some cardiovascular parameters of apparently healthy pregnant women residing within gas flaring communities in Bayelsa state. Out of six hundred volunteers screened, two hundred subjects met the inclusion criteria drawn from Obuna, Polaku, Immiringi and Amossoma Communities as study group. The subjects were match for age, trimesters and duration of exposure to gas flares in their respective communities. The study reveal a prevalence rate of 0.33%,0.66% and 2.33% hypertension among the pregnant women in their first, second and third trimesters but 2%,and 10.33% pre-hypertension during second and third trimesters with normal blood pressure of 6%,26.66% and 17.33% in their first through third trimesters respectively during pregnancy. However, the prevalence of pre-hypertension and hypertension in non-pregnant was (14%) and (4.66%). The study also reveal a significant increase ($p<0.05$) in the systolic, diastolic, mean arterial and pulse pressure with a decrease percentage difference in respect to their duration of exposure to gas flares. Further revelations from the study also indicate a negative effect of gas flares in the age of the subjects in relation to their blood pressures. In conclusion, prolonged exposure to gas flares will result in an increase case of hypertension, and cardiovascular diseases among pregnant women living in gas flaring communities in Bayelsa state, Nigeria.

Keywords: Gas flares, pregnancy, exposure, blood pressure, pulse rate, pulse pressure, mean arterial pressure.

INTRODUCTION

Cardiovascular diseases are the common leading cause of death during pregnancy with clear manifestation of evidence showing a correlation between complications and cardiovascular diseases later in life-such as pregnancy induced hypertension, reduced growth of infant delivered indicating the mother's adaptation to physiological stress. Apparently healthy pregnant women are relatively resistance to the hypertensive effects of elevated rennin Angiotensin aldosterone system compared to women having history of cardiovascular diseases (Folkhalsan, 2015; Charles et al., 1998). Despite the advancement in medical research studies worldwide maternal death during pregnancy continue to be on the rise. Medical management may be compromised as a result of so much attention on the effect of medications on the embryo when compared to the non-pregnant. Mortality rate associated with complications from pregnancy due to hypertension during pregnancy and other hypertensive effects have been on the increase (Fabio et al., 2015). Diseases of the cardiovascular system with its pathological changes in blood flow to vessels due to damage of endothelium physiological role in modulating inflammatory process and homeostasis are usually compromised during this condition and it changes in relation to physiological functions in apparently healthy pregnant women. Cardiovascular diseases associated with renal dysfunctions are among the top leading causes of complications and death during pregnancy (Depak et al., 2016). Cardiovascular disease sometimes called epidemiology because of its spread and frequency to public health in this 21st Century has been investigated

by many epidemiological studies and the outcome from those studies indicate the unwanted effect of heavy metals on mortality of cardiovascular diseases (Peter, 2012).women reproductive organs have created much interest and research on this area in the medical field (Woolock and Bead, 1972).

Cardiovascular diseases remain the topmost cause of death that kills twice as much people when compared to parasitic and other infectious diseases. Apparently healthy pregnant women without known history of gestational diabetes has been observed in Bayelsa State and its negative outcome on the unborn fetus with a prevalent rate of 2.59% per 1000 pregnancies and other related complications but Cardiovascular parameters in gas flaring communities and its effect in apparently healthy pregnant women in Bayelsa State have not really been isolated to serve as a base line for others, thus this effect could be as a result of dietary overload or other related environmental factors (Agofure et al., 2019). Gestational hypertension could not actually mean an unhealthy pregnancy but can be a ringing bell of exposure to hazardous gases with its resultant effect on reduction in the flow of blood to the placenta etc. (Nivin, 2019). Cardiac output become elevation during normal pregnancy is attributed to an increase in blood volume of about 40% - 50% in preload, decreased after load due to reduction in vascular systemic resistance and elevation in the maternal heart rate to about 10-15 beats per minute. Compression of inferior vena cava by the enlarge uterus during the third trimester result in a decline of the stroke volume. Normal pregnancy is associated with decreased exercise capacity, fatigue, mild peripheral edema, audible physiologic systolic heart murmurs from augmented blood flow (Pushpalathmia, 2010).Though during term pregnancy maternal cardiac output may reduce depending on position of the mother for instance, lying in the supine position compressed the inferior vena cava resulting in a decrease venous return to the heart and low cardiac output as a result of the enlarge uterus called the syndrome of the inferior vena cava.

MATERIALS AND METHODS

The study is a cross-sectional descriptive qualitative research study with semi structured questionnaires to obtain data's directly from pregnant women who have been exposed to gas flares in their respective communities over a period of time in Bayelsa State. The pregnant women were grouped into first, second and third trimesters.

Location of Study

The location of study was Immiringi, Obuna communities and environs in Ogbia and Yenagoa local government area randomly selected hospitals and health centers in Bayelsa state.

Inclusion criteria

- Pregnant women within the ages of 18 to 50 years
- Subjects who have consistently reside in gas flaring communities and its environs for five years and above
- Informed consent
- Within the category of Healthy subjects.

Exclusion criteria

Participant with known manifestation of cardiovascular disease, obesity, diabetes, new residents, smokers, and less than 18years where excluded from the study.

Gestational Age

The gestational age was calculated using the date of the last menstrual period and palpation of the fundus.

Measurement of cardiovascular parameters

The participant's blood pressure was measured from the left arm with Acuson (England) mercurial sphygmomanometer and appropriate cuff in a sitting position after about ten minute rest. Two different readings were taken in each of the subjects after two minutes intervals and the average documented on the questionnaire. The systolic and diastolic blood pressures were taking at the first and fifth karotkoff sounds respectively. The mean arterial blood pressure (MAP) was calculated using systolic $_{+}$ (2) Diastolic/3 and the pulse pressure was calculated by subtracting the diastolic from the systolic blood pressure.

Pulse rate

The pulse was taken from the radical artery at the anatomical snuff box site in a sitting position for sixty seconds.

Ethical consideration; In accordance to Helsinki declaration on biomedical research, the was duly approved by the University of Port Harcourt and the Bayelsa State ministry of health ethical committee with approval number BSHREC/vol.1/20/1.

RESULTS AND DISCUSSION

The research study results were analyzed using

Table 1. Cardiovascular indices of the study population.

Parameters (mmHg)	Pregnancy in (trimesters)					
	1st (n=19)	2nd (n=90)	% Diff	3rd (n=91)	% Diff.	P-value <0.05
SBP	115.42±13.46 (100.00-153.00)	114.75±13.52 (86.00-151.00)	0.58	115.07±15.06 (89.00-161.00)	0.30	0.00#
DBP	69.95±11.33 (53.00-100.00)	65.07±11.01 (48.00-96.00)	6.97	71.24±11.62 (50.00-100.00)	-1.84	0.00 #
MAP	85.12±11.45 (70.00-117.67)	81.63±11.01 (62.67-113.33)	4.10	85.85±12.04 (66.57-127.00)	-0.85	0.00 #
Pulse (bpm)	85.21±12.07 (58.00-114.00)	85.78±11.89 (53.00-115.00)	-0.66	83.75±10.03 (59.00-108.00)	1.71	0.00 #
Pulse pressure	46.47±8.73 (29.00-65.00)	50.05±9.59 (26.00-79.00)	-7.70	44.44.3±9.97 (20.00-80.00)	4.36	0.02 #

NB: Results are given as mean ± standard deviation and range in parenthesis. # = <0.05 Significant.

Table 2. Relationship between cardiovascular parameters with age of the residents.

Parameters	<21yrs n=19 (%)	21-30yrs n=116 (%)	31-40yrs n=63 (%)	41-50yrs n=2 (%)	Anova. Sig. P=<0.05
SBP(mmHg)	105.00±1070 (22.62)	114.64±13.53 (24.56)	115.50±12.83 (24.78)	130.36±22.89 (28.01)	0.00#
DBP(mmHg)	65.63±9.15 (22.97)	67.79±11.37 (23.72)	69.47±11.19 (24.31)	82.82±13.33 (28.99)	0.00#
MAP(mmHg)	79.09±8.42 (22.86)	83.41±11.19 (24.11)	84.81±11.08 (24.51)	98.67±15.65 (24.75)	0.00#
Pulse (bpm)	87.68±11.94 (25.77)	84.78±10.15 (24.92)	83.55±11.50 (24.56)	84.18±11.48 (24.75)	0.53 not significant
Pulse Pressure (mmHg)	40.37±10.22 (21.82)	47.43±9.85 (25.75)	46.46±8.97 (25.23)	49.91±14.41 (27.09)	0.02#

NB: Results are given as mean± standard deviation #=significant.

Table 3. Relationship between duration of exposure and cardiovascular parameters.

Parameters (mmHg)	Short<10yrs	Long>10yrs	% difference	Anova sig.<0.05
Systolic	113.85±14.61	126.22±14.00	-10.86	0.02
Diastolic	68.72±11.43	79.02±11.96	-14.98	0.03
MAP	84.56±11.47	101.34±11.75	-19.84	0.04
Pulse (bpm)	84.37±11.09	85.76±10.72	-1.64	0.18not sig.
Pulse pressure	45.13±10.30	47.20±9.58	-4.58	0.03

statistical packaging for social sciences (SPSS) version 20.0.The cardiovascular parameters of the pregnant women of the study population are presented in Table 1, 2, 3 and 4.

Two hundred (200) hundred apparently healthy pregnant subjects were randomly selected for this study from gas flaring communities within Bayelsa State.

DISCUSSION

The study reveals the characteristics of cardiovascular status of the entire study population as follows: systolic blood pressure (114mmHg), Diastolic blood pressure (69mmHg), mean arterial blood pressure (84mmHg), Pulse (83bpm), and pulse pressure (45mmHg)

Table 4. Comparison of blood pressureamong pregnant subjectsin trimesters.

BP(mmHg) Trimesters	Hypotension <90/<60 No (%)	Normal 90-119 No (%)	Pre-hypertension 120-139 No (%)	Hypertension >140/90 No (%)	Total No (%)
1st	-	18 (6)	-	1(0.33)	19(6.33)
2nd	2 (0.66)	80 (26.66)	6 (2)	2 (0.66)	90(30)
3rd	1(0.33)	52(17.33)	31(10.33)	7(2.33)	91(30.33)
Prevalence pregnant No(%)	3(1)	150 (50)	37 (12.33)	10 (3.33)	200(66.66)
Prevalence non-pregnant No(%)		44(14.66)	42(14)	14(4.66)	100(33.33)

NB: BP=Blood pressure

respectively. However, the cardiovascular parameters mean values of the pregnant women indicate a significant P-values of <0.00. The pregnant subjects had an increase pulse rate of 85.78beats per minutes in second trimesters but 83.75 beats during the third trimester compared with those in their first trimester 85.21bpm. Larger diastolic blood volumes during pregnancy contribute to an increase cardiac heart rate and prolong exposure to gas flares increases the pulse rate of adults living in such polluted communities and due to the depletion of oxygen tension within the blood by the inhaled particulate matter makes the body to respond by increasing the heart rate so as to sustain the body tissues oxygen demand. Note that persistent increase heart rate over a long period can result in myocardial hypertrophy (Hamilton, 1949; Ovuakporaye et al., 2016). A Research study by Sumaira et al. (2016) observed a normal blood pressure range among his participants but a decreased diastolic blood pressure during the first and second trimesters but return almost to the control during third trimester. Our study reveals normal blood pressures of the pregnant women with no decrease in diastolic blood pressure that returns to that of first trimester during the third trimester (WHO, 2014). Ismail et al. (2012) observe the rate of hypertension among female subjects in Amossoma Community in southern Ijaw local Government area of Bayelsa State at (12.5%) with a P-value of (0.08). The indiscriminate gas flares could be a major factor contributing to the development of cardiovascular diseases such as high blood pressure among residents in the Niger Delta including preterm delivery (Onome et al., 2020; Julia, 2020).

The study also reveals slight increase systolic, diastolic and mean arterial blood pressures of the pregnant subjects during their third trimester when compared with those in their first and second trimesters with a statistically significant p-value of (0.00) though not hypertensive (115/71mmHg) (115/69mmHg) (113/69mmHg). This study agrees with Samar (2013) who observed a normal blood pressure range among his pregnant study population when compared to non-pregnant but disagree with him in the area of decrease diastolic blood pressure of the pregnant test group during their first and second trimesters. This is because according to World Health Organization (2014), normal blood pressure is classified as (99-119/60-79mmHg) but our findings never fall short of this range.

Further classification of the Cardiovascular status of the pregnant women with age reveal a significant increase in systolic, diastolic, mean arterial and pulse pressures progressively from less than twenty years of age to fifty years (P-values 0.00). Aging in addition to gas flares exposure is a major predictor of adverse cardiovascular indices such as the elevation of the central vascular stiffness (Jochen et al., 2011). The pulse rate decreases along with an increased age range of within 31-50years though not significant (0.53). The reduction in maximum heart rate is link with ageing process that reduces the spontaneous electrical system generated by the major pacemaker – myocytes in the SA node of the heart which could be caused by behavioral changes of some ions channel membranes in the older cells (Eric et al., 2013). The study reveals that the longer the exposure to gas flares according to age the higher the effect on blood pressure of the subjects. This observation agrees with Ovuakporaye et al. (2019) who observe a similar increase in the blood pressure (138/84mmHg), though with a pulse rate of (85bpm) among female subjects living in gas flaring communities in Ogbia Bayelsa State, south- south Nigeria but not specifically on pregnant women. We also observed a statistically increase (p<0.00) pulse pressures among the pregnant subjects with advancing age and duration of exposure to gas flares.

CONCLUSION

The systolic, pulse pressure and the mean arterial blood pressure of the pregnant increased significantly (0.00) among participants above forty (>40) years of age in addition to duration of exposure with a prevalence rate of

12.33% and 3.33% pre-hypertension and hypertension. There was a significant increase pulse rate of 85bpm which may be due to depletion of oxygen tension in the blood caused by particulate matters from the gas flares.

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