ISSN 2664-8075 (Print) & ISSN 2706-5774 (Online)
South Asian Research Journal of Applied Medical Sciences
Abbreviated Key Title: South Asian Res J App Med Sci

| Volume-3 | Issue-4 | Nov-Dec 2021 | **DOI: 10.36346/sarjams.2021.v03i04.003**

Original Research Article

The Impact of Toxic Gases on Cardiovascular Indices of Non Pregnant Women in Bayelsa State Nigeria

DR Solomon-M Uvoh, DR Azibalua A Asara, Dr Charles Ngaikedi NNAMDI[1]

[1]Department of Human Physiology, Faculty of Basic Medical Sciences, College of Health Sciences University of port Harcourt, Rivers State Nigeria

***Corresponding Author**
DR Solomon-M Uvoh PhD

Article History
Received: 29.10.2021
Accepted: 04.12.2021
Published: 07.12.2021

Abstract: This study investigated the impact of toxicological air on cardiovascular indices of non-pregnant women in Bayelsa state. The study subjects consist of two hundred apparently healthy non pregnant women in gas flaring communities selected randomly between the ages of 20 to 45 years. Parameters measured was systolic,diastolic,pulse rate, pulse pressure, mean arterial blood pressure, body mass index using auscultatory, weight and height methods and calculation of the prevalence rate of high blood pressure among non-pregnant women in Bayelsa state. Result from the study shows significant higher mean values of systolic (123mmHg),diastolic (78,75mmHg), mean arterial blood pressure (93,90mmHg) among resident of Obunagha/Polaku and Immiringi located in the epicentre of gas flares compared with Kolo/Otuagila (118mmHg), (72mmHg) and (87mmHg) a non-gas flaring communities. However the pulse rate and pulse pressure was higher (86bpm) (47mmHg) among resident subjects in Kolo and Otuagila compared with Polaku and Immiringi having a decrease percentage difference. Furthermore, the blood pressures of the participants increase significantly with advancing age while the pulse rate decreases. The systolic blood pressure increases among those that fall into the category of underweight compared with other body mass index. The prevalence of hypertension was 14%, prehypertension 42% and a normal blood pressure of 44% respectively. Subjects with prolong exposure to gas flares in their respective communities had higher blood pressure in comparison to short duration of exposure. This study has shown that exposure to the toxic components from gas flares have a detrimental effect on the cardiovascular tree of women residents with resultant increase in their blood pressures in Bayelsa state.

Keywords: Blood pressure, women, Bayelsa, gas flares, toxic, prevalence.

INTRODUCTION

The exploration of oil by companies in conjunction to the flaring of gas within the state over the past years has resulted immensely in environmental contamination with its unwanted impacts on cardiorespiratory functions of its citizens in host communities (Bayelsa State MH, FHI 360 2013).

Gas flares from the oil rich kingdom of Bayelsa state

According to World Health Organization (2016), about 6.5 million deaths are attributed to the exposure to outdoor air pollution, water, and land related. This has resulted to the development of non-communicable diseases such

as pulmonary obstructive diseases that is chronic in nature and cardiovascular diseases. Flaring of gases has resulted in the introduction of considerable number of hydrocarbons such as oil gas, water and waste oil gas with Substantial evidence from studies indicating a correlation between particulate from gas flares within Niger Delta communities such as Rivers and Bayelsa with respiratory diseases (Adoki, 2012). Diseases of the cardiovascular system is the main causes for pathological alterations in heart, blood flow and their vasculature due to damage of endothelium that usually plays a physiological role in the modulation of inflammatory process, homeostasis and vasodilatation worldwide. Cardiovascular diseases remain the topmost causes of death that kills twice as much people compared to parasitic and other infectious diseases. The air we inhale into our respiratory system consist of free radicals in the form of toxins and air pollutant from gas flares into the environment have thus implicated the disease conditions such as cardiovascular diseases, cataracts, lung dysfunction, skin lesions, and aging (Tausett, 2002). Indiscriminate gas flaring into the environment have contributed to development of cardiovascular diseases by increasing the process leading to the thickening of the lumens of the arterial walls of blood vessels (Harman, 1992) (frank, 1985) (Andrew, 2001). Hazardous chemicals have a toxicological effect on biological system when absorbed into blood stream from a smaller risk to a more profound risk. A study conducted by Nwafor *et al.,* (2015) provide a baseline population data establishing that the populations in the oil bearing communities in the Niger Delta are at high risk of developing hypertension. Hazardous chemicals have a toxicological effect on biological system when absorbed into blood stream from a smaller risk to a more profound risk. Therefore, it becomes pertinent to provide an explicit prediction for some cardiovascular parameters among non-pregnant women to ascertain whether the increase in cardiovascular dysfunction is link to the indiscriminate gas flares in Bayelsa state.

MATERIALS AND METHODS

Study sample

This study involve two hundred non-pregnant female adult subjects between the ages of (20-45 years) residing in some gas flaring polluted communities (Immiringi, Nembe, Obuna,kolo,otuagila) in Bayelsa state, Nigeria. These communities have been involuntarily subjected to indiscriminate emission of gas flares insensitively silted close to communities by the shell petroleum companies over several decades.

Data Collection

Random sampling method and well-structured questionnaires were used to select the participant for the study. Participants with obvious cardiovascular abnormalities were excluded from the study.

The blood pressure of the participant was measured in a sitting position from the left arm with an Atlas (China) mercurial sphygmomanometer and a stethoscope twice with the average numbers taken.

The pulse rate was taken from the anatomical snuff box using the index finger also known as forefinger. The weight and height of the subjects was measured using Camry (China) bathroom scale weight balance while their height was determined using a calibrated height meter rule.

Statistical Analysis

The analysis was carried out using statistical packaging for social sciences version 23.0 Chicago USA.Analysis of data were expressed as mean ± standard deviation and percentage for independent variables calculated. A P-value of <0.05 was considered statistically significant.

Ethical Consideration

The methodology employed for this study was approved by the ethical committee of the University of Port Harcourt.

Consent was obtained from each of the participant before they could freely participate in the study.

Table 1: Comparison of cardiovascular indices in different communities among non- pregnant subjects

Parameters (mmHg)	Kolo/Otuagila (N=50)	Obuna /Polaku(N=80)	% Diff	Immiringi (N=70)	% Diff	P-value
BMI (Kg/m²)	25.92±4.95	22.95±6.31	-12.15	24.30±5.97	-6.45	0.11NS
Sys	118.50±4.74	123.43±14.28	3.72	128.30±13.60	1.50	0.03#
Dias	72.40±2.89	78.52±11.71	8.11	75.03±12.25	3.56	0.03#
MAP	87.32±3.49	93.60±12.26	6.94	90.13±13.26	3.16	0.21NS
Pulse rate (bpm)	86.45±14.06	80.34±11.18	-7.32	80.32±10.21	-7.35	0.00#
Pulse Pressure	47.07±9.18	45.60±7.19	-3.17	46.00±8.10	-2.29	0.06NS

NB: Results are given as mean ± standard deviation, green=increase %diff, red=decrease %diff. # = Significant

Table 1 shows cardiovascular changes in the different communities in non-pregnant women. Kolo and Otuagila were used as control communities with no gas flares compared with Immiringi, Obunagha, Polaku communities located at the epicentre of gas flares.

Table 2: Relationship between duration of exposure to gas flares and cardiovascular indices

Parameters	**Short <5yrs**	**Long >5yrs**	**%Diff.**	**P value**
Sys (mmHg)	112.33±7.22	130.37±10.11	-17.67	0.02#
Dias (mmHg)	68.52±9.12	88.79±8.45	16.07	0.02#
MAP(mmHg)	83.12±5.77	73.15±7.35	29.58	0.04#
Pulse pressure(mmHg)	81.80±5.67	78.92±6.23	-11.99	0.25NS
Pulse rate(bpm)	43.75±10.23	41.09±4.76	-6.08	0.04#

 # Significant, NS not significant

Table 2 shows the categorization of the participant according to their years of stay and exposure in their respective communities.

Table 3: Cardiovascular status of non-pregnant women with age

Parameters	**<21yrs n=14 (%)**	**21-30yrs n=96 (%)**	**31-40yrs n=70 (%)**	**>40yrs n=20 (%)**	**Anova. sig. P=<0.05**
SBP(mmHg)	109.00±13.45 (23.55**)**	110.77±15.86 (23.94**)**	113.66±13.42 (24.56**)**	129.33±14.01 (27.95**)**	0.01#
DBP(mmHg)	68.60±12.32 (23.58**)**	69.21±10.83 (23.79**)**	70.48±13.60 (24.22**)**	82.66±6.42 (28.41**)**	0.02#
MAP(mmHg)	82.06±12.21 (23.57**)**	83.91±13.76 (24.09**)**	84.03±11.10 (24.13**)**	98.22±2.83 (28.21**)**	0.02#
Pulse (bpm)	84.40±10.13 (27.79**)**	81.02±8.37 (26.69**)**	79.19±8.99 (26.08**)**	59.00±29.87 (19.43**)**	0.00#
Pulse pressure(mmHg)	40.40±7.43 (22.92**)**	41.56±8.36 (23.37**)**	43.18±10.05 (24.28**)**	46.66±19.55 (26.24**)**	0.00 #

Table 4: Relationships between Body mass index and 0verall CVS Parameters in non-pregnant subjects

BMI (kg/m^2)	**<18. 5-24.9 kg/m² (n=14)**	**18.5-24.9 kg/m² (n=106)**	**25.0-29.9 kg/m² (n=60)**	**>30 obese kg/m² (n=20)**	**P value**
SBP (mmHg)	145. ±000	113.38±15.78	111.57±11.85	113.00±14.15	0.15 not significant
DBP (mmHg)	78.00±0.0	70.68±13.03	68.60±10.86	70.41±10.74	0.28 not significant
MAP (mmHg)	100.33±0.00	84.91±13.22	82.92±10.52	84.60±11.56	0.23 not significant
Pulse (bpm)	67.00±0.00	78.55±12.46	81.57±7.46	81.29±6.52	0.00 #
Pulse pressure (mmHg)	67.00±0.00	42.13±10.56	42.80±8.22	42.59±6.67	0.10 not significant

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

Table 5: Prevalence of high blood pressure among different age group

BP(mmHg) **Age (years)**	**Hypotension <90/60 No (%)**	**Normal 90-119/60-79 No (%)**	**Pre-hypertension 120-139/80-89 No (%)**	**Hypertension >140/90 No (%)**	**Total number No (%)**
<21	- -	10 (5**)**	4 (2**)**	-	14(7**)**
21-30	- -	48 (24**)**	38 (19**)**	10 (5**)**	96(48**)**
31-40	- -	22 (11**)**	38 (19**)**	10 (5**)**	70(35**)**
>41	- -	8 (4**)**	4 (2)	8 (4**)**	20(10**)**
Prevalence No (%)	- -	88 (44**)**	84 (42**)**	28 (14**)**	200(100**)**

NB: BP=blood pressure.

DISCUSSION

The blood pressures of the non-pregnant women whose Body mass index was (≤18.5kg/m²) below normal weight were observed to have higher (145/78mmHg) blood pressures than those with normal Body mass index of 18.5-24.9kg (113/70mmHg) with no statistical significant p-value (0.15). Aging 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 31-45years 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 behavioural changes of some ions channel membranes in the older cells (Eric *et al.*, 2013). 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. There was also significant increase ($p<0.00$) in pulse pressures among the study subjects with advancing age. Their blood pressure increases according to their age range with significant decrease in pulse rate from age twenty one (84bpm) to age above forty (59bpm). The result from the study further shows a significant increase in cardiovascular indices of subjects expose above five years compared with short duration of exposure. However there was a decrease in the pulse pressure of among long duration participant in relation to short duration with decrease percentage difference. Solomon *et al.,* (2021) conducted a similar study in pregnant subjects observed significant increase in blood pressure though a little bit lower due to the physiological effect of relaxing secreted by the anterior pituitary gland regards duration of exposure and age of the participants to gas flares in Bayelsa state. Egwurugwu (2013) also observed a similar increased in the systolic, diastolic, and mean arterial blood pressures of indigenous residents in gas flaring communities from his research studies. Omosivie *et al.,* (2017) results on how gas flares significantly affect the blood pressures of residents of host communities when compared to non-gas flaring communities. Hypertension has contributed to the global burden of cardiovascular diseases (Alagoa *et al.,* 2013). The total prevalence rate of hypertension and prehypertension among non-pregnant from this study was 14% and 42% and a p- value of <0.05. However, research findings of Ismail *et al* (2013) indicate the rate of hypertension among female subjects in Amossoma Community in southern Ijaw local Government area of Bayelsa State as (12.5%) with a P- value of (0.08). According to Brooke *et al* (2010), PM 2.5 has been deeply linked to the increase risk of developing myocardial infarction, cardiac arrhythmia, stroke, and heart failure within few days in susceptible individuals. Endothelial dysfunction and vaso constriction of individuals living in gas flares region are major contributing factors to the development of arteriosclerosis leading to hypertension, alteration in prothrombin, autonomic imbalance and arrhythmias (Pope *et al.*, 1996).

CONCLUSION

This study have shown that the increase in cardiovascular indices among non-pregnant resident in communities located at the epicentre of gas flares had deranged blood pressures, body mass index and high prevalence rate compared to non-gas flaring communities in Bayelsa state.

Conflict of Interest: The authors have declared no conflict of interest.

Acknowledgment: We acknowledge and appreciate the fatherly contribution of Great Professor Arthur N Chuemere to the success of this research study.

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Citation: Solomon M Uvoh *et al* (2021). The Impact of Toxic Gases on Cardiovascular Indices of Non Pregnant Women in Bayelsa State Nigeria. *South Asian Res J App Med Sci, 3*(4), 29-33.