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EFFECT OF CONTAMINATED AIR ON RENAL INDICES OFNON-PREGNANT WOMEN IN BAYELSA STATE NIGERIA

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ABSTRACT

This study determines some renal parameters of non-pregnant women exposed to polluted air and ascertains whether the increase in renal dysfunction is linked to the indiscriminate gas flares in Bayelsa state. A random sampling technique was used in this study. Participants within the ages of31-40 years of age had a non-significant higher uric acid concentration (4.03mg/dl) compared with age 41-50 (2.53mg/dl), age 21-30 had a significant increased urea (3.44mmol/l) compared to age 31-40 (3.41mmol/l) and 41-50 (3.06mmol/l). Creatinine concentration was significantly higher among age 31-40 (93.29µmol/l) in comparison with age 41-50 (90.33µmol/l). The prevalence of high urea, creatinine, and uric acid was (2%),(39%), and (2%) respectively. All the renal indices of non-pregnant women from the epicenter of contaminated air were all significantly higher compared to the control communities (Kolo and Otuagila) with decreased percentage difference except Immiringi having an increased percentage difference in uric acid concentration. in relation to the number of years exposed to contaminants, participants above five years of exposure were observed to have a significantly higher renal mean values concentration and a decreased percentage difference compared with less than five years of exposure. This study has confirmed that indiscriminate flaring of gases into host communities increases renal indices of non-pregnant women and could gradually result in renal dysfunction in the Bayelsa state.

KEYWORDS

Toxic air, prevalence, exposure, renal indices, non-pregnant.

INTRODUCTION

According to World Health Organization (2016), about 6.5 million deaths are attributed to outdoor air pollution, water, and land related exposure. This has resulted in the development of non-communicable diseases such as renal, pulmonary obstructive diseases that is chronic in nature and cardiovascular diseases. The quality of air status as contained in green data book (2015) indicates that Nigerian population are exposed to toxic air at PM 2.5 levels that is above the permissible limit of World Health Organization(Fabio *et al.*, 2015).Exploration of oil and gas in Nigeria started sometimes in 1908 and 1914 by the German and British colonial petroleum company. The discovery of oil in larger quantity in Oloibiri 1956 then River state by Shell British petroleum in the tertiary Agbada formation with more discoveries in Ughelli Delta state have resulted in the contamination of the natural air depended upon for survival by the citizens (Nwankwo 2011;Nwaobi 2005) (Satarug 2006).**Urea** (carbamide) is a highly soluble organic compound and a major end product of protein catabolism that is relatively nontoxic but synthesized in the liver from ammonia and excreted by the kidney as a result of its transportation through circulated blood. **Creatinine** is a waste product from the metabolism of muscles from a breakdown compound called creatinine. (C4H7N3 0).The serum creatinine may occasionally decreased during dehydration, decreased blood volume and decreased diet on proteins meal or medications. When there is low muscle mass such as muscular dystrophy, liver disease, aging and pregnancy can result in low creatinine concentration level. High creatinine level can result in fluid retention within the bladder and body tissues of the body to cause tissue swollen, nausea etc. Renal manifestation are of two types but in the more common form, renal failure develop insidiously and usually progresses slowly over a period of several months to years. Another form occurs suddenly in the absence of obvious previous renal impairment and is manifested by acute renal failure with oliguria. It is also probably induced by obstruction by the Bence Jone protein cast, commonly occurring in patients with other precipitating factors such as dehydration which could be cause by regular heat from gas flares (Robins and Cotran 1979).Health risk defined as any factor responsible in raising the possibility of adverse health outcome such as air pollution from gas flares, cigarette smoke with unsafe water, sanitation and hygiene responsible for 4% of leading global risk for burden of diseases particularly affecting Africa populations with low income (WHO 2009).However, five risk factors resulting in non-communicable diseases as outline by WHO (2019) include are air pollution, unhealthy diet, alcohol abuse, physical inactivity and tobacco smoke as one of the leading causes of death worldwide. Hence, a deeper understanding of these factors will help to develop effective strategies for improving the health status of non-pregnant women in Bayelsa state, Nigeria.

MATRIALS AND METHODS

Study Design

The study is a cross-sectional descriptive qualitative research with semi structured questionnaires used to obtain data's directly from participants exposed to toxic air in their respective communities over a period of time using a systematic sampling method.

Study Location

The non- pregnant participants were interviewed in Government hospitals and health centers including some private hospitals / health centers located in gas flaring communities and its environs in Polaku, Obunagha, Kolo, Immiringi and Otuagila communities in Bayelsa State Nigeria.

Sources of data: primary

Inclusion criteria

- Participants within 18 to 50 years.
- Participants who have spent at least five years and above consistently in their respective communities and its environs.

Exclusion criteria

Participant with known family history of diabetes, on antacid therapy, diuretics, new residents renal disease, smokers, and less than 18years where excluded from the study.

Study Population

A total of two hundred non- pregnant women were randomly recruited from Obuna, Polakau, Immiringi, Kolo, and Otuagila.

- JAYKARAN AND TAMOGHNA 2013 FORMULA
- The minimum sample size was calculated using 13.73% estimate proportion of non-pregnant women with renal diseases in Bayelsa state (Ide et al., 2018).
- n= *pq /(e/ 1.96)2.*
- n= 13.73*x86/(5/ 1.96)2*
- n= 1180/6.51
- = 181.37 participants
- Where n= sample size
- *P* = working prevalence rate for non-pregnant women in Bayelsa state
- *q* = 100 -*p*
- *e* = margin of sampling error tolerated at 95% degree of confidence.
- Adjusting for non- response rate of 10% =10/ 100x 181.37 = 18.137
- Sample size = 181.37+18.14= 199.507participants.Approximately 200 participants

Collection of blood samples

Three milligrams of peripheral venous blood was collected through venipuncture and transferred immediately into a sterile lithium Heparinized bottles for analysis on the same day at the NDUTH.

Determination of Serum Urea

About 10pl of the incubated at 37^{oc} for 15minusing Randox urea test kit (United Kingdom). The absorbance was taken at 546nm. The serum urea concentration was determined in mmol/L using Berthelot method.

Urea+H_2o $2NH_3$+Co_2 ⟶

NH_3+hypoclorite +phenol Indophenol (blue compound). ⟶

Determination of serum creatinine

The amount of the complex formed due to creatinine reaction with picnic acid in alkaline solution is directly proportional to the concentration of the creatinine using modified jaffe's methods.

Procedure

100pl of the serum were added to reagent and then mixed. The absorbance A, of the standard A_2 of the standard and sample were taken two minutes later and the creatinine concentration was determine and expressed inμmol /l.

Uric Acid(mg/dl)
Randox (United Kingdom) test kits using enzymatic colorimetric method.

Blood pressure: Omron digital blood pressures monitor using the left arm.

Ethical Consideration

In accordance with the proposed ethical regulatory requirement from every researcher on human subjects and in line with Helsinki declaration on bio-medical research, an informed consent was duly obtained from all the subjects to enable them freely participate without pressured. The research was duly approved by the University of Port- Harcourt with
Approval number UPH/CEREMAD/REC/MM62/009

Table 1: Characteristics of the study population

Parameters	Mean values (No =200)	minimum	Maximum
Urea (mmol/L	3.41±0.99	1.10	7.10
Creatinine (µmol/L)	88.78±21.35	60.00	177.00
UricAcid (mg/dl)	3.76±1.18	1.00	6.00

Table 1 shows the characters exhibited by the participants i.e. mean values, standard deviation, minimum and maximum range of the analyzed parameters.

Table 2: Relationship between renal indices and age in non-pregnant women

Parameters	<21yrs N=18 (%)	21-30yrs N=92(%)	31-40yrsN=70(%)	41-50yrsN=20(%)	P-Value<0.05 Significant
Uric Acid (mg/dL)	3.72±1.33 (26.63)	3.67±1.16 **(26.27)**	4.05±1.12 **(28.99)**	2.53±1.33 **(18.11)**	0.14ns
Urea (mmol/L	3.16±0.30 **(24.18)**	3.44±0.96 **(26.32)**	3.41±1.07 **(26.09)**	3.06±1.61 **(23.41)**	0.03#
Creatinine (µmol/L)	80.00±14.17 **(22.81)**	87.13±19.26 **(24.84)**	93.29±25.17 **(26.59)**	90.33±30.00 **(25.75)**	0.04#

NB: Results are given as mean ± standard deviation # significant, ns not significant.

Table 2. Shows the renal changes in non-pregnant women exposed to toxic air in relation to their age. Participants were grouped into < 21 to 50 years of age. There was a non-significant (p>0.05) increase values in uric acid concentration among age (31-40) years compared to the younger age mean values of (41-50) years. A significant (p<0.05) decrease in urea among age greater than forty years compared to less than forty years subjects. Creatinine mean value was significantly (p<0.05) lower among age (<21) years.

Table 3: Comparison of renal indices in different communities among non-pregnant women

Parameters	Kolo/ Otuagila (N=40)	Obuna /Polaku (N=50)	% Diff	Immiringi (N=50)	% Diff.	P-Value
Uric acid (mgl/dl)	3.52±1.22	3.70±0.73	-5.11	3.99±1.51	13.3	0.00
Urea (mmo/l)	3.08±0.92	3.53±1.81	-14.6	3.34±0.73	-8.44	0.00
Creatinine (µmol/l)	80.63±20.24	81.13±18.66	-0.62	84.40±15.37	-4.67	0.01

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

Green=increase %diff, red =decrease %diff

Table 3 Shows the various gas flaring communities compared to the control (Kolo and Otuagila) a non-gas flaring communities of about nine kilometers from the epicenters. Significant (p<0.05) lower mean values were observed in Kolo and Otuagila compared to communities located in the epicenter of gas flares. The subtraction of the test groups from the control with subsequent division using the control values and multiplication by one hundred is the percentage difference.

Table 4: Duration of exposure and renal indices in non-pregnant women

Parameters	**Non pregnant**			P value sig <0.05
	Short (<5yrs) N=72	Long (>5yrs) N=128	**%diff**	
Urea (mmol/L)	3.31±0,84	3.45±1.06	-4	0.00#
Creatinine (µmol/L)	85.13±20.31	90.82±21.79	-6.68	0.02#
Uric acid (mg/dl)	3.61±1.40	3.84±1.03	-6.37	0.00#

NB: Results are given as mean ± standard deviation # significant. Red =decrease %diff

Table 4 Shows how the participants are grouped into years of exposure to polluted air in their respective communities' ie consistent residents in less than five years and above within gas flaring communities were categorized into short and long duration of exposure with a significant (p<0.05) in non-pregnant women.

Table 5: Relationship between Uric acid and blood pressure in non-pregnant women

BP (mmHg) / **Uric A. (mg/dl)**	**Hypotension <90/<60 No (%)**	**Normal 90-119 No (%)**	**Prehypertension 120-139 No (%)**	**Hypertension >140/90 No (%)**	**Prevalence No(%)**
low<2.4	-	14 (7)	8 (4)	2 (1)	24 (12)
normal 2.4-6	-	74	72	26	172 (86)

		(37)	(36)	(13)	
high >6	-	-	4 (2)	-	4 (2)
Prevalence No (%)	-	**88** **(44)**	**84** **(42)**	**28** **(14)**	**200(100)**

Table 6: Relationship between serum creatinine and blood pressure in non-pregnant women

BP(mmHg) / **Creatinine** (µmol/L)	**Hypotension <90/<60 No (%)**	**Normal 90-119** No (%)	**Prehypertension 120-139** No (%)	**Hypertension >140/90 No (%)**	**Prevalence %**
normal 45-90)	-	50 (25)	50 (25)	22 (11)	122(61)
high >90	-	38 (19)	34 (17)	6 (3)	78 (39)
Prevalence No (%)	-	88 (44)	84 **(42)**	28 **(14)**	200(100)

Table 7: Relationship between serum urea and blood pressure in non-pregnant women

Urea(mmol/L) / **BP(mmHg)**	**Low (<2.5)** **No.(%)**	**Normal (2.5-7.1)** **No.(%)**	**High (>7.0)** **No.(%)**	**Total number** **No.(%)**
Hypotension <90/<60				
Normal 90-119/60-79	22 (11)	66 (33)		88 (44)
Pre-hypertension 120-139/ 80-89	8 (4)	72 (36)	4 (2)	84 (42)
Hypertension>140/90	2(1)	26 (13)		28 (14)
Prevalence No. (%)	32 (16)	164 (82)	4 (2)	200 (100)

DISCUSSION

The result shows a higher significant blood serum uric acid, urea, and creatinine (0.00) with a slight decrease in urea and creatinine among the non-pregnant women aged (>40yrs).Ageing reduce renal tissues, number of nephron and decrease blood flow to kidney which may increase renal indices. Another factor may be reduction in lean body mass decrease blood plasma renal indices.Our study also reveals a significant increase in renal function indices in relation to the effect of prolonged exposure to gas flares among the participants. Persistent dehydration and decrease renal perfusion due to prolonged exposure to gas flares can lead to an increased level of blood urea (Ovuakporaye, 2016).This is congruent with (Abia et al., 2019 and Odo et al., 2019) who observed a marked increase in renal function test due to exposure to gas flares in the Niger Delta region using human subjects. The overall prevalence of low, normal and high serum urea level according to in relation to blood pressure among the non-pregnant women was (16%) <2.5mmol, (82%) 2.5-7.1mmol/ L and (2%) mmol/L. The percentage prevalence values for the distribution of serum uric acid were (86%) normal with an elevated concentration of (2%). Creatinine was (61%) normal and (39%) high among the participants. Thus the prevalence of hypertension in relation to renal indices was (14%).An elevated serum uric acid is a key factor leading to the development of articular degeneration, gout, atherosclerosis and vascular inflammation (Jessica et al 2015). The increase serum creatinine concentration among non-pregnant women may be due to excess heat generated from gas flares resulting in dehydration and as well stress from daily farming and fishing activities (Oseji, 2011).The percentage of normal uric acid was (37%) among non-pregnant women with normal blood pressure followed by (36%) pre hypertension but (17%) and (3%) with high creatinine level had their blood pressure in pre hypertension and hypertensive stage. The study further reveal (36%) and (13%) of normal urea level having pre hypertension and hypertension among non-pregnant women in Bayelsa state.

CONCLUSION

This study revealed that the longer the duration of stay in an exposed environment to constant gas flares (contaminated air) affect humans who depend on such environment for survival such as increased serum creatinine and uric acid concentration as road map to renal dysfunction among non-pregnant women.

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