

Blood Serum Lead and Cadmium Level Among Pregnant Women in Gas Flaring Communities in Bayelsa State Nigeria.

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Abstract: This research study determines the serum lead and cadmium (ppm) level of pregnant women living in gas flaring communities in Bayelsa State, Nigeria. Two hundred apparently healthy pregnant women and one hundred non-pregnant as control were randomly selected as participants for this study. The prevalence of elevated serum lead (>0.1ppm) above the world health organization permissible range among the non-pregnant and pregnant subjects was (2%) and (5%) while that of cadmium (>0.0012ppm) was (11.33%) and (19.66%) respectively. However the total prevalence of elevated heavy metals in the blood of non-pregnant and pregnant subjects was (6.66%) and (12.33%).The study reveal a non-significant increased concentration of Lead level among the non-pregnant control group (0.07ppm) to that of the pregnant test (0.05ppm) with no difference in their cadmium (0.01ppm) level. The study reveal a non-significant slight increase in the level of Lead among the pregnant test group (0.06ppm) during their third trimester when compared with those in their first and second trimesters (0.05ppm) with a cadmium blood level of (0.02ppm) among those in their third trimester.

Keyword: Lead, Cadmium, Pregnancy, Serum, Blood pressure, Trimesters

INTRODUCTION

Lead is a naturally occurring metal found in the environment and earth crust. The activities of man such as mining, and the burning of fossil fuels discharged lead into our environment. The human body cannot use lead but rather stores it like calcium in the bones, teeth etc.(Navas *et al*, 2007); Maternal exposure to lead, cadmium and its subsequent absorption into the blood stream through the gastrointestinal tract may be either through food, soil, dust, water from the environmental. Lead crosses the placenta blood barrier to the unborn child to cause miscarriage, premature birth, stillbirth, low birth weight, severe brain damage, and nervous system disorder. This is because they absorb lead faster than adults. (WHO 2016).Studies also indicate that mothers with significant level of cadmium had significant increase in both systolic and diastolic blood pressure (Erebi *et al*, 2013; Nilima *et al*, 2011). Cardiovascular disease also known as the epidemiology due to its rapidity and frequency with its implication to public

health in this our 21st Century has been investigated by many epidemiological studies and the results from those studies shows the negative effect of lead and other heavy metals on mortality of cardiovascular diseases (Peter 2012). The long term effect of lead poisoning can result in irreversible nephropathy, cognitive difficulties with extended electroencephalogram pattern and encephalopathy in the nervous system. Reduction in the synthesis of hemoglobin and anemia also result in high level exposure to lead (Hernberg *et al*, 1970). The effect of lead on renal impairment can result in proximal tubular dysfunction and changes in ultra-structural architecture to either chronic nephropathy or kidney failure (Goyer, 1971). The exposure to lead has been shown to cause a deficiency of nitric oxide and its relaxing endothelial effects thereby resulting in high blood pressure. Severe exposure to lead thus results in the exaggeration of the sympathetic nerve tone activities with norepinephrine plasma level increase (Tsao *et al*, 2000). Evidence from previous studies have shown cadmium as a strong initiator of atherosclerosis and progression by increasing blood pressure or damages through the kidneys (Satarug *et al* 2006 and Hwangbo *et al* 2011).

MATERIALS AND METHODS

Location of Study; gas flaring communities and its environs in Yenagoa, Ogbia, Southern Ijaw local government area of Bayelsa State Nigeria.

Sample of Study Population; A total of two hundred pregnant and one hundred non- pregnant women were randomly selected from Tombia, Obuna, Polakau, Okolobiri, Immiringi etc. as research test groups and control subjects for the research study. The subjects must have lived in their respective communities consistently within Bayelsa State for at least five years.

Analysis: The results were analyzed using statistical packaging for social sciences (SPSS) version 20.0.

Sources of Data; The Primary data were collected from the subjects directly in government health centers located in their respective communities located within the state.

Determination of blood cadmium and lead concentration

Heavy metal analysis was conducted using Varian AA240 Atomic Absorption Spectrophotometer according to the method of APHA 1995 (American Public Health Association) at Springboard research laboratories Awka Anambra State Nigeria.

Working principle: Atomic absorption spectrometer's working principle is based on the sample being aspirated into the flame and atomized when the AAS's light beam is directed through the flame into the monochromator, and into the detector that measures the amount of light absorbed by the atomized element in the flame. Since metals have their own characteristic absorption wavelength, a source lamp composed of that element is used, making the method relatively free from spectral or radiation interferences. The amount of energy of the characteristic wavelength absorbed in the flame is proportional to the concentration of the element in the sample.

Ethical Consideration: The research was duly approved by the Bayelsa state ministry of Health ethical committee, with approval number **BSHREC/Voi,1/20/1**.

RESULTS

Table 1: Blood serum concentration of lead and cadmium of the study population

Parameters	Non-pregnant	Pregnancy in Trimesters						
		1 st Trimester	% diff	2 nd Trimester	%diff	3 rd Trimester	%diff	Anova Sig.
	N=100	N=19		N=90		N=91		
Pb (ppm)	0.07±0.21 (0.00-1.58)	0.05±0.09 (0.00-0.40)	28.5	0.05±0.12 (0.00-0.80)	28.5	0.06±0.14 (0.00-0.80)	14.2	0.16not sig
Cd (ppm)	0.01±0.02 (0.00-0.07)	0.01±0.01 (0.00-0.03)	0	0.01±0.01 (0.00-0.08)	0	0.02±0.06 (0.00-0.68)	50	0.00sig.

NB: Results are given as mean ± standard deviation and range in parenthesis.

Table 2: Relationship between serum lead and cadmium level and age in pregnancy

Parameters	<21yrs (n=19)	21-30yrs (n=116)	31-40yrs (n=63)	41-50yrs (n=2)	Anova sig. P=<0.05
Pb (ppm)	0.05±0.09	0.05±0.14	0.05±0.13	0.06±0.12	0.94
Cd(ppm)	0.01±0.02	0.01±0.02	0.01±0.01	0.06±0.20	0.00#

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

Table3: prevalence of elevated lead and cadmium in non-pregnant and pregnant subjects

Parameters	Non pregnant		Pregnant	
	permissible No (%)	High No (%)	permissible No (%)	High No (%)
Lead (ppm)	94(31.33)	6(2)	185(61.66)	15(5)

Cadmium	66(22)	34(11.33)	141(47)	59(19.66)
(ppm)				
Total mean no	160(26.66)	40(6.66)	326(54.33)	74(12.33)
(%)				

NB: permissible range for lead=0.1ppm and cadmium=0.0003-0.0012ppm

DISCUSSION

The result from the study reveal a non-significant increased concentration of Lead level among the non-pregnant control group (0.07ppm) to that of the pregnant test (0.05ppm) with no difference in their cadmium (0.01ppm) level. However we observed a non-significant slight increase in the level of Lead among the pregnant test group (0.06ppm) during their third trimester when compared with those in their first and second trimesters (0.05ppm) with a cadmium blood level of (0.02ppm) among those in their third trimester. We noticed a link between the age of the pregnant test group with Lead and cadmium among those within the ages of forty one to fifty years (0.06ppm) each when compared with the younger adults that are less than twenty one to forty years of age (0.05ppm Pb and 0.01ppm Cd).A similar observation was also noticed among those in their third trimesters (0.09ppm and 0.02ppm) when compared with the first and second trimesters (0.05ppm and 0.01ppm) respectively. The non-pregnant and the pregnant group who depend regularly on carbohydrate (cassava) dietary food had higher serum Lead (0.07) and cadmium (0.01ppm) (0.05ppm) (0.01ppm) than those subjects that depend on other dietary food. Though the serum level of Lead was not above the World Health Organization permissible (WHO 2007) range acceptable in the blood pegged at 10µg/dL (0.1ppm) Lead and 0.03 to 0.12µg/dl (0.0003ppm to 0.0012ppm) for cadmium. The level of blood cadmium of the non-pregnant control and the pregnant test group were all above the World Health Organization range that the body can tolerate compared to our findings of (0.01ppm and 0.06ppm).The blood cadmium level results is not consistent with the findings of Ifenkwe John et al (2018) who observed 0.03ppm from his study in Bayelsa state gas flaring communities. Women with history of abortion and infertility have been linked with high level of blood cadmium because the metal is capable of altering the normal Physiology of reproductive hormones when it accumulate in the granulosa cells of the ovaries and membrane of the pituitary gland to cause a significant reduction in the binding of gonadotropin and dysfunction of folliculogenesis.Prolonged exposure to gas flares have also be linked with preterm birth and low birth weight (Durska et al 2001, USC 2020,and Hidekuni Inadera 2020).

Consumption of certain dietary food grown in soil contaminated with cadmium and smokes from cigarette and tobacco, gas flares are all contributing factors responsible to the development of increase blood cadmium level which can result to serious kidney, lung and bone disorder known as Itai-Itai disease in women mainly (Kobayashi et al 2006 and Ezaki et al 2003).

CONCLUSION

The serum lead level among the non-pregnant was higher than the pregnant test group with no significant (p-value (>0.05) but there was a significant increase in serum cadmium level above the world health organization bench mark among the pregnant test

group according to trimesters and age compared with the non-pregnant control group. The prevalence of elevated serum lead above the world health organization permissible range among the non-pregnant and pregnant subjects was (2%) and (5%) while that of cadmium was (11.33%) and (19.66%) respectively.

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