Lead Activity In Blood Of Children In Crude Oil Polluted Sites Of Niger Delta – Nigeria

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Abstract- Crude oil contains lead as one of its heavy metals. The Niger Delta is vast with oil facilities that is capable of causing pollution to the environment. Lead is a toxic metal that has affected the children exposed to these polluted sites. This toxicity causes severe brain damage, neuropathy, weakness and many more. Therefore, the detection of this metal is very important to know its threshold in the blood. The source of intake could be in the air or through agricultural produce from these polluted sites. From this study, Mean value for children exposed is 40.1µg/dl while the Standard Deviation is 30.9µg/dl. This also affected their Intelligent Quotient with value of 40%. The children that are not exposed, have their Mean value of 3.4µg/dl while the Standard Deviation is 1.6µg/dl and Intelligent Quotient as 60%.

I. INTRODUCTION

The Niger Delta extends over about 70,000km^2 and make 7.5 of Nigeria land mass. It is a petroleum-rich region and has been the centre of international controversy over pollution that has caused great devastation of land and human life. The crude oil that is being discovered has economically changed man's way of life and is a complex mixture of hydrocarbons with heavy metals. Lead which is one of the group of heavy metals that is found in crude oil causes metal poisoning in the body and the brain being the most vital part. The exposure route is the soil when being contaminated with crude oil and this percolate to affect the underground water, and the adsorption of plants of the metal. [10] In the United State, 14 - 20% of total lead exposure is found in drinking water, and the Centre for Disease Control has set the upper limit for lead in the blood for adult at 10µ/dl. [7] At low lead concentrations 95 to 99% of blood lead is bound to red blood cells (RBC) and 1% is found in the plasma, while at higher lead concentrations, a larger percentage of lead is distributed in plasma. Plasma lead is relatively easily exchanged into bone and soft tissues such as the kidney and the brain. The amount of lead bound to red blood cells is reduced by half after approximately 36 days, also for lead found in plasma, the same process takes less than an hour.[11] In the soft tissues lead affects various cell processes and cause toxic effects. In bone, it replaces calcium and this is where 70 to 80% of lead is stored in children, compared to 90 to 95% in adults. [11]Lead can be stored in bone for years, and continues to accumulate throughout an individual's lifetime. The effect of lead is a concern in children that should be considered since exposure to lead in childhood may affect the lifetime. They are particularly vulnerable to lead poisoning because they absorb 4–5 times as much ingested lead as adults from a given source. Besides, children's age and innate behavior of hand to mouth result in swallowing lead-containing or lead-coated objects, such as contaminated soil or dust and flakes from decaying lead-containing paint. The main disorders associated with lead exposure are emotional and behavioral disorder, muscle weakness, headache, weight loss etc. [6] The mode of absorption of lead could be oral mucosa, nose or eye, and in children it is mainly by inhalation and food. [1] In further study, certain factors has contributed to lead poisoning such as occupational lead exposure, consumption of contaminated vegetables, playing in contaminated environment and low educational level. [8] Studies has shown mean level of lead poisoning in children as approximately 57µ/dl, which shows high lead poisoning among children. [5] Also, in 2016, the institute for Health Metrics and Evaluation (IHME) estimated 540,000 death as caused by lead exposure.[4] This has further caused concern for World Health Organization 1 of 10 chemicals of major public health concern and to protect health workers, children and women of productive age. However, the United State Centre for Disease Control considers 5µg/dl to be the reference blood lead level in children.[5]

Therefore, environmental pollution with crude oil and heavy metals has become a global problem. The contaminated soils are dangerous to health and is the only means by which human dispose waste for satisfaction. The crude oil pollution caused by pipe line rupture or vandalism in the Niger Delta of Nigeria, has created serious underground water pollution as contaminant infiltrate the soil up to 70 to 80cm depth or more. [3] There was increase in concentration of metals in humans that were exposed to lead and chromium in industries, as samples were digested and analysed. [9] There are many oil facilities in the rural areas of the Niger Delta, and are seasonally ruptured due to equipment failure, corrosion of pipeline and vandalism. The children at these locations are constantly exposed to lead during environmental pollution. This study will bring a close of gap of the knowledge in the danger affecting these children poor performances in education and a decline in Intelligent Quotient. This should be considered as a factor and be considered by environmental activist to protect the future of children exposed to lead and to build better nation. Although, chelators are available for treatment of lead in blood, but prevention is better than cure.

II. METHOD

The study was conducted in three rural communities in Okrika, Gokana and Akuku Toru Local Government Area. Samples of blood were taken from 60 children in rural and urban

areas, between the ages of 2 to 7 years. Children selected from urban areas are free from oil facilities (non exposed), while children from the rural areas are within oil facilities of spilled sites (exposed). The samples were taken to Rivers State University Teaching Hospital for analysis, and comparative study was done in there educational performance. Informed consent were taken from parents of these children before considered for the study. Also, the inclusive criteria were that, no previous lead poisoning case and weakness (anaemia), while the exclusive criteria are those of medical disease. The parents of these children provided relevant information about there children.

The basic apparatus used for in this study are pyrex glass of 50ml and 100ml, beakers, pipette and Atomic Absorption Spectrophotometer of frequency 100 – 400Hz. The reagents used are Hydrochloric acid (Hcl), Nitric acid (HNO_3) and Hydrogen peroxide (H_2O_2). A standard solution of lead was prepared as stock solution being diluted with 5% HNO_3 solution in distilled water. Reagent black was prepared using the stock solution and 5% HNO_3. The Atomic Absorption Spectrophotometer was used to analyse the blood sample. The accuracy being given priority, samples were prepared in duplicate.

The samples are digested using wet digestion process by adding 5ml of the sample into 10ml of nitric acid in a volumetric flask. It was then placed on a hot plate for temperature increase of about 150^{O}C for 2 hours. The blood sample was then filtered and allowed to cooled. After the process of digestion, 10ml of H_2O_2 was added for complete oxidation process and further diluted up to 50ml.

III. RESULT

In this study, samples taken from children between the ages of 2 to 7 years is shown in table 1. The mean value for exposed children is 32.6µg/dl and standard deviation to be 14.4µg/dl, and this indicates increase concentration of lead. Also, mean value for the non-exposed is 3.4µg/dl and standard deviation to be 1.6µg/dl. In table 2, shows the percentage Intelligent Quotients of children in school age (5 to 7 years). Performance chart was used to enter children's academic performance gotten from their teachers in school. The children exposed had percentage of 40% and non-exposed had 60% in performance.

Table 1

Mean concentration of lead in children exposed

	Exposed	Non-exposed
Sample size	30	30
Mean (µg/dl)	32.6	3.4
Standard deviation (µg/dl)	14.4	1.6

Table 2

Percentage Intelligent Quotient in children

	Exposed	Non exposed
Sample size	19	19
% Intelligent Quotient	40	60

Figure 1, shows the concentration of lead against the non exposed children. In the graphical presentation, lower concentration was recorded in greater population of the children. Though, slight increase above 5µg/dl was randomly observed among the children. This could be considered as lead from other sources or transport of farm products from polluted rural areas to urban areas, and could be open for further studies. Also, figure 2, shows the increase concentration of greater children exposed to lead, having highest concentration of 60µg/dl with decrease concentration of 4µg/dl. Figure 3, indicates the percentage of Intelligent Quotient in exposed and non exposed children.

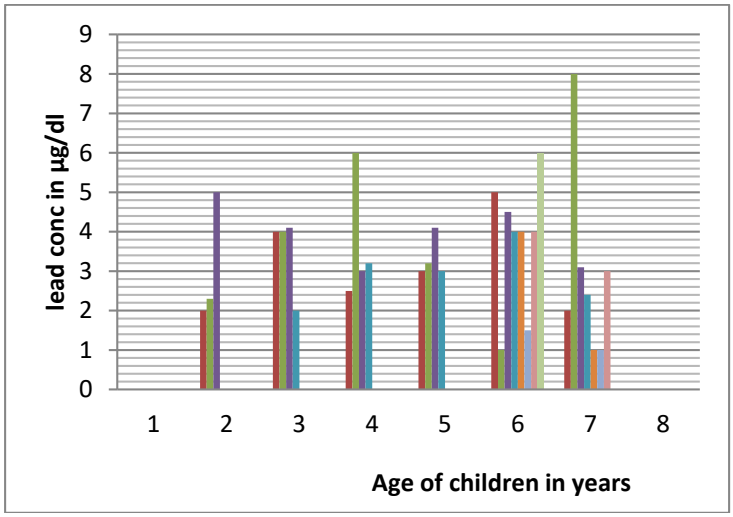

Fig. 1 Concentration of lead in non exposed children sample.

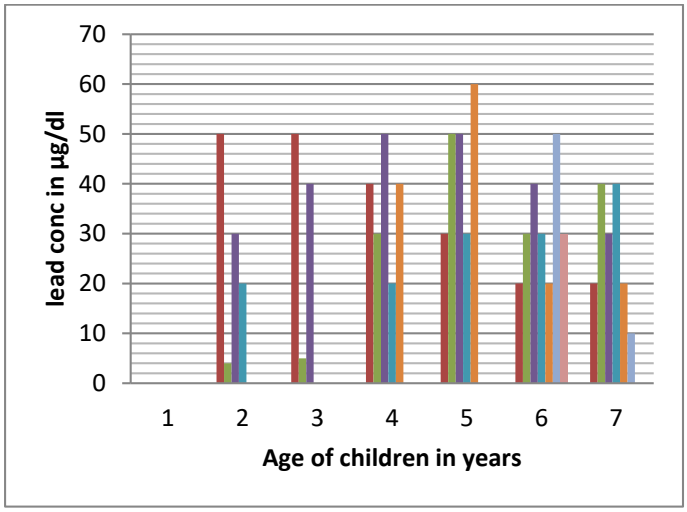

Fig. 2 Concentration of lead in exposed children sample

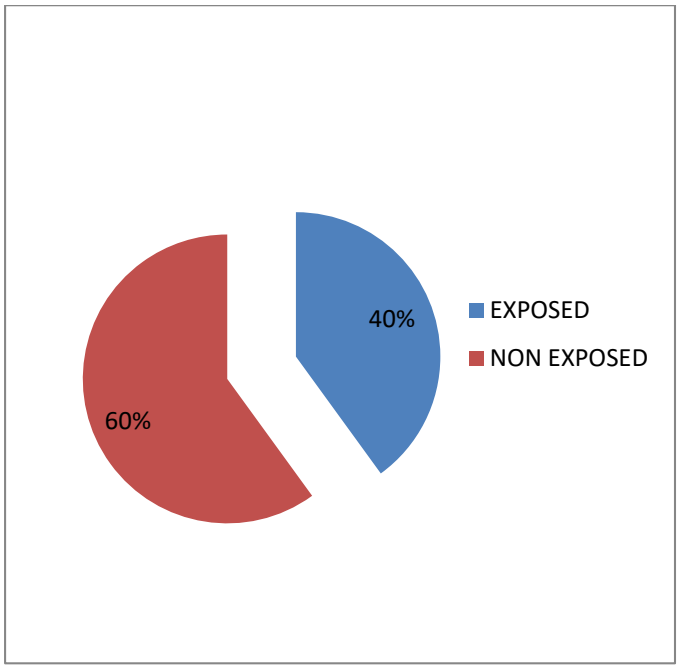

Fig. 3 Percentage of Intelligent Quotient

IV. DISCUSSION

In this study, the concentration range for lead in exposed children is 4 - 60 µg/dl while the mean value is 32.6µg/dl. Also for the non-exposed, the range is 1 -8 µg/dl while the mean value is 3.4 µg/dl. These values are found in children of 2 – 7 years carried out for this study in the rural area of Niger Delta exposed to crude oil spill, and those in the urban area not exposed to crude oil spill.

Studies have shown that symptoms such as drowsiness, exhaustion, convulsion and coma can occur in high lead concentrations of 100µg/dl and above [13]. However, United State Centre for Disease Control considered 5µg/dl to be reference blood level in children [5]. Studies have also shown that lead exposure result from chronic exposure to low lead levels of ≤ 10µg/dl which causes neurological problem in children [3]. Iranian's children were found to have lead poisoning of value 57 µg/dl [5]. Yale et al. studied British school children with lead concentration to have significantly lower Intelligent Quotient, reading and spelling score.

Presently in this study, the factor considered for increase lead in major crude oil polluted sites is pipeline vandalism and facility failure by oil industries. The children in the rural areas closed to these sites are exposed to risk factors. These crude oil contain heavy metals and of which lead is part. This should be a source of concern for the government to stop this menace and to protect the children from being exposed to lead. Also, children lead monitoring in diagnostic centres should be a concern to maintain their health and academic excellence.

V. CONCLUSION

The concentration of lead in children's blood in these rural areas of Niger Delta, shows the risk of lead in crude oil polluted sites. This is a potential neurological problem in children and has caused low performance in learning. Government should protect the future of these children by creating awareness of danger in exposure to lead and having regular check in blood lead level in children with preschool and school age.

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