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Investigation of Lead Concentration in Cow Teeth within Ota an Urban Town of Abeokuta.

Ogungbemi*, K. I and Oyebola, O. O.

Department of Physics, University of Lagos, Akoka Yaba, Lagos, Nigeria.

Abstract

In this study, three (3) sites of cattle grazing and slaughtering for marketing were identified in Ota due to population growth of this industrial city in Ogun state Nigeria. Identified cattle for slaughtered from these sites (A, B and C) were marked and their teeth collected; analyzed for the presence of Lead using an Atomic Absorption Spectrophotometer (AAS) model S4 series, Model (GBC 906) (USA). The highest mean level of Lead concentrations present in the teeth of the cow slaughtered were recorded for each site as Site A = 0.0730 ± 0.00954µg/ml, Site B = 0.2585 ± 0.00853 mg/ml; and for Site C = 0.1111 ± 0.02315 mg/ml. From the results obtained, we can conclude that Lead pollution in the environment is of ecological concern. Of these 3 sites, between 15% and 35% of all cattle had lead concentrations consistent with acute lead poisoning (greater than 0.29 mg/ml), and between 33% and 48% of these cows were in the high-normal range (0.1– 0.34 mg/ml).

Keyword: Lead poisoning, Genotoxic metal, lead concentration, Induce tumors, Lead toxicity and Environment pollution.

1. Introduction

Lead polluted environment constitutes a serious health hazard man. Lead is one of the toxic heavy metals known. It is dangerous to most human body organs if exposure exceeds tolerable level. Lead is released from natural sources, such as volcanoes, windblown dust, while atmospheric lead originates from a number of industrial sources; leaded gasoline appears to be a principal source of general environmental lead pollution. Lead acetate is used as a water repellent, for mildew protection, and as a mordant for cotton dyes. Lead acetate

*Corresponding Author: Ogungbemi, I. K.
Email: kogungbemi@unilag.edu.ng

tri-hydrate is used in varnishes, chrome pigments, and as an analytical reagent, while lead chloride is used in asbestos clutch or brake linings, as a catalyst, and as a flame retardant. Lead nitrate is used in the manufacture of matches and explosives, as a heat stabilizer in nylon, and as a coating on paper for photo thermography. Lead sub acetate is used in sugar analysis and for clarifying solutions of organic substances (HSDB, 2009).

These sources of lead are dispersed throughout the environment and are the result of anthropogenic activities. Industrial sources of lead can result from the mining and smelting of lead ores, as well as other ores in which lead is a by-product or contaminant. Electrical utilities emit lead in flue gas from the burning of fuels, such as coal, in which lead is a contaminant. Because of the large quantities of fuel burned by these facilities, large amounts of lead can be released. Cattle may be contaminated by lead from all these sources described; lead contaminated cows are toxic for human consumption since lead may cause cancer. The mechanisms by which lead causes cancer are not understood. Lead compounds do not appear to cause genetic damage directly, but may do so through several indirect mechanisms, including inhibition of DNA synthesis and repair, oxidative damage, and interaction with DNA-binding proteins and tumor-suppressor proteins (NTP, 2003).

The cattle graze in an open field near or probably on the industrial waste disposing field and are thereby contaminated through vegetation. Accurate determination of lead concentration in cattle is important since the intake of even low concentrations of lead can cause serious toxic effects. The presence of lead in the environment is partially due to natural processes and anthropogenic sources (Beavington *et al.*, 2004; Fernandes *et al.*, 2000), but is mostly the result of industrial wastes (Khillare *et al.*, 2004). Our investigation provided information about the concentrations of lead in cows slaughtered in Ota an industrial area of Ogun State Nigeria, from three main sites that represent different ecosystems in, highly populated, urban and industrial areas. Our objective in this investigation is to examine the concentrations of lead in the teeth of cattle, after ingestion of lead particles from discarded batteries and other industrial heavy metal related waste, and to see whether there may be any cow that was exposed to lead as a result of industrial waste deposition in the cattle grazing field. Lead levels in bone and teeth provide information on past exposure to lead. Due to its long half-life in the body. Chronic toxicity of lead is of most concern when considering the potential risk to human health. Lead may be a weak indirect genotoxic metal (Al-Masri *et al.*, 2006).

However, there is extensive experimental evidence that at high doses lead can induce tumors (IARC, 2006) at a number of different sites in rodents. The International Agency for Research on Cancer classified inorganic lead as probably carcinogenic to humans (Group 2A) in 2006. And secondly to make suggestion to the concern authorities about our findings on the three site in a close proximity to the industries in Ota Area.

2. Materials and Methods

The materials used were teeth from slaughters cows from the abattoirs on the three sites identified in Ota, Ogun State Nigeria. About several teeth were collected from about 30 cows that were slaughtered during the period of our investigation. These samples were to be wet digested for analysis of lead concentrations. Thus, a Standard solution of Lead (Pb) is needed and this was provided by Merck (Darmstadt, Germany). The standard solution was prepared from the stock solution (1000 mg/l), in 0.1N HNO_3. Flame Atomic Absorption Spectrophotometer (AAS) model S4 series, Model (GBC 906) (USA) was used for the analysis of the solutions for the elemental composition of the sample.

Ashing is thus used as the first step in preparing the solid teeth samples for the analysis by AAS. Each sample weighing 5.5g or less only was admissible for the ashing. The expected moisture content had been sun-dried and oven-dried to prevent spattering during the process. Wet digestion was employed, to break down and removed the organic matrix surrounding the minerals so that they were left in aqueous solution. Dried samples of marked weights were placed into a flask (each at different times) containing 10ml each of HNO3, per chloric acid and then heated. The heating process was stopped after the sample had completely digested leaving only the mineral oxides in solution. The same procedure was repeated for all the samples. Little loss of volatile minerals occurred because of the lower temperatures used.

3. Result and Discussion

The three (3) sites A, B, and C studied are in close proximity to Ota industrial waste field, where the slaughtering area is located.

Table 1: Mean lead levels on the three sites of interest in Ota.

SAMPLES NUMBER (30 COWS PER SITE)	LEAD ppm (Mean ± SE)
SITE A	0.0730±0.00954
SITE B	0.2585±0.00853
SITE C	0.1111±0.02315

Table (1) shows that site A cows have lead concentrations being 0.0730 ± 0.00954µg/ml, while site B lead concentrations begin 0.2585±0.00853 mg/ml; and site C has 0.1111±0.02315 mg/ml. Figure 1 shows the distribution of lead concentration per cow slaughtered from site A.

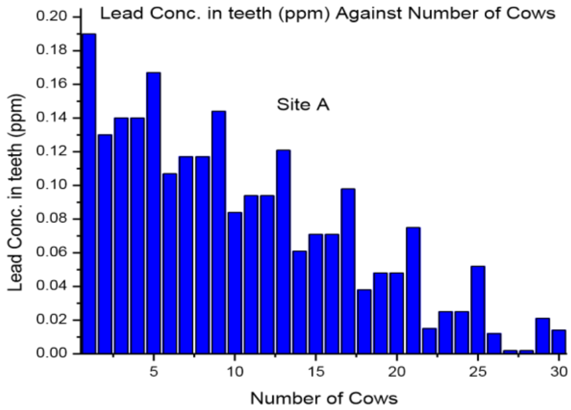

Figure: 1: Distribution of lead Concentration (ppm) in the teeth of Cows from Site A

The highest lead concentrations from this site A is 0.190 ppm for about three (3) cows slaughtered while the lowest lead concentrations is about 0.038ppm for about four (4) cows from the site, while the lead concentrations of other cow were either less than the highest concentrations or higher the lowest value of lead concentration on the site. The mean distribution of lead concentration of cows slaughtered from this site is 0.0730ppm.

The distributions of lead concentration in the teeth of the Cows from site B is as illustrated in figure 2. From this site many of the cows have lead concentration of greater than 0.25ppm, while the lowest lead concentrations is more than 0.15ppm.

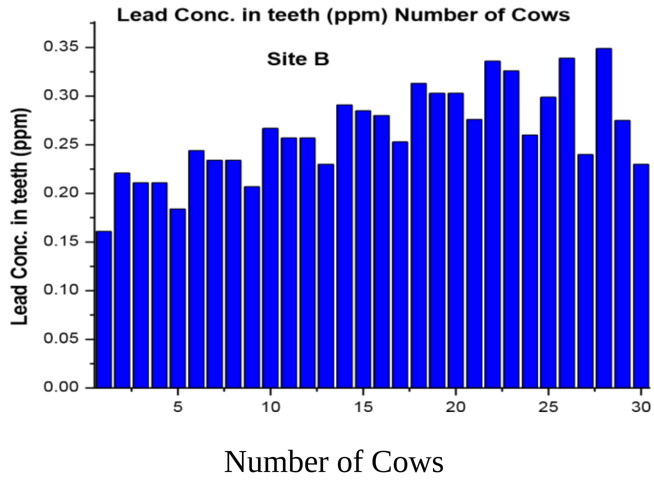

Figure: 2: Distribution of lead Concentration (ppm) in the teeth of Cows from Site B

Many of the cows slaughtered from site B showed Lead concentration greater than 0.10ppm resulting in average lead concentration of 0.2585 ppm for the site. Cows slaughtered from site C have 0.30ppm as the highest lead concentrations and about -0.40ppm (figure 3) as the lowest lead concentration of the distributions from this site.

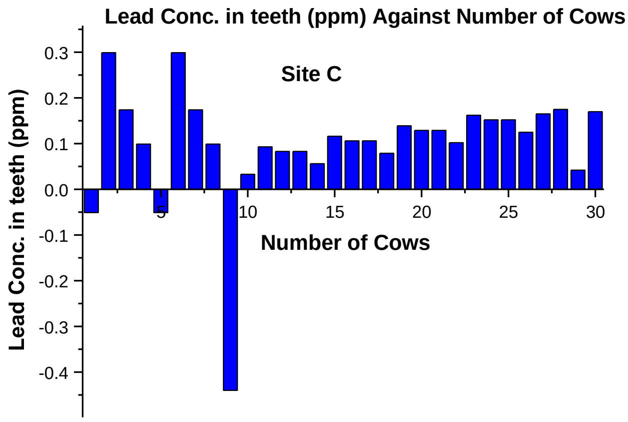

Figure: 3: Distribution of lead Concentration (ppm) in the teeth of Cows from Site C

These show the level of cow exposure to lead in each of the site of interest (A, B, and C) at Ota a growing industrial Urban Town near Abeokuta Ogun State, Nigeria. However, the lead distributions in the teeth of the cattle in each case from the sites are comparable in values as shown in figure 4.

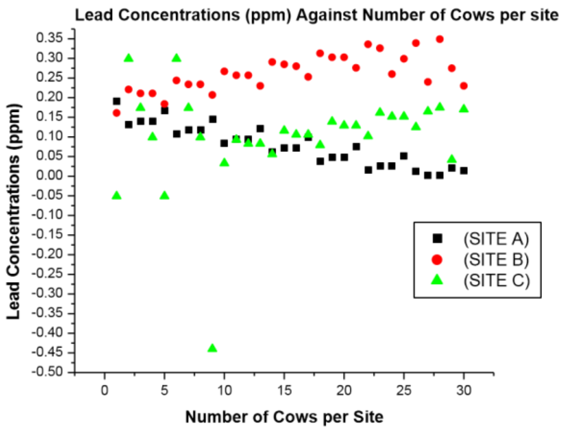

Figure: 4: Distributions of lead Concentration (ppm) in the teeth of Cows from the Three Sites

The figure illustrates the mean deviation of lead concentrations in the cattle from site A, B and C. The values are sparsely distributed in cattle studied from site C when compared with those from site A and B.

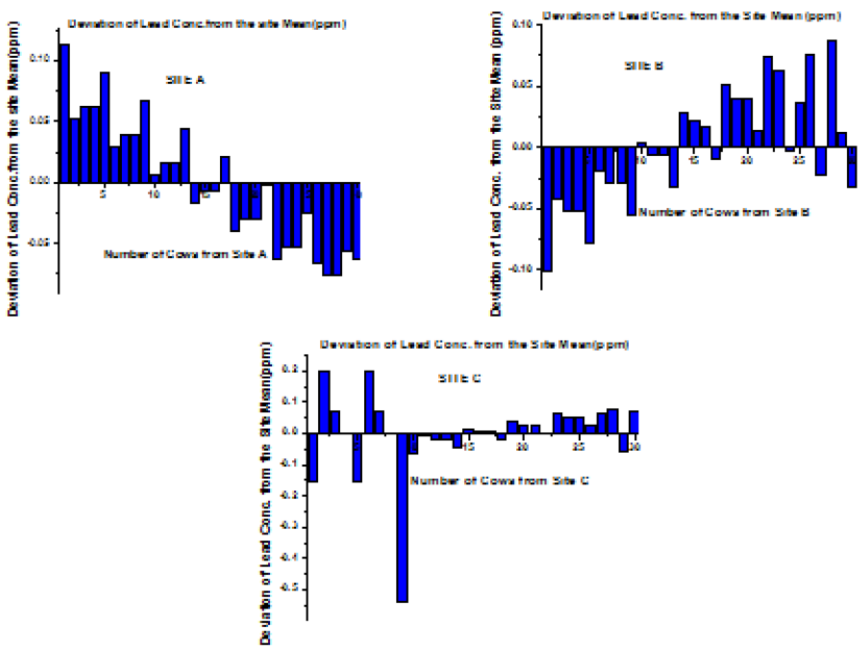

Figure: 5: Distributions of the mean deviations of lead Concentration (ppm) from each site studied.

In most of the cow from the sites A and B the mean deviation shows little disparity in values of Lead concentration in each cow (Figure 5).

In most part of the world lead pollution has been an important factor in health issue both to human and the environments. The level of lead content in Animals is also of ecological importance to the scientists and researchers all over the world. Concentrations of lead in air depend on a number of factors, including proximity to roads and point sources. Annual geometric mean concentrations measured across Canada is 0.10μg/m^3 in 1989 (Environ. Canada, 1989; Report EPS, 1986), which is the reflection of the use of lead additives in petrol in Canada. The quarterly averages for urban areas without significant point sources in the USA in 1987 were in the range 0.1–0.3 mg/m^3.

In the vicinity of major point sources, such as lead smelters and battery plants, air levels usually ranged from 0.3 to 4.0 mg/m^3 (Report EPA, 1986). The levels Barcelona (Spain) in 1985 winter ranged from 0.9 to 2.5 mg/m^3 (Tomas *et al*., 1988), while the overall means in London in 1984–85 is 0.50 mg/m^3 (range 0.23–0.82) and of Suffolk in the year is 0.10 mg/m^3 (range 0.05–0.17), respectively (Strehlow *et al*., 1987). The levels of lead in 1983 in the Norwegian, an area remote from urban influences, varied between 0.1–0.3 and 0.3–9.0 ng/m^3 (Pacyna *et al*., 1985). Table 2 shows the mean distribution of lead in the three (3) sites investigated for lead contaminations using thirty (30) cows slaughtered during the period of our investigation in Ota.

Table 2: Concentrations of Pb in teeth samples of cattle from the three sites (A, B, C) in Ota (mg/ml)

Sites	Samples	Median	Mean	S.D	Min	Max	Range
Site A	30	0.0730	0.07743	0.05226	0.002	0.190	0.188
Site B	30	0.2585	0.26253	0.04669	0.161	0.349	0.188
Site C	30	0.1111	0.09997	0.12681	-0.440	0.299	0.739

4. Conclusion

In conclusions, the concentrations of lead in the teeth of the cow slaughtered on site A range (0.038 - 0.190 mg/ml) with mean of 0.7743 mg/ml, while on site B high-normal range (0.161-0.336 mg/ml) with an average of 0.2625 mg/ml, and from site C range (-0.44 - 0.229 mg/ml) with an average of 0.0999 mg/ml. This shows that cattle from the site C contains more lead than cattle from site A. While site B have lesser lead than the cattle from site A. The high concentrations of lead in cows from site C may be due to it closeness to the industrial waste field and absorption of lead from metal particles from the grazing field. From the three (3) sites, between 15% and 35% of all cattle had lead concentrations consistent with acute lead poisoning (greater than 0.29 mg/ml), and between 33% and 48% of these cows were in the high-normal range (0.1– 0.34μg/ml).

The results obtained shows that the contents of lead in the vicinity of the industrial waste field are ecologically important. The hygienic control of beef from the polluted area should be intensified with regard to human consumption. With regard to the fact that in some samples maximum allowable limits for food were exceeded, effective ecological measures should be taken that would have a beneficial effect on the landscape and environment in the vicinity of metallurgical plant. This research work may sever as data baseline for cattle rearing in the Ota for lead monitoring before its finds way to human body system.

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