

An Investigation into The Effect of Traffic Pollution on The Levels of Some Heavy Metals in Goats' Urine Samples

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Abstract: This study is part of an investigation into the possible environmental contamination resulting from the traffic congestion in Nigeria. The aim of this study was to quantify the levels of some heavy metals in goats urine samples. Samples were collected from different location (Expressway, Araromi way, Federal College of Agriculture, Akure Campus and Irun Akoko), wet digested and analyzed with atomic absorption spectrophotometer. The mean Pb level (3.8 mg L^{-1}) of Araromi way was higher than those recorded for other locations. Pb/Zn ratio of Araromi way and expressway was higher than the others. Young goats were found to have higher levels of metals than the mature ones. It then denotes that these areas are polluted by the high traffic congestion. Although analytical results revealed that the metals were below safety limits, however, it is suggested that the areas be regularly monitored to avoid traffic pollution.

Key words: Traffic pollution, urine samples, heavy metals, Pb/Zn ratio, young and mature goats

INTRODUCTION

There has been an increased awareness about the health effects of toxic and other trace metals in relation to environmental exposure^[1-3]. Assessment of pollution especially trace metals in biological fluids has been a subject of active investigation by communities over the years because of the hazardous effect on health, materials and plants. An analysis of goats urine samples obtained in certain areas located in heavy traffic areas in Ondo State, Nigeria is an indicator of environmental pollution.

Some metals are essential components which are required in enzymatic biochemical activities in the body. Even though some are essential to human and animals at elevated levels as well as non-essential metals can cause morphological abnormalities, reduced growth, increased mortality and mutagenic effects in humans and animals. Chronic exposure to heavy metals have been recorded to have common effects which include: loss of strength, anemia development of characteristic streak across the finger nails, hypertension, osteomalacia, brain damage, unpaired hearing, tissue damage, reduced energetic resources and performance^[4-6].

The aim of the study was to quantify the levels of some heavy metals in goats' urine samples with a view to ascertain the level of pollution in Ondo State, Nigeria as a result of the high traffic density.

MATERIAL AND METHODS

The samples included twenty randomly selected goats which ranged from young to mature were obtained from Irun Akoko (control Araromi way, expressway and Federal College of Agriculture, Akure Campus (FECA) Ondo State, Nigeria in May, 2005. The penises of the goats earmarked for this work were tied with clean plastic containers to collect the urine samples. The samples were filtered, 1 cm^3 , of the filtrate was digested with 50 cm^3 of 2 M HNO_3 , until dried to 10 cm^3 , this was made up to 50 cm^3 with 2 M HNO_3 . The heavy metals were subsequently analyzed with SP9 Pye Unicam atomic spectrophotometer. Results were subjected to statistical analysis using SPSS for windows.

RESULTS AND DISCUSSION

The heavy metal compositions of urine sample are depicted in Table 1. The mean Zn of urine samples was 13.3 mg L^{-1} . The overall compositions (mg L^{-1}) of the samples were 70, 1.3, 2.1 and 9.0 for Fe, Cu, Pb and Mn respectively. Cd was not detected in all the samples. The Pb values were significantly higher in Araromi way compared to Irun Akoko, FECA and express way. The main reason for numerical higher Pb value in Araromi way might be attributed to the exposure of vehicular fumes.

Table 1: Mean level of trace metals (mgL⁻¹) in the urine samples analyzed

Location	Zn	Fe	Cd	Pb	Cd	Mn
Irun Akoko	14	75	-	-	-	-
FECA	16	60	1.3	1.3	-	11
Araromi way	12	70	-	3.8	-	9
Express way	11	75	-	1.3	-	7
Minimum	11	60	-	1.3	-	-
Maximum	16	75	1.3	3.8	-	11
Std. Deviation	2.2	7.1	-	1.4	-	2.0
Coff variation(%)	16.7	100	-	67.7	-	22.2

Table 2: Ratios of Pb to Zn concentrations for the locations

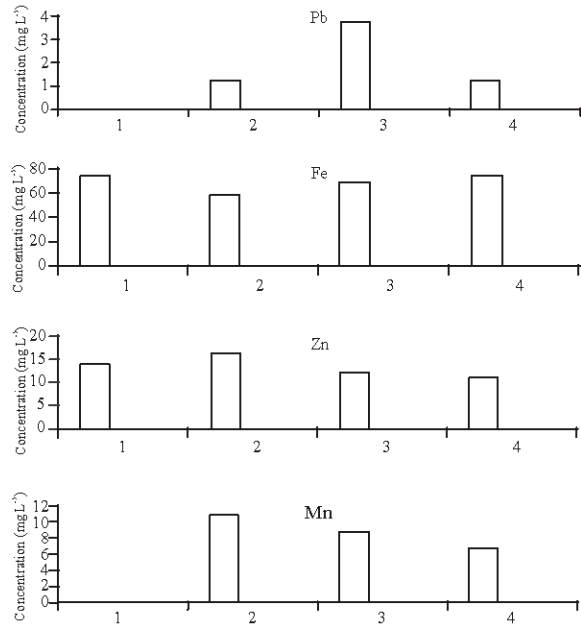
Location	Value
Irun Akoko	-
FECA	0.081
Araromi way	0.317
Express way	0.118

This area of the State has high traffic congestion. In addition, the goats have had significantly longer exposure to vehicle exhaust fume compared with other areas. The higher values of Fe and Zn in FECA and Irun Akoko could be explained that communities (non-exposed to vehicle exhaust fumes) are equally prone to metal contamination possibly from non-source points and other human and animal activities. The presence of Cu in FECA samples could be due to agricultural activities (i.e. the use of fertilizers, pesticides and insecticides). Except for Fe there were low variations in the concentration of virtually all the metals from one urine sample to other. This was attested to by the CV (%) that ranged between 16.7 and 67.7. This probably suggests that these samples are concentrating the metals almost the same rate.

In this study, the obtained Pb values of all the urine samples were relatively higher to the 9.6mg d L⁻¹ and 12.23 mg L⁻¹ reported by Saito *et al*^[7] (Japan) and Haeger- Aronsens *et al*^[8] (Sweden). The lower levels recorded for the two countries might be due to the Pb content of petrol, 0.5 g L⁻¹ in Sweden and 3.31g L⁻¹ in Japan. The Pb results were lower in the present study than the results by Aggarwal *et al*^[9] in India. Consistent findings to our study with respect to Zn value was found by Khaniki^[10]. Adeniyi and Olawoore^[3] recorded the findings with regard to Pb in urine samples similar to our results. In Iran, Ebali *et al*^[11] observed moderately consistent results to our study with respect to Pb (0.531-5.30 mg kg⁻¹).

Our results showed that young goats were found to have higher levels of metals than the mature ones. This finding was similar to the research work conducted by Abulude^[1]. The reason could be due to the fact that young goats tend to lick and chew all the fittings which in many cases may have residues of these heavy metals and a significant amount of these metals could be absorbed directly through their tender skin.

A measure of automotive-related pollution is Pb/Zn



1. Irun Akoko 2. Federal College of Agriculture
3. Araromi way 4. Expressway

Fig. 1: Variation of Pb, Fe, Zn and Mn in the locations

t ratio^[12]. This ratio was calculated for all the samples and he means of the four locations are presented in Table 2. The ratio was generally highest in the highway area (Araromi way) with high vehicular emission.

Figure 1 shows the variation of the concentrations of Zn, Fe, Pb and Mn among the four different locations. Fe, Zn and Mn concentrations were the highest in the locations. This is expected as most vehicles on road are aged and disjointed parts are left on the road indiscriminately. Added to this is the corrosion of metallic parts of vehicles, re-entrained dust from unmaintained paved and unpaved roads and wear and tear of tyres and engine parts.

CONCLUSION

It could be concluded that:

- a. High traffic congestion and other vehicular reasons contributed significantly to metal concentrations in the urine samples.
- b. Agricultural activities could have contributed to the metal concentrations in the samples, especially in FECA and Irun Akoko.
- c. It is gratifying to note that the metal concentrations were below safely limits. But there is a great need to reduce their levels in the environment.

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