

## BLOOD LEAD VALUES IN OCCUPATIONALLY EXPOSED WORKERS IN LAGOS, NIGERIA

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**ABSTRACT :** The level of lead in the blood of occupationally exposed workers among 23 automechanics and 14 petrol attendants from five different sites in Lagos and 20 nonexposed students of the Lagos State University, Lagos, serving as control, was determined. The mean blood lead values in the automechanics and petrol attendants,  $67.6 \pm 13.2 \mu\text{g/dl}$  and  $70.6 \pm 19.0 \mu\text{g/dl}$  respectively, were significantly higher than the value of  $25.6 \pm 6.7 \mu\text{g/dl}$  among students ( $P < 0.05$ ). Linear regression analysis showed that among the automechanics, years of experience at the job had an inverse relationship with blood lead. Blood lead decreased by a factor of 0.45 for every year on the job. The situation was different with petrol attendants. Among the latter group, there was a positive correlation between the years of experience on the job and blood lead values. An increase of  $2.2 \mu\text{g/dl}$  of blood lead was observed for every year on the job. Age was poorly correlated with blood lead values among all subjects. Blood lead value was significantly higher among smokers in all the three groups studied ( $P < 0.05$ ).

## INTRODUCTION

Lead is a heavy metal that belongs to the group 4 elements, and is widely distributed in nature. It is widely used as a component of the lead acid storage battery and as an antiknock additive to petrol. It is also used as protective shielding for X-ray machines, for bullets and shots and as lead arsenate for insecticides (1).

Lead acts as a poison when taken into the body in sufficient quantity, leading to anaemia, nephropathy, encephalopathy and eventually death. Symptoms include constipation, pallor, vomiting, stupor, abdominal pain, anorexia, mental retardation and behavioural disorders (2,3). Recognizable symptoms of poisoning are known to occur in some individuals when levels of lead in the bloodstream exceed  $70\text{--}80 \mu\text{g/dl}$  of whole blood (1), though there is the possibility of more subtle adverse effects to health at lower levels of exposure.

People are also exposed to lead through breathing lead-polluted air and through ingestion of lead in food and drinks due to supply of water through lead pipes (4). It is of interest to note that the amount of lead being mobilized into the environment, especially through the agency of leaded petrol, has resulted in an enhanced level of lead in foodstuffs, especially vegetables grown along heavy traffic highways (5) because of the deposition of lead aerosol. Thus, it is of great importance to monitor the heavy pollution of lead aerosol and blood lead levels in an urban town like Lagos. Although this can be seen as a minor contributor to blood lead for the general population, compared to diet, it is very important to study the effects on occupational situation. This study was, therefore, undertaken to see the effect of exposure to lead on blood lead levels among automechanics (who

habitually suck petrol) and petrol attendants. Data on blood lead values among various groups in Nigeria are also sparse in the literature.

## MATERIALS AND METHODS

Twenty three automechanics and fourteen petrol attendants from different locations in Lagos metropolis volunteered to participate in the study. Twenty students of the Lagos State University served as control. All subjects were male and free living. A careful history of their dietary habit, especially in terms of smoking cigarettes, and their job experience was taken.

### Sampling and Analysis

Ten mls of (non-fasting) blood was collected intravenously from all subjects and placed into heparinized tubes. Blood lead was immediately estimated in whole blood by the use of diphenylthiocarbazone (Dithizone) colorimetric method (6). Recovery tests were carried out to authenticate this methodology. Lead (in the form of lead nitrate) in amounts ranging from 10 - 30  $\mu\text{g}$  was added to samples of control blood. An average of  $85.8 \pm 4.89\%$  recovery was obtained. Blood lead was expressed in  $\mu\text{g}/\text{dl}$  of whole blood.

Differences in blood lead among various groups were subjected to statistical analysis using Student t-test. Linear regression analysis was used to test for associations.

## RESULTS

### Characteristics of the subjects

Table 1 shows the characteristics of the subjects studied. Their age ranged between 13 and 48 years. The mean ages of the automechanics, petrol attendants and students were  $23.1 \pm 8.4$ ,  $28.8 \pm 7.1$  and  $23.8 \pm 2.9$  years respectively. The years of experience on the job for the exposed workers had a wide variation, ranging from 0.04 to 28.0 years and the means were  $5.2 \pm 6.6$  and  $4.5 \pm 4.1$  years for automechanics and petrol attendants respectively.

### Blood lead values

Table 2 shows the mean blood lead values of the subjects. The mean values among automechanics and petrol attendants,  $67.6 \pm 13.2$  and  $70.6 \pm 19.0$   $\mu\text{g}/\text{dl}$  respectively, were significantly higher than the level of blood lead in control subjects,  $25.6 \pm 6.7$   $\mu\text{g}/\text{dl}$  ( $P < 0.05$ ). However, there was no significant difference in the blood lead values of automechanics and petrol attendants ( $P > 0.05$ ).

Table 1 : Age and job experience of experimental subjects.

Type of job	Age (years)	Experience on job (years)
Automechanics (n=23)	23.1 ± 8.4 (13.0 - 48.0)	5.2 ± 6.6 (0.04 - 28.0)
Petrol Attendants (n=14)	28.8 ± 7.1 (20.0 - 41.0)	4.5 ± 4.1 (0.5 - 12.0)
Control (Students) (n=20)	23.8 ± 2.9 (18 - 29)	-

Values represent the means ± S.D. with the ranges in parentheses.

Table 2: Blood lead values in experimental and control subjects.

Subjects	Number	Blood lead (ug/dl)
Automechanics	23	67.6 ± 13.2 (49.4-98.8) a,b
Petrol Attendants	14	70.6 ± 19.0 (37.5-99.4) a,b
Control (Students)	20	25.6 ± 6.7 (15.0-40.0)

Figures represent the means ± S. D. with the ranges in parentheses.

a = Significantly higher than control ( $P < 0.05$ )

b = No significant difference between exposed workers ( $P > 0.05$ ).

#### Effect of age and years on the job on blood lead

Linear regression analysis showed that among automechanics, age had no effect on the level of blood lead, though the trend showed a decrease with increase in age (Table 3).

Among the petrol attendants and students, positive correlations were observed between age and blood lead but these were not significant (Table 3). There was a decrease of 0.45 µg/dl in blood lead for every year change in the years of experience on the job. The regression equation is :

$$\text{Blood lead} = 69.26 - 0.45 \times \text{years of experience on the job}$$

But blood lead increased by 2.21 µg/dl for every year change in the years of job experience among petrol attendants and the relationship was significant (Table 3).

$$\text{Blood lead} = 60.55 + 2.21 \times \text{years of experience on the job}$$

Table 3: Correlation of blood lead to age and years of experience on the job.

Variable	BLOOD LEAD		
	Automechanics (23)	Petrol Attendants (14)	Control (Students)(20)
Age	-0.190	+0.097	+0.104
Experience (Years)	-0.34	+0.48	-

\*Not significant ( $P > 0.05$ ), \*\*Significant ( $P < 0.05$ ).

#### Smoking and blood lead

Table 4 shows the effect of smoking on blood lead levels of exposed workers and controls. The mean blood lead value of  $74.3 \pm 18.8 \mu\text{g/dl}$  among exposed smokers was found to be significantly higher than the value of  $67.3 \pm 13.7 \mu\text{g/dl}$  among exposed non-smokers (Table 4). A significant difference was also obtained among students between smokers and non-smokers.

Table 4: Blood lead among smokers and non-smokers

Subjects	Number	Blood Lead ( $\mu\text{g/dl}$ )
Exposed Smokers	11	$74.3 \pm 18.8$
Exposed Non-smokers	26	$67.3 \pm 13.7$
Student Smokers	7	$31.5 \pm 5.3$
Student Non-smokers	13	$21.7 \pm 4.2$

Exposed subjects include automechanics and petrol attendants.

#### DISCUSSION

The lead circulating in the blood stream is mobile, in contrast to that stored in bones. It is this lead that is able to exert adverse effects on the body, hence the concentration of lead in the blood stream is an important parameter in the characterization of an individual's exposure to lead.

The blood lead of unexposed students living along a highway had a mean value of  $25.6 \pm$

6.7  $\mu\text{g/dl}$  with a familywide range of 15.0 to 40  $\mu\text{g/dl}$ . This range shows a high variability, which is quite expected as there is a high degree of variation in the intake, uptake and metabolism of lead. This variability which was observed in other population groups was responsible for fixing the normal range of 10 - 30  $\mu\text{g/dl}$  for adults and a marginally higher value for children (1,7).

The exposed subjects in this study, however, exhibited a higher family value of blood lead. This can be attributed to the location of residence. Studies involving 200 teachers from one urban area in each of ten countries showed a similar relationship between blood lead values and exposure to lead in petrol (8).

The blood lead values of the exposed workers, the automechanics and petrol attendants, were significantly higher than those of students who served as control. This agrees with the findings of Mohammed (9) who reported a mean value of 64.5  $\mu\text{g/dl}$  of blood lead among exposed workers in lead acid battery factory in Sudan. Attempts have been made to fix a maximum permissible level of lead in blood, but this is still being debated, although the general consensus for industrial exposure is 80  $\mu\text{g/dl}$ , since no overt symptoms occur at this level (1). However, some studies have shown that intellectual deficits may occur in individuals with blood lead in the range 40 - 80  $\mu\text{g/dl}$  during exposure (3).

Age had no influence on blood lead among all subjects. This was not surprising as they were all adults. Age tends to increase blood lead from birth to adolescence (10,11) but remains fairly constant in adults until old age.

Years of experience on the job tend to decrease blood lead among the automechanics while no such decrease was observed among petrol attendants. The plausible explanation is that experienced automechanics have increased job responsibilities and thus a reduced contact with petrol (which is usually sucked with the mouth). But petrol attendants are merely vendors and require no skill in particular. Exposure to petrol is therefore not decreased as years of experience increases.

Smoking increased blood lead among all subjects. This is in agreement with a previous report (8). The present study has revealed quite high levels of blood lead among exposed workers and some non-exposed workers. Since the threshold of lead intoxication is still debatable, caution has to be exercised in the use of lead as an antiknock agent in petrol. Exposed workers should also be educated on the dangers associated with sucking petrol with the mouth. This study has also provided some baseline data on blood lead levels in Nigerians.

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