

A SURVEY ON LEAD ABSORPTION IN THE EMPLOYEES OF TEHERAN BATTERY WORKSHOPS

H. Farsam*
M. Zamani*

ABSTRACT

A total number of 67 workers of Teheran battery workshops were investigated for probable lead absorption due to the working with lead storage batteries. Twenty workers with other occupations were selected as control group. Blood and urine analysis were carried out for both groups. Lead content of the urine in about 95.5% of the subjects was below 10 $\mu\text{g}/100$ ml. Two subjects showed higher concentrations of lead in urine. In one subject other analyses revealed lead intoxication. In the other subject no signs of lead poisoning was found. The intoxicated person was a worker who used to break old batteries and smelt their lead plates for many years and his intoxication was not presumably sourced from working in the battery workshop. No evidence was found to support the increase of lead absorption in these workers.

INTRODUCTION

Lead storage battery plants are of important sources of lead absorption and lead poisoning. These plants have been investigated from different points of view.⁽¹⁻⁷⁾

In the present paper the employees of Teheran battery workshops were studied in order to find out any lead absorption due to the working with lead storage batteries. Since these workshops have not been studied yet, the determination of lead in the workers of these small industries seemed worthy of investigation.

* College of Pharmacy, University of Teheran, Teheran, Iran.

MATERIALS AND METHODS

Battery workshops in Teheran are usually concerned with charging, cleaning and repairing automobile lead storage batteries. The workshops are usually a 4 x 5 square meter shop with 3-4 workers. The ventilation system is restricted to exhaust fans. The workers generally use no protective devices such as masks or gloves. Some workers used to drink beverages, smoke cigarettes, and occasionally eat meals without washing their hands while working. In few workshops the workers broke old batteries to take their lead plates out.

A total of 67 workers from different regions of the city were chosen. Twenty workers with other occupations were selected as control.

A full account of the investigated groups with data about age, length of occupation, work hours per day, present ailment and any probable symptoms of lead intoxication have been prepared.

Urine specimens were obtained from both groups. The lead content of the samples were determined by atomic absorption spectrophotometry according to the method of Farrelly and Pybus(8) and colorimetric dithizone method described by Thienes and Haley(9).

Blood hemoglobine (Hb) was determined by the standard method after conversion to cyanomethemoglobine. Hematocrit levels were measured using a microcappillary centrifuge. Haemograms were prepared for punctate basophilia. Urinary coproporphyrine (CP-U) estimated by the method of Soulsby and Smith.(10)

RESULTS AND DISCUSSION

The values obtained for lead in urine by use of the two analytical methods were in good agreement, but the colorimetric method gave lower selectivity than atomic absorption spectrophotometry.

The results obtained in this investigation are given in Tables 1-3. Table 1 shows the age distribution of the subjects according to the length of occupation. Table 2 displays the blood Hb, hematocrit, and CP-U of both the groups. Table 3 illustrates lead concentration in urine according to the length of occupation.

Table 1
Age distribution according to the length of occupation

Age in Years	Length of occupation in years					Total
	1-5	6-10	11-15	16-20	20+	
15-25	7	3	—	—	—	10
26-35	4	7	3	1	—	15
36-45	2	3	5	7	5	22
46+	—	1	5	6	8	20
Total	13	14	13	14	13	67

Table 2
Biological findings in Test and Control group

	Workshops		Control	
	Mean	SD	Mean	SD
Pb-U, µg/100 ml	3.625	19.9	3.460	17.7
Hb, g/100 ml	14.85	1.3	15.00	1.2
Hematocrit, %	44.0	1.0	44.5	1.0
Cp-U, ug/1	36.0	18.2	32.5	10.5

Table 3
Lead in urine according to the length of occupation

Pb-U, $\mu\text{g}/$ 100 ml	Length of occupation in years					%
	1-5	6-10	11-15	16-20	21+	
0-2.5	6	4	2	5	2	28.36
2.6-5.0	4	5	6	3	5	34.33
5.1-7.5	2	3	3	2	3	19.40
7.6-10.0	1	2	1	3	2	13.43
10.1-12.5	—	—	—	1	—	1.49
12.6 +	—	—	1	—	1	2.99

The mean values for Pb-U were 3.62 and 3.46 $\mu\text{g}/100$ ml in the test and control groups respectively, which shows no significant difference. The same consistency were seen in the results obtained for blood analysis and CP-U (Table 2).

Excluding the higher values of Pb-U in two persons and the increased level of CP-U in one subject, which will be discussed later, the range of variations of the data obtained for blood and urine analysis did not show significant differences.

The lead content of the urine in 62.99% of the subjects was up to 5 $\mu\text{g}/100$ ml, while about 95.5% showed a level less than 10 $\mu\text{g}/100$ ml. The results obtained for the mean values of Pb-U were within the values given by Goldwater and Hoover⁽¹¹⁾ as normal level of lead in urine.

The haemograms of the workers in both groups showed hypochromic anaemia in a few cases, but none of the changes were considered the cause of lead absorption except in two subjects. In one subject the Pb-U was 40.0 $\mu\text{g}/100$ ml associated with high value of CP-U (502 $\mu\text{g}/1$) and stippled cells which put forth the lead poisoning of the subject. In the other subject the Pb-U was 32.0 $\mu\text{g}/100$ ml, but

CP-U was normal (70 $\mu\text{g}/\text{l}$) and no indication of lead intoxication was found. The intoxicated subject was a worker who for many years used to break old batteries for their lead plates and smelting these plates in small furnaces. Since the job of this person was somehow different from the others and no other intoxicated person was found in this study, presumably his lead poisoning has not been sourced from battery workshop, but from smelting lead plates. In this respect, more investigations on lead absorption among the workers of these small lead smelting furnaces, located in the southern part of Teheran, seems to be necessary.

No relationship was found between lead content of the urine and length of occupation, and no evidence supported the increase of lead absorption in these workers. Therefore, it can be concluded that in these types of battery workshops, the workers are not actually under such conditions to threaten increasing of lead absorption or lead intoxication.

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