BIOTOXICOLOGICAL ASPECTS AMONG WORKERS EXPOSED TO LEAD IN THE CAR BATTERY TECHNOLOGY PRODUCTION

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Abstract: *In car battery technology production the occupational exposure to lead continues to be an important cause of morbidity. Monitoring the work environment and health status are efficient means within an integrated health and safety occupational strategy.*

Cuvinte cheie: *plumb, evaluare, mediu, sănătate, lucrători*

Rezumat: *În tehnologia fabricării de acumulatori auto expunerea profesională la plumb continuă să fie una din cauzele de îmbolnăvire. Monitorizarea mediului de muncă concomitent cu evaluarea stării de sănătate a personalului expus la plumb sunt măsuri eficiente în cadrul unei strategii integrate de sănătate şi siguranță ocupațională.*

INTRODUCTION

It is known that the most important jobs, technology and operations occupations exposed to lead and lead oxide are: removal of lead from ore, the batteries and repair industry, the manufacture of crystal, paints and ceramics industry (2). Occupational risk of activities in the lead environment depends on several factors like the quantity of airborne particle materials, airborne lead particle size, solubility compounds, exposure time and hygiene (1,3). In car battery manufacturing technology the inorganic lead and/or lead oxides that are used present a risk of systemic toxic effects to workers due to inhalation of dust and lead from the industrial atmosphera (4, 5).

THE AIM OF THE STUDY

A cross-sectional study was carried out among a group of workers exposed to lead in a battery manufacturing section in order to evaluate potential lead toxicity.

MATERIAL AND METHOD

In the industrial air samples (N=27) lead concentration was determined by X-ray fluorescence spectrofotometry and respirabe PM10 by gravimetric methods. The sampling time was equal to those toxics emission.

The study population included a total of 57 male workers, with 40.1 ± 10.1 years age average, 16.7 ± 10.6 years mean of working period of time and an average of loyalty in the section workplace 9.1 that ± 9.6 years. Blood lead levels (PbB) were measured by stripped anodic voltametry method and urinary ΔALA levels by AAS and also main haematological parameters: erytrocytes, haemoglobin, haematocrit were determined.

The quantification of the environmental and biological effects of exposure to lead data was done using Microsoft Excel Version 5.0 by summary statistics tests (mean, median, standard deviation and frequencies).

RESULTS

Results of this study show concentrations of lead in air that exceeded lead MAC values and PM10 MAC values in occupational air 85.71% and 10.71% of the time, respectively.

The average lead concentration was approximately 24 times greater than the maximum permitted levels, while average PM10 concentration did not exceed the specified maximum allowed. (Table 1)

Table no. 1. Values of lead and PM10 in battery manufacturing occupational air

Analyzed parameters	Mean	Standard deviation	Minimum value	Maximum value	MAC	Exceeded MAC (%)
Lead in air [mg/m^3]	2,14	4,09	0,001	16,93	0,10	85,71
Total particulate matter [mg/m^3]	5,16	7,23	0,001	31,33	10,00	10,71

PbB levels were between 16 µg/dL minimum value and 65 µg/dL maximum value, the mean 38,9 ± 10,8 µg/dL and PbB up 40 µg/dL in la 36 % of the exposed subjects.

When PbB values were analyzed among the exposed groups, greater mean values were found in subjects with a length of exposure up to 5 years being observed an increasing trend (fig.1).

The urinary ΔALA levels were between 2,96 mg/l minimum value and 50,32 mg/l maximum value, the mean 11,4±9,3 mg/l and ΔALAU up 10mg/l in 46,9 % of the exposed subjects (table 2).

When ΔALAU values were analyzed among the exposed groups, greater mean values were found in subjects with a length of exposure from 1 to 5 years and an ascendent trend (fig.1)

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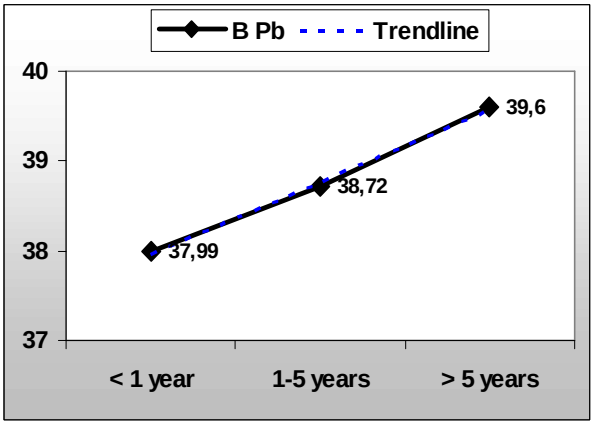
Table no. 2. Values of urinary ΔALA PbB in battery manufacturing workers

Analyzed parameters	Mean	Standard deviation	Minimum alue	Maximum value	MAC	Exceeded MAC (%)
PbB (ug/dL)	38,9	10,8	16,0	65,0	<40	36,0
Urinary Δ ALA (mg/L)	11,9	9,3	2,96	50,32	<10	46,9

Figure no. 1. Trendline of B Pb and urinary Δ-ALA related with exposure length (average)



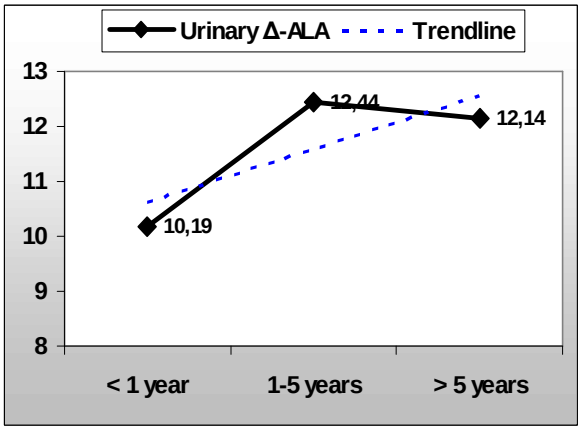
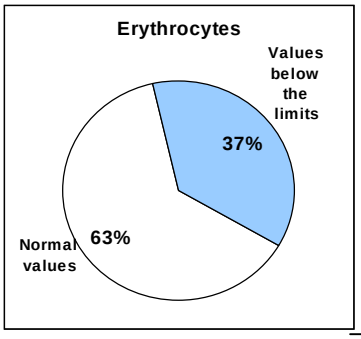
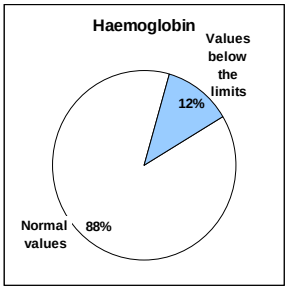
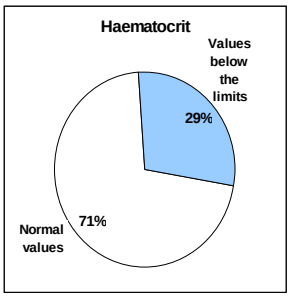


Figure no. 2. Results of haematological parameters at batteries factory workers







The results of haematological parameters (fig.2) showed changes of erytrocytes levels lower than the normal value that were present in 37% of workers, haematocrit levels lower than the normal value were in 29 % and haemoglobin in 12 of investigated subjects, which is consistent with other literature published data (4).

CONCLUSIONS

- Results of this study have shown that in car battery technology production where lead and respirable particular matter are present, for approximately 2/3 investigated workers torelable biological limit for Pb (bB≤ 40 µg/dL) were within normal limits.
- The Δ ALAU biological limit of 10mg / L to over 50% of examined subjects at the end of the work is within normal limits.
- In majority of examined subjects the effect biomarkers in exposure to lead: erytrocytes, haemoglobin and haematocrit were within normal limits.
- It is possible that the occurence of toxic effects in sensitive workers is due mainly to failure of best practices at work and a failure to apply organizational and technical measures to increase occupational health and safety (1)

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