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EFFECTS OF POLLUTING SUBSTANCES ON RISK CATEGORI MOLTEN AND AGGLOMERFATION WORKERS FROM "ROMPLUMB SOCIETY" BAIA MARE

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Abstact: The studies described, followed the blood stream changes that took place in the risk category of molten and agglomeration workers, at the "Romplumb Society" Baia Mare, during 2000. In the activity environment was an increase of lead concentration and cadmium**.**

Changes of hematological parameters in the working personnel indicated alterations of hem synthesis. Hematological changes of working staff are depending on length of service, age of the subjects and various sections were they work.

Key words working personnel, professional noxious, lead, hematological parameters.

1. INTRODUCTION

Professional noxious agents represent a category of xenobiotics – toxic chemical substances that "accidentally appear" along the technological procedures. In the non-ferrous metal processing industrial environment, lead represents, as a polluting agent, one of the major threats.

Lead can penetrate into living organisms through the digestive tract, respiratory system and less, through the skin. In human, the main pathway is the respiratory one (Cézard & Haguenoer, 1992; Demichele, 1984; Hu et. al., 1991). The absorption of lead through the respiratory system can be of 70 to 100%, depending on the dimension of led particles, the exposure duration, the dimensions of the particles and their concentration, the physical estate of the metal, its granulometric composition and hygroscopic qualities, the status of the respiratory mucosa, the rhythm of respiration, etc (Dossing & Paulev, 1983; Ghergariu, 1980).

In blood, lead can be bound to the red blood cells-undiffusive (Lolin & O'Gorman, 1988) or diffusive-free in the plasma, the proportion between these two segments is influenced by individual factors, the duration of the exposure and the intensity of the toxic.

On red blood cells, lead has important and strong influences (Botta et al., 1976;

Kisser, 1977). Baranowska-Bosiacka et al. (2000) showed that the presence of lead inhibits the synthesis of the hem, without specifying at which level takes place this inhibition or which enzyme might be affected. Lead acts on the sulfhydril radicals, inducing conformation changes, which finally conduct to the inhibition of delta aminolevulinic dehydratase, porphobilinogen desaminase, uroporphyrinogen decarboxylase.

Lead also inhibits the synthesis of globins (Baranowska-Bosiacka et al., 2000) by several mechanisms that include its action upon the genes that encode globins synthesis, by its action on lysine, incorporated into the globins molecule, by altering the polyribosomal complex and finally, by increasing A_2 and fetal hemoglobin levels.

Another mechanism of lead action is that on membrane lipids (Valentino et al., 1982), by the change of the fatty acids' concentration in these. The proportion of oleic acid to linoleic acid is diminished (Apostoli et al., 1985), while that between phosphatydilcholine and phosphatydilethanolamine is increased (Cook et al., 1987). There is a contradiction in bibliography in what concerns membrane cholesterol and phospholipids proportion (Apostoli et al., 1985; Karai et al., 1982). Lead affects peroxidation the process being influenced by the selenium or vitamin E deficit (Sunderman, 1986). Changes in membrane composition affect the permeability of the red blood cell, inducing an increased hemolysis, that can take place either in the liver, spleen or in the blood stream.

Our research was directed towards the investigation of the human.

2. MATERIALS AND METHODS

The studies described followed the blood stream changes that took place in the risk category of molten and agglomeration workers at the "Romplumb Society" from Baia Mare, during the semesters I and II of 2000. An important factor of influence, taken into account was the length of service, the groups being formed by 7 to 9 subjects. Corresponding samples of blood were collected from people in Seini, located 30 km further from the polluting source, and those served as controls.

Whole blood was subjected to determination of: total leukocyte counts, hemoglobin, zinc protoporphyrines, and sedimentation speed of red blood cells.

All the results were statistically processed, and the significance of the differences was interpreted by Student's t-test (Snedecor & Cochram, 1978). Percentual differences were evaluated against the controls. The statistical level of significance was considered starting with $p<0.05$.

3. RESULTS AND DISCUSSIONS

Mean monthly concentrations of SO_2, powders in suspension, lead and cadmium in the environment showing an increased level for the last elements. The investigations carried out on a group of workers from "Romplumb" S.A. during 2000, stress the possibility of appearance of professional diseases, when the maximal concentrations of lead are exceeded in the molten and agglomeration sections.

The increased noxious concentrations in sections, their physical estate and the sizes represent important factors in the human organism reactivity.

To these factors, the particularities of the personnel, the type of work they carry out, their hygienic habits, the alimentary regime, smoking, alcohol consumption can be added. All the encountered factors influence the onset of the professional intoxication (Dossing & Paulev, 1983; Sakai, 2000). We considered that the persistence of lead for longer periods of time represented the cause of hematological parameters that were determined.

Hematological changes in the molten working staff, depending on length of service, showed that toxic effects were more pronounced in people for less than 10 years on length of service (fig. 1, 2, 3). Hemoglobin contents decreased in signification. There were statistically differences references to hemoglobin contents between -7.05% (1 year length of service) to -9.86% (9 year length of service) against the control. The statistically differences between total leukocytes numbers was between -21.54% ($p<0.05$) to -37.24% ($p<0.001$), against control, at 4 years and 10 years on length of service.

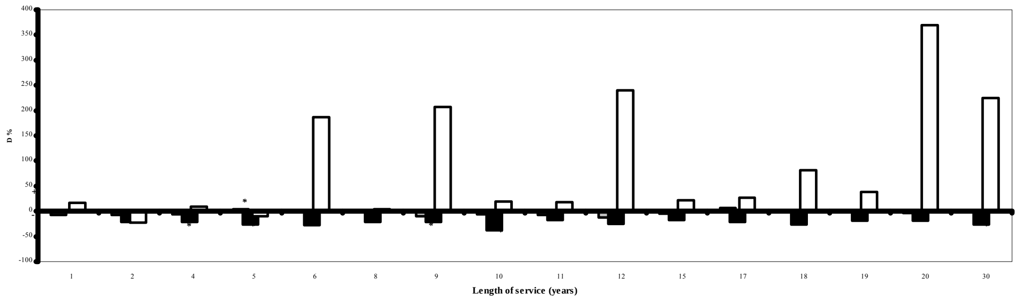

Fig. 1. Percentual differences again the controls of hemoglobin contents (columns grey), red blood cell sedimentation speed (columns white), number of leukocytes (columns black) in whole blood of workers from the molten section, semester I. Control are note with O. Differences signification are note with asterisk.

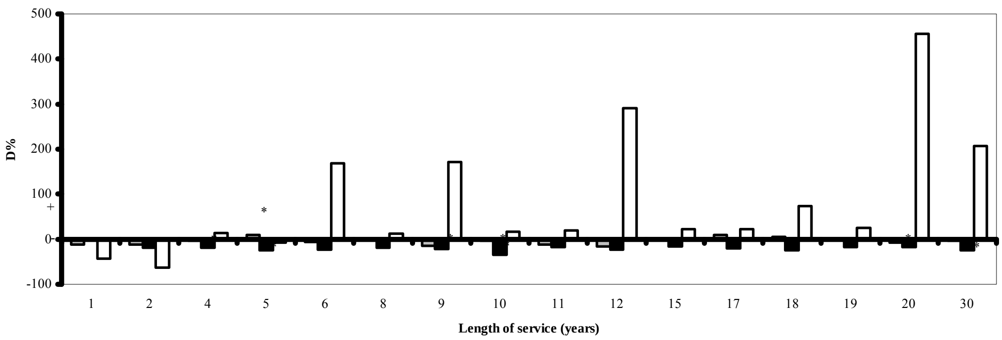

Fig. 2. Percentual differences again the controls of hemoglobin content (columns grey), red blood cell sedimentation speed (columns white), number of leukocytes (columns black) in whole blood of workers from the molten section, semester II. Control is note with O. Differences significations are note with asterisk.

Our data showed that the variations concentration of zinc-protoporfirines in whole blood of workers dependent on length of service, between 1 and 30 years, its levels being well over those of the control. Increase of zinc-protoporfirines in whole blood indicates alteration in hem synthesis. The concentration of the parameter is more affected during second semesters (fig. 3).

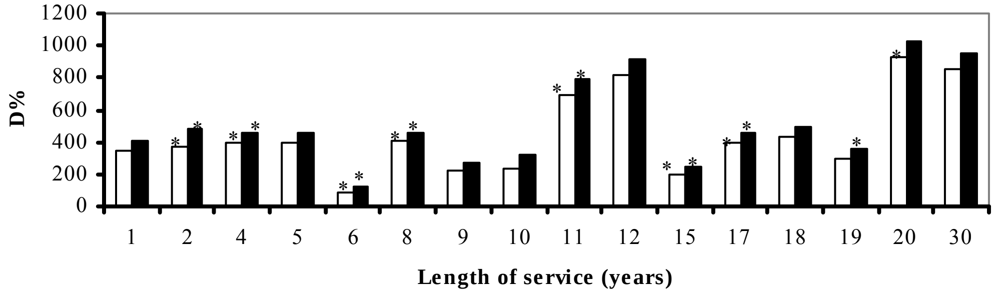

Fig. 3. Percentual differences again the controls of zinc-protoporfirines (ZPP) in whole blood of workers from the molten section, semesters I and II Control are note with O. Differences signification are note with asterisk. Column white–ZPP, semester I; column black–ZPP, semester II. Differences signification are note with asterisk.

Hematological changes (hemoglobin, leukocytes, sedimentation speed of red blood cells and zinc protoporphyrines) in the agglomeration section, depending on length of service, showed that toxic effects were more pronounced (fig. 4, 5, 6).

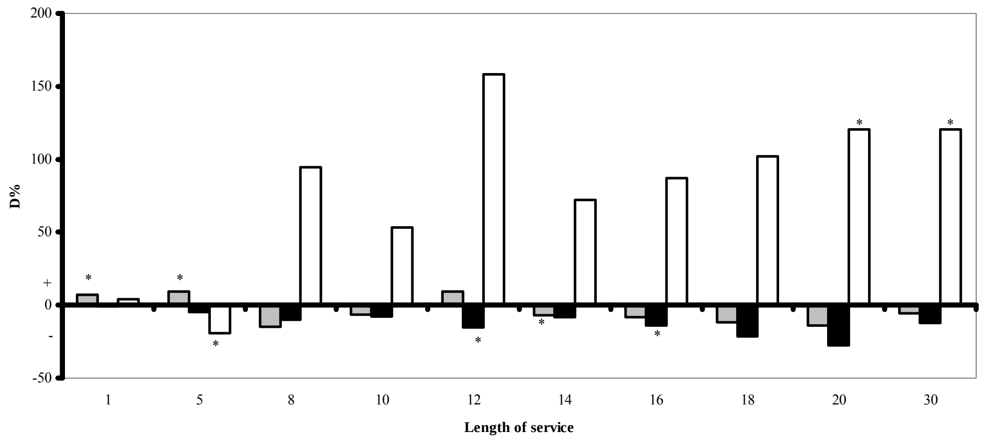

Fig. 4. Percentual differences again the controls of hemoglobin contents (columns grey), red blood cell sedimentation speed (columns white), number of leukocytes (columns black) in whole blood of workers from the agglomeration section, semester I. Control is note with O. Differences signification are note with asterisk.

The content in hemoglobin decreased from 8 years to 30 years according length of service (fig. 4). The decrease was significantly at 1, 5, 12, 18 and 30 years on length of service, in semester II (fig. 5). These changes could be due to protein constituents (Apostoli et al., 1988 a, b) and lipids (Apostoli et al., 1985) from the red blood cell membranes that change the permeability, shape and plasticity of it. Lead also induces changes in the globulin synthesis (Baranowska-Bosiacka, 2000).

The toxic affects total leukocyte numbers, the decrease being more pronounced between 5 years to 20 years of service length. The sedimentation speed of red blood was increase both semesters (fig. 4 and 5). Hematological changes were more pronounced at semester II.

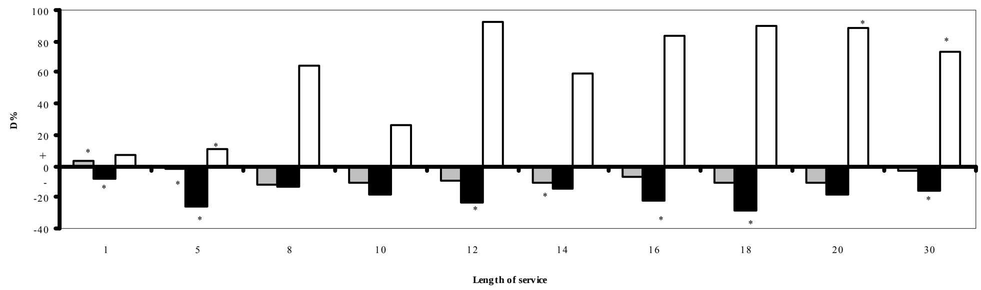

Fig. 5. Percentual differences again the controls of hemoglobin contents (columns grey), red blood cell sedimentation speed (columns white), number of leukocytes (columns black) in whole blood of workers from the agglomeration section, semester II. Control is note with O. Differences significations are note with asterisk.

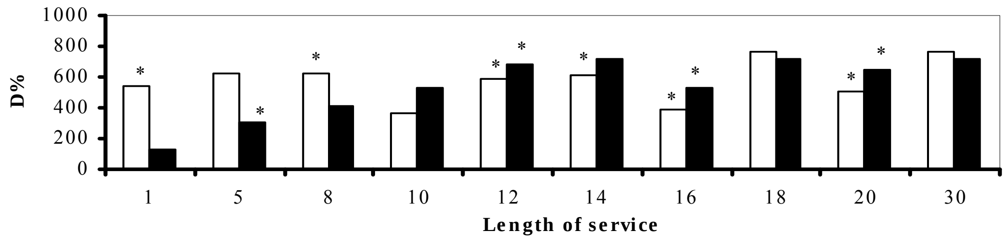

Fig. 6. Percentual differences again the controls of ale zinc-protoporfirines (ZPP) in whole blood of workers from the agglomeration section, semesters I and II, 1997. Control is note with O. Differences significations are note with asterisk. Column white–ZPP, semester I; column black–ZPP; semester II. Differences signification are note with asterisk.

Blood zinc protoporphyrines delivered information on the degree of lead poisoning (Alessio et. al., 1978; Baloh, 1974). This parameter being more altered in the workers from the agglomeration section compared to the molten section (fig.6).

CONCLUSIONS

In the working environment of the personnel at “Romplumb” Baia Mare, monitored during 2000 as well there was an increase of lead concentration all year long. The other toxic elements, such as cadmium, sulfur dioxide and suspended powders, were present in concentrations overrunning the accepted limit for short periods, during the year.

Changes of hematological parameters (hemoglobin, leukocytes, sedimentation speed of red blood cells, zinc protoporphyrines) in the working personnel indicate alterations in hem synthesis.

We concluded that the presence of lead in increased concentrations, all along the year of 2000, modified the investigated hematological parameters, depending on service length, age of the subjects (the highest sensitivity was encountered between 16-44 years) and various sections were the work was carried out (molten or agglomeration).

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