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STUDY CONCERNING THE EFFECTS OF POLLUTION ON THE STAFF WORKER

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ABSTRACT. The experiments have monitored the effects of pollutants specific to nonferrous metallurgy upon 100 workers from metallurgy industry. The workers were exposed to various environments, in which the intensity and duration of pollutants varies, following the modifications of some haematological and renal factors. The obtained results have indicated kidney damage and some haematological changes.

Keywords: environments, effects of pollutants, metallurgy industry, monitored the effects, haematological changes

INTRODUCTION

Among the "Romplumb" S.A. are taken over non ironed ores, and in the technological flow results volatile dusts and gases which are discharged in the atmosphere. This experimental variant illustrates the problem of health linked with the predominant pollutants at the work place.

The study evaluates the existence of great differences concerning the risks of getting ill, these being conditioned by a series of factors like: the concentration of the pollutants in the environment, the microclimate from the departments (the agglomeration and smelter), the work done and the individual factors. Because of these causes the effects upon the human body can appear at the different range after the exposure to pollutants.

MATERIALS AND METHODS

The study was made on the 110 males from which 100 work at the "Romplumb" S.A. and 10 are witnesses. The analysed group was made from representative groups from the sections of smelter and agglomeration toxicologically examined, in the year of 1997, with the age between 20 and 50 years old, without significant pathological history. Were analysed 85 subjects from the smelter department and 15 subjects from agglomeration department.

They were grouped by their seniority in the production field so: from 1 to 30 years for those from the smelter department and from 8-14 years for those from the agglomeration department. From the laboratory methods after the Michele D. and Pavlovici M., 1996, we taken blood, on the anticoagulant were determined the following parameters: the number of the white blood cells, the content of the haemoglobin and the of the sedimentation rate of the red blood cells. From the urine was dosed the delta aminolevulinic acid and the coproporfirines.

The dates were processed after the "t" test of the Student, and the aberrant values were eliminated after the Chavenet (Snedecor and Cochram, 1978) criteria. Were calculated the percentage differences over witness (D %). Statistical signification was considered from $p < 0.05$.

RESULTS AND DISCUSSIONS

The exposure of the subjects towards the professional pollutants with lead, affected the enzymes that are involved in the synthesis of the red blood cells, which determined the increase of the concentration of the delta aminolevulinic (DAL) acid (Mishele D., Pavlovici M., 1996) and of the coproporfirines (CP) from the blood and urine. Because of this, in the intoxications with the lead, are dosed delta aminolevulinic acid and the coproporfirines from the urine.

What concerns the average concentration of the DAL from the urine the dates from the literature are contradictory. While some authors (Lahaye et al., 1977; Kisser, 1977) considered average values as being smaller than 6 mg/‰, another, (Samuel S., Fisher C.,1970) indication smaller values then 5 mg/‰, bat Stankovic, 1971, those smaller than 4 mg/‰. In our case the average obtained from the witness lot was 5.5 mg/l.

In case of the subjects from the smelter department, which were professionally exposed to pollutants between 1 to 18 and 20 years was observed an excess of the delta aminolevulinic acid concentration towards the witness.

The excesses were significant at the seniority of one year (574.9%, $p < 0,001$), at 2 years (959.09%, $p < 0.05$), 5 years (440.72, $p < 0,01$), 6 years (1369.27, $p < 0.05$), 7 years (307.63%, $p < 0.05$), at 9 years (364.91%, $p < 0.05$), 11 years (632.73%, $p < 0.05$), 12 years (476.36%, $p < 0.01$) and at 18 years (506.2%, $p < 0.05$). In case of the exposure to pollutants during 19 and 30 years the values didn't change significantly towards the witness (Table 2).

Another urinary parameter taken into the study was referred to the urinary coproporfirines. Simmonds et al. (1995) considered that this parameter is very sensitive at the vibrations of the concentration of the lead in the blood. In case of an increased absorption the urinary coproporfirines increase significantly. In the realized

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study was observed that at the subjects from the smelter department with seniority between 1 and 15 years, the urine concentrations of coproporfirines exceeded significantly the concentrations seen at the witnesses group. Instead, in case of the subjects with the seniority between 17-19 and 30 years the concentrations detected in the urine are under the values of the reference group (Table. 2). The effectuated analyses on the subjects from the agglomeration department (Table. 1) with seniority between 1 and 14 years indicated an increase of delta aminolevulinic acid and of the coproporfirines from the urine, depending on the duration of exposure to pollutants.

The dates from the literature indicate the apparition of the degenerative processes at the renal level (Hirsch, 1973). The morphological and structural changes which appear in case of prolonged intoxications with lead, causes functional changes. In these conditions is possible, that after a prolonged period of exposure to pollutants with lead, to appear a process of glomerular and tubular atrophy with functional abnormalities of the glomerule and of the renal tube (Fowler B.A., et al., 1994).

Table 1

The correlation between the seniority in the production field of the subjects from the agglomeration department and the concentrations of the delta-aminolevulinic acid (DAL) and of the coproporfirines (CP) from the urine

Seniority in the production field (years)	Total number of the subjects		DAL	CP
		X ±ES	40.36 ± 8.22	514.50 ± 166.19
1	5	D%	+633.82	+ 243
		p	<0.05	NS
		X ±ES	52.11 ± 26.21	427.25 ± 110.97
3	3	D%	+847.45	+ 184.83
		p	NS	NS
		X ±ES	81.20±0.00	261.00 ± 0.00
4	1	D%	+1376.36	+74.00
		p	NS	NS
		X ±ES	49.35 ± 30.85	178.00 ± 83.25
5	2	D%	+ 797.27	+ 18.66
		p	NS	NS
		X ±ES	17.90 ± 0.00	40.00 ± 0.00
6	1	D%	+ 225.45	-73.34
		p	NS	NS
		X ±ES	1.61 ± 6.05	358.51 ± 36.62
8	5	D%	+238.36	+ 139.01
		p	<0.05	NS
		X ±ES	47.56 ± 0.00	1053.00 ± 0.00
9	1	D%	+ 764.72	+ 602.00
		p	NS	NS
		X ±ES	32.19 ± 15.86	289.00 ± 190.20
10	3	D%	+ 485.27	+ 92.66
		p	NS	NS
		X ±ES	70.80± 10.50	779.50 ± 77.73
11	2	D%	+ 1187.27	+ 419.66
		p	NS	< 0.001
		X ±ES	51.72 ± 19.20	392.60 ± 68.21
12	4	D%	+ 840.36	+ 161.73
		p	NS	<0.001
		X ±ES	30.00 ± 0.00	416.00 ± 0.00
13	1	D%	+ 445.45	+ 177.33
		p	NS	NS
		X ±ES	42.93 ± 18.98	362.64± 136.14
14	4	D%	+ 680.54	+ 141,76
		p	NS	NS

Note: There are noted the average values ±, the corresponding standard error (X±ES), the percentage difference towards the witness (D %) and the statistical significance is considered from p < 0.05. The insignificant values statistically are noted with NS.

In the case of the subjects intoxicated with lead appear a series of conformational modifications of the protein and fats from the structure of the haematic membrane. These modifications affect the permeability of the membrane; modify the shape and the plasticity of the red blood cell (Selhi H.S., While J.M., 1975). As well the lead affects also the synthesis of the red blood cell and of the globins (Baranowska-Bosiacka I., et al. 2000). The red blood cells with deficiencies of the shape, volume, structural deficient are haemolyzed in

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the liver, spleen and at the level of capillaries. The exaggerate lysis produces the apparition of the hemolytic anemia.

Table 2

The correlation between the seniority in the production of the subjects from smelting department and the concentrations of the delta-aminolevulinic acid (DAL) and of the coproporfirines (CP) from the urine

Seniority in the production field	Total number of the subjects		DAL	CP
		X ±ES	37.12 ± 2.47	230.39 ± 34.47
1	3	D%	+ 574.91	+ 53.59
		p	<0.01	NS
		X ±ES	58.25 ± 19.30	783.92 ± 280.26
2	3	D%	+ 959.09	+ 422.61
		p	<0.05	NS
		X ±ES	28.27±9.65	498.27 ± 177.91
4	4	D%	+ 414.00	+ 232.18
		p	NS	NS
		X ±ES	29.74±3.86	361.43 ± 106.96
5	7	D%	+ 440.72	+ 140.95
		p	<0.01	NS
		X ±ES	80.81 ± 35.26	1613.50 ± 20.70
6	3	D%	+ 1369.27	+ 975.66
		p	<0.05	NS
		X ±ES	22.42±4.47	264.08 ± 46.05
7	9	D%	+ 307.64	+ 76.05
		p	<0.05	NS
		X ±ES	34.22 ± 19.17	246.92 ± 89.95
8	5	D%	+ 522.18	+ 64.61
		p	NS	NS
		X ±ES	25.57±9.50	343.14 ± 108.32
9	5	D%	+ 364.91	+ 128.76
		p	<0.05	NS
		X ±ES	24.68±1.64	502.07 ± 272.31
10	5	D%	+ 348.73	+ 234.71
		p	NS	NS
		X ±ES	40.3 ± 8.71	414.5 ± 105.75
11	9	D%	+ 632.73	+ 176.33
		p	<0.05	< 0.001
		X ±ES	31.7 ± 4.61	396.5 ± 100.7
12	3	D%	+ 476.36	+ 164.3
		p	<0.01	NS
		X ±ES	15.56 ± 6.43	173.8 ± 36.13
15	3	D%	+ 182.91	+ 15.58
		p	NS	NS
		X ±ES	15.27±7.31 +177.64	133.71 ± 76.2
17	4	D%	NS	– 10.86
		p		NS
		X ±ES	33.37 ± 10.97	96.35 ± 3.47
18	3	D%	+506.73	– 35.77
		p	<0.05	NS
		X ±ES	5.60 ± 0.76	77.52 ± 16.95
19	3	D%	+ 1.82	- 48.32
		p	NS	NS
		X ±ES	30.23 ± 8.02	202.63 ± 15.7
20	7	D%	+ 449.64	+ 35.08
		p	<0.05	<005
		X ±ES	9.08 ± 4.45	51.00 ± 0.29
30	5	D%	65.09	- 66
		p	NS	NS

Note: There are noted the average values ±, the corresponding standard error (X±ES), the percentage difference towards the witness (D %) and the statistical significance is considered from p < 0.05. The insignificant values statistically are noted with NS.

The content of Hemoglobin (Table 4). The facts highlight that no matter the age and the duration of the exposure to the toxic substances from the smelter department, the quantity of the haemoglobin isn't

significantly affected, with just one exception at the seniority of 5 years, the workers aged between 24 -50 years present a significant increase (+9.59%, $p < 0.05$). Is to be remarked the fact that in the majority of cases the values of this haematological parameter is situated under the values of the witnesses. The decrease of the number of the red blood cells isn't constant and is not providing information about the severe manifestations of the intoxication only by correlation of them with other parameters.

The white blood cells (Table 4) at the persons from the same department (smelter) in all cases decrease comparing with the number of it at the witness (7000/mm3). Is registered statistically significant decreases of the number of the white blood cells at the seniority of 4 years in the production field (19.29%, $p < 0.05$) 5 years (24.58% $p < 0.01$), 9 years (21.43% $p < 0.05$), 10 years (34.86% $p < 0.001$), 20 years (17.15% $p < 0.05$) and 30 years (24.58% $p < 0.01$). Is found, as well, that the decrease is accentuating until 10 years of work, for longer time this decreases are found to be more reduced.

Table 3

The correlation between the seniority in the production field of the subjects from the agglomeration department and the haematological modifications

Seniority in the production field	Age	Total number of the subjects		Hg	White blood cells	VSH (sedimentation rate)
8	26-48	4	X ± ES	12.12 ±1.35	5.85 ± 0.43	11.68 ± 6.29
			D%	-9.56	-16.43	+66.85
			p	NS	NS	NS
10	28-46	3	X ± E	13.25±0.71	5.98 ± 0.34	9.19 ± 3.88
			D%	-1.12	-14.58	+ 31.28
			p	NS	NS	NS
12	29-34	3	X ± ES	15.50 ±2.4	50.50±0.40	15.50 ± 12.52
			D%	+15.67	-21.43	+121.42
			p	NS	<0,05	NS
14	30-43	7	X ± ES	13.23±0.60	5.97 ± 0.94	10.33 ± 5.60
			D%	-1.27	-14.72	+47.57
			p	<0.05	NS	NS

Note: There are noted the average values ±, the corresponding standard error (X±ES), the percentage difference towards the witness (D %) and the statistical significance is considered from $p < 0.05$. The insignificant values statistically are noted with NS.

The sedimentation rate of the red blood cells (Table 4) at the workers from the smelter department, observed at the same period of time, also the content of the red blood cells and the number of white blood cells, is a parameter that doesn't suffer any significant modification. Is to remark the fact that in the majority of cases this index registers an increase, except 3 periods of seniority (1 year, 2 years, 5 years), when it decreases.

At the agglomeration department, these parameters observed until the seniority of 14 years (Table 3) highlight modifications of the content of the red blood cells at 14 years (-1.27% $p < 0.05$) and of the number of white blood cells (-21.43, $p < 0.05$), without being affected the sedimentation rate of the red blood cells. We have noticed that the direction of the modifications is alike with the one from the smelting section.

From those presented above it can be found that the apparition of the professional diseases is influenced by the intensity of the pollutants from the environment in which the analysed group works, by the duration of exposure, by the microclimate conditions but also by the individual factors, the reactivity of the body to lead intoxication is different, being involved a series of factors.

CONCLUSIONS

The urinary concentrations of the delta aminolevulinic acid and of the coproporfirines increased in the case of the subjects with a seniority ranging between 1 and 18 years. But, in case of a prolonged exposure, lasting 19, 30 years, the urinary eliminations of these compounds decreased. In case of a prolonged exposure the renal function is affected. The damage depends on the duration of the exposure to pollutant, on the intensity of the organism but also on the reactivity of the organism.

The content of the haemoglobin decreased insignificantly in case of the subjects with a seniority in the production field ranging between 1 and 12 years.

The decrease of the haemoglobin content is correlated with the increase of the delta aminolevulinic

acid and of the coproporfirines from the urine, in case of the subjects with a seniority ranging between 1 and 12 years. The number of the white blood cells decreased significantly in the realised study.

Table 4

Correlation between the seniority in the production field of the subjects from the smelting department and the haematological modifications

Seniority in the production field	Age	Total number of the subjects		Hg	White blood cells	VSH (sedimentation rate)
1	16-23	2	X ± ES	12.20±1.00	6.95± 2.47	4.00 ± 1.97
			D%	– 11.34	– 0.71	– 42.86
			p	NS	NS	NS
2	23-30	3	X ± ES	12.13± 0.57	5.66± 0.42	2.62 ± 1.14
			D%	– 11.85	– 19.15	– 62.58
			p	NS	NS	NS
4	27-31	4	X ± ES	13.27 ±0.93	5.65 ±0.17	7.92 ± 1.99
			D%	– 3.57	– 19.29	+ 12.14
			p	NS	<0.05	NS
5	24-30	7	X ± ES	15.08 ±0.4	5.28 ±0.25	6.43 ± 1.83
			D%	+9.59	- 24.58	- 8.15
			p	<0.05	<0.01	NS
6	27-31	3	X ± ES	13.00 ±0.32	5.33 ±0.97	18.83 ± 10.00
			D%	- 5.53	- 23.86	+ 169
			p	NS	NS	NS
8	27-33	8	X ± ES	13.50 ±0.72	5,68 ±0.43	7.87 ± 4.12
			D%	-1.89	-18.86	+ 12.42
			p	NS	NS	NS
9	27-30	5	X ± ES	11.80 ±1.01	5.50 ±0.41	19.02 ± 8.60
			D%	- 14.25	- 21.43	+ 171.71
			p	NS	<0.05	NS
10	30-50	5	X ± ES	13.40 ±0.79	4.58 ±0.41	8.12 ± 1.71
			D%	- 2.62	-34.58	+ 16.00
			p	NS	<0.001	NS
11	31-46	5	X ± ES	12.18 ±0.83	5.82 ±0.69	8.37 ± 1.65
			D%	-11.49	-16.86	+ 19.57
			p	NS	NS	NS
12	34-44	9	X ± ES	11.56 ±0.58	5.40 ± 0.80	27.41 ± 10.65
			D%	-15.99	-22.86	+291.57
			p	NS	NS	NS
15	33-36	3	X ± ES	13.56 ±0.32	5.87 ±1.17	8.58 ± 4.15
			D%	-1.46	-16.15	+ 22.57
			p	NS	NS	NS
17	35-41	3	X ± ES	15.5 ±0.07	5.60 ±1.40	8.60 ± 3.46
			D%	+ 9.37	-20	+ 22.85
			p	NS	NS	NS
18	35-42	4	X ± ES	15.5 ±0.07	5.60 ±1.40	12.12 ± 5.38
			D%	+ 9.37	-20	+ 73.14
			p	NS	NS	NS
19	37	3	X ± ES	13.57 ±1.59	5.77 ±1.09	8.75 ± 3.19
			D%	-1.39	- 17.58	+25
			p	NS	NS	NS
20	39-42	3	X ± ES	12.75 ±0.69	5.80 ±0.27	38.87 ± 11.40
			D%	-7.35	-17.15	+ 455.28
			p	NS	<0.05	NS
30	47-50	7	X ± ES	13.25 ±0.28	5.28 ±0.40	21.50 ± 6.01
			D%	-3.71	- 24.58	+ 207.14
			p	NS	<0.01	NS

Note: There are noted the average values ±, the corresponding standard error (X±ES), the percentage difference towards the witness (D %) and the statistical significance is considered from p < 0.05. The insignificant values statistically are noted with NS.

The sedimentation rate of the red blood cells increased in all cases excepting the subjects with a seniority of 1 year, 2 years and 5 years.

Correlating the increased values of the VSH with an increased values of the delta aminolevulinic acid on of the coproporfirines from the urine for the same seniority in the production field, can be concluded that the subjects with a seniority of 6 years, 12 years, 20 years and 30 years have the renal function affected.

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