Lead Intoxication in Printing Houses

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Introduction

Lead as the cause of chronic intoxication, could be harmful to many workers upon exposure, among which the workers in printing-houses, letter makers etc. could be mentioned as an example. (KEHOE, 1972; MICHAEL and UTIDJIAN, 1973; HALL, 1972) The SMALL printing workshops usually have a limited number of 5 to 20 workers who run the whole process and do all the operations. Metallic lead however, is almost the main everyday harmful material to which they are in direct contact. In some shops the used letters are collected from every other shop and taken to vessels for melting and reshape. Workers engaged in such operations, even in a very limited number, are badly endangered and have continuous exposure to lead fumes as well as dusts. Environmental conditions in such offices are unfavourable and personal hygiene is practically very poor.

In the modern LARGE printing-houses and newspaper, good ventilation and exhaust system are provided and also huge modern automatic printing machines of ROTATYPE or ENTEROTYPE are in operation and use. In this type of workshops the workers have no direct contact with lead and the letters are simply produced by special typewriter machines fed by molten lead. Over the pot of molten lead in such machines, exhaust pipings are provided and connected to the main ventilation system, thus no fumes of lead could be practically scattered in the vicinity. Personal and collective hygiene is satisfactory and workers economical condition is favourable.

The present study was performed according to WHO recommendations (Occupational Health Section) to compare the degree of exposure to lead dusts and fumes in the aforementioned groups of workers and compared with a control group in textile industry where no contact of Pb is expected.

Materials & Methods

Out as 306 printing-houses with a total number of 6120 workers 252 were considered SMALL (5-20 workers each and with a total number of 3351 workers) and 54 considered LARGE (over 20 workers each, and with a total number of 2769 workers). The survey was made among 472 workers from 21 printing houses and workshops by Random Sampling from which 18 fell in the SMALL group of workshops (with a total number of 205 workers) and 3 fell in the LARGE group of

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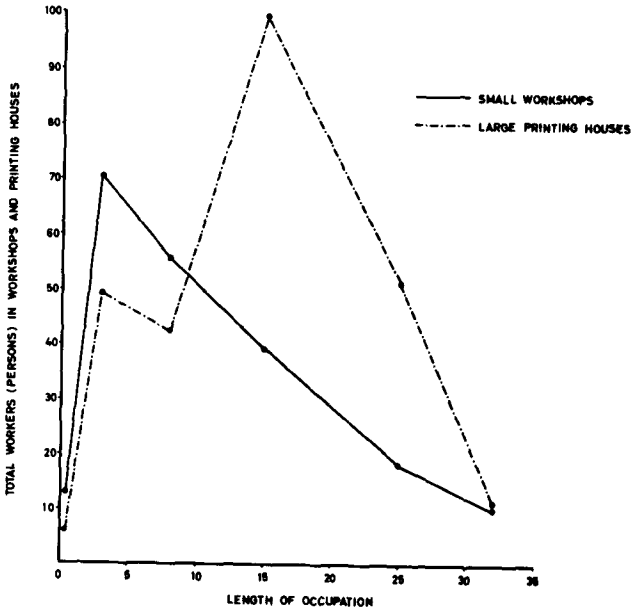
printing houses (with a total number of 267 workers).

Questionaires according to WHO recommendation were filled out for each printing house and workshop and individual forms were prepared for each worker indication, kind of job, length of occupation, age, present and past ailment as well as hours of work per day.

Lead content and coproporphyrin was determined in urine samples and blood was tested for hematocrete, hemoglobine content and basophylic stippled cells (TAGUCHI, SUZUKI, SUZUKI, and TAKEMOTO, 1972; GOLDWATER and HOOVER, 1967; PATTY, 1967). Similar test were carried out on 64 workers engaged in textile factory with no contact of lead dust and/or fumes (control group). (SANAI, ZIAI, GHIAMI, and GHASEMI, 1973) Lead was determined by Dithizane Method and checked by Atomic Absorption Spectrometry, Hemoglobine by Cyanmethemoglobine method and Basophyllic Stippled cells by Gaimsa staining method. Coproporphyrin was also investigated in urine samples. (TAGUCHI, SUZUKI, SUZUKI and TAKEMOTO, 1972; GOLDWATER and HOOVER, 1967; SANAI, ZIAI, GHIAMI and GHASEMI, 1973; Patty, 1967)

Results of tests are given in graph one and tables I to IV.



Graph No 1 showing total age distribution of workers according to the Length of Occupation (See also Table IV Symptoms present)

Table I
Age distribution according to the length of occupation (Persons)

AGE	Less than 1 year			1-5 years			LENGTH OF OCCUPATION 6-10 years			11-20 years			21-30 years			31 and over		
	S	L	C	S	L	C	S	L	C	S	L	C	S	L	C	S	L	C
Less than 10 years	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10-20 years	10	-	5	46	17	14	18	3	3	1	-	-	-	-	-	-	-	-
21-30 years	2	5	3	19	26	5	33	28	5	16	39	3	-	1	-	-	-	-
31-40 years	1	1	3	5	5	4	4	9	3	18	46	7	7	22	-	1	-	-
41-50 years	-	-	-	-	1	-	-	2	3	2	14	3	8	27	-	7	6	-
50 and over	-	-	-	-	-	-	-	-	-	2	-	-	3	1	3	2	5	-
Total	13	6	11	70	49	23	55	42	14	39	99	13	18	51	3	10	11	-

S = SMALL workshops L = LARGE printing-houses C = Control

Table II
Lead (mg/lit) in urine according to the kind of job (Persons)

Kind of job	SMALL WORKSHOPS		Pb mg/lit URINE LARGE PRINTING HOUSES		CONTROL	
	Less than 0.2 mg/lit	0.2 mg/lit & over	Less than 0.2 mg/lit	0.2 mg/lit & over	Less than 0.2 mg/lit	0.2 mg/lit and over
1. TYPE SETTER	37	9	94	11		
2. ROTATYPE OPERATOR	2	-	25	4 ⁎		
3. LITHOGRAPHER	2	-	3	-	All Samples	
4. PRINTING MACHINE OPERATOR	72	9 ⁎	36	1	were between	
5. SPACE & MARGIN SETTER	15	3	32	3	0.0–0.16	None
6. LEAD SMELTER	9	4	9	2	mg/lit	
7. OFFSET OPERATOR	3	1	5	-		
8. PLATE EDITOR	2	-	12	1		
9. LEAD ENGRAVER	-	-	10	-		
10. MECHANIC	1	-	4	-		
11. MESSENGER	5	1	5	-		
12. OFFICE WORKER	8	-	7	-		
13. BINDER	22	-	3	-		

⁎ Three out of 9 and two out of 4 were formerly type-setters(Lead-letter Assorters) who changed their jobs since more than a year age.

Table III
mg/lit of Pb in Urine according to the length of occupation (Persons)

Pb mg/lit urine	LENGTH OF OCCUPATION																	
	Less than 1 year			1-5 years			6-10 years			11-20 years			21-30 years			31 and over		
	S	L	C	S	L	C	S	L	C	S	L	C	S	L	C	S	L	C
0.0-0.08 mg/lit	6	2	4	32	26	10	28	20	10	17	44	8	7	19	-	7	8	-
0.09-0.20	6	4	7	33	22	13	19	18	4	15	45	5	6	24	3	1	2	-
0.21-0.30	-	-	-	3	1	-	4	2	-	3	4	-	2	5	-	-	-	-
0.31-0.40	-	-	-	2	-	-	3	1	-	3	3	-	3	2	-	1	1	-
0.4 and over	-	-	-	-	-	-	1	1	-	1	1	-	-	1	-	1	-	-
Total	12	6	11	70	49	23	55	42	14	39	97	13	18	51	3	10	11	-

S = SMALL Workshops

L = LARGE printing houses

C = Control

Table IV

Coproporphyrin, stippled cells, hemoglobine content & clinical symptoms observed in all groups under experiment according to the length of occupation (Persons)

TESTS	LENGTH OF OCCUPATION																	
	Less than 1 year			1-5 years			6-10 years			11-20 years			21-30 years			31 years and over		
	S	L	C	S	L	C	S	L	C	S	L	C	S	L	C	S	L	C
Stippled cells	-	-	-	-	-	-	-	-	-	-	-	-	1 *	-	-	-	-	-
Coproporphyrin	-	-	-	1	-	-	-	-	-	2	-	-	-	1	-	-	-	-
Hemoglobine less than 14 % **	-	-	2	4	5	-	7	4	3	6	6	2	4	9	-	2	5	1
Symptoms Present ***	-	-	-	1	4	-	4	7	1	6	24	-	2	14	2	2	4	-

S = SMALL workshops L = LARGE printing houses C = Control

* Stippled cells were found in one worker's specimen of blood after 22 years work being lead letter assorter with 0.225 mg/lit Pb in urine.

** Some cases of anemia could be due to malnutrition in all groups.

*** Symptoms present were abdominal pain, loss of teeth, anemia, weakness etc.

Results and Discussions

Table I shows that the total number of workers in all ages in different length of occupations, engaged in SMALL workshops, is different from LARGE printing houses. Distribution of workers according to the length of occupation in both groups of workers is shown in graph No. 1, Graph I and table I indicate that in SMALL workshops, larger number of workers are among those with low length of occupation while in LARGE printing houses they fall in groups over 11 years of length of occupation.

This is mostly because workers in SMALL workshops change more frequently for better job and salary while those in LARGE printing houses with better socio-economic conditions (financial support, insurance, etc.) continue their service for longer periods of time.

Long length of occupation and better service could also be observed in Table IV where chronic clinical symptoms are mostly seen in workers of LARGE printing houses havine longer length of occupation. This means that the workers in LARGE printing houses have been working for longer time under unfavourable conditions in the past and different symptoms of chronic exposure could be seen in them.

In other words low incidence of acute Pb poisoning, less higher values of Pb (Table III), lack of coproporphyrin in urine with no stippled cells in blood (Table IV), in one hand, and chronic chemical symptoms, anemia, teeth decay, gastrointestinal disorders etc. (Table IV), in the other hand, indicate that the workers of LARGE printing houses have had severe lead exposure in hte past years while in recent years the work conditions has improved to a great extent, and automation of system, better ventilation, favourable socio-economic conditions has covered this group of workers.

Table II shows job distribution according to the number of workers and values of lead over 0.2 mg/lit in urine in each group. It could be easily understood that higher values of lead is mostly observed in jobs having direct contact with lead.

REFERENCES

GOLDWATER, L.J., & W.A. HOOVER, Arch. Env. Health 15, 60 (1967).

HALL, S.K., Environ. Sci. and Tech. 6, 31 (1972).

KEHOE, R.A., J.O.M. 14, 390 (1972).

MICHAEL, H., & D. UTIDJIAN. J.O.M. 15, 590 (1973).

PATTY, F.A., in Industrial Health and Toxicology, Vol. II, Interscience Publishers, Inc., New York, (1967) pp. 941-985.

SANAI, G.H., N. ZIAI, A. GHIAMI, & A. GHASEMI, Ind. Health II, 197 (1973).

TAGUCHI, T., T. SUZUKI, S. SUZUKI, & T. TAKEMOTO, Ind. Health, 10, 77 (1972).