

RELATIONSHIP OF BLOOD LEAD AND
MANGANESE IN OCCUPATIONALLY
UNEXPOSED SUBJECTS

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Lead and manganese concentrations in blood were determined in 25 male and 13 female healthy and occupationally unexposed subjects by flameless atomic absorption spectrophotometry. The mean lead and manganese values were 176.3 ± 50.8 and 75.3 ± 30.8 $\mu\text{g/L}$ for men and 131.4 ± 44.0 and 65.5 ± 29.2 for women. The correlation coefficient for lead and manganese was 0.33 ($p > 0.05$) for men and -0.03 ($p > 0.05$) for women. No relationship between lead and manganese blood levels could be established.

It has been suggested that manganese in blood may be influenced by lead exposure (1, 2). There is a tendency for manganese in blood to increase with a rise in blood lead level. So far no study has been undertaken to show whether there is any relationship between blood lead and blood manganese in occupationally unexposed populations.

This study aims to shed some light on the possible correlation between manganese and lead levels in healthy and occupationally unexposed working populations.

SUBJECTS AND METHODS

Twenty-five male and 13 female employees participated in the study. All of them came from the same working area and had been living at least one year in Jakarta. The average years of service were 6 ± 5.8 for men and 5.1 ± 4.6 for women.

Blood contents of lead and manganese were determined with flameless atomic absorption spectrophotometry. Although the sample was small it was of interest to see whether there might be any relationship between the two metals in the occupationally unexposed persons.

RESULTS

Table 1 shows the means, ranges and standard deviations for age and manganese and lead levels in whole blood by sex. At the level of $p = 0.10$, the age of male subjects was not statistically different from the females. The blood manganese contents were also alike ($p > 0.10$). However, the difference in blood lead between male and female subjects was statistically significant ($p < 0.01$). Neither blood lead nor blood manganese correlated with age ($p > 0.05$).

Table 2 shows correlation coefficients between blood lead and blood manganese levels. These were 0.33 for the male and -0.03 for the female group and neither was significant ($p > 0.05$).

Table 1.
Age and blood lead and manganese contents by sex

Sex	Age (years)				Metal	Blood concentrations ($\mu\text{g/L}$)		
	N	\bar{x}	SD	Range		\bar{x}	SD	Range
Male	25	32.6	7.9	23-53	Lead	176.3	50.8	78.5-251.1
					Manganese	75.3	30.8	11.9-162.2
Female	13	28.0	4.4	22-35	Lead	131.4	44.0	78.9-214.9
					Manganese	65.5	29.2	11.5-126.4

Table 2.
Correlation coefficients between blood lead and blood manganese by sex

Sex	Correlation coefficient (r)	P
Male	0.33	>0.05
Female	-0.03	>0.05

DISCUSSION

Gutelius and co-workers were presumably the first to mention a positive correlation between lead and manganese blood levels in children (3). *Zielhuis and co-workers* confirmed these findings not only in children but also in adult male workers, who were exposed to lead but apparently not to manganese (1).

The values of blood manganese in occupationally unexposed healthy persons as measured in this study were 75.3 ± 30.8 for men and 65.5 ± 29.2 $\mu\text{g/L}$ for women. These values occupy the middle region of the range of normal mean concentrations usually found in literature indicating the levels varying from 0.8 and 150.0 $\mu\text{g/L}$ of whole blood. One or two studies, however, reported that in occupationally nonexposed populations the manganese contents in blood did not exceed 20 $\mu\text{g/L}$ (4). In comparison to these, our blood concentrations of manganese were several times higher. The lowest and highest values were 11.9 and 162.2 for men and 11.5 and 126.4 $\mu\text{g/L}$ for women. There was no statistical difference between blood manganese levels in men and women. Blood manganese appears to be constant and the finding that blood manganese did not correlate with age supports it.

The blood lead concentrations of 176.3 ± 50.8 and 131.4 ± 44.0 in our unexposed male and female subjects were in the middle of the range of 100-250 $\mu\text{g/L}$ as usually found in the literature. The values, however, were lower in comparison to the normal blood lead levels reported from northern Italy or France with the concentrations as high as 200-300 $\mu\text{g/L}$. The lowest and highest concentrations were 78.5 and 251.1 in men and 78.9 and 214.9 $\mu\text{g/L}$ in women. The blood lead levels in men were statistically higher than in women ($p < 0.01$). This finding supports the common phenomenon of a significant difference in blood lead content between the two sexes. Neither in men nor in women did blood lead increase with age ($p > 0.05$). There are only a few reports suggesting an increase of blood lead with age (5).

So far no special studies have been conducted to pinpoint a possible correlation between lead and manganese contents in blood. Suggestions have been only made for the possibility of higher blood manganese concentration in exposure to lead. This may be due to causes which need to be studied. By having shown in this study that in healthy and unexposed persons no relationship has been established between blood lead and blood manganese, the increased content of manganese in those exposed to lead may be due to additional exposure to manganese occurring together with exposure to lead.

CONCLUSION

In healthy and unexposed men aged 32.6 ± 7.9 years and women aged 28.0 ± 4.4 years with blood lead and manganese contents of 176.3 ± 50.8 and 75.3 ± 30.8 $\mu\text{g/L}$ and 131.4 ± 44.0 and 65.5 ± 29.2 respectively, lead and manganese concentrations in whole blood showed no relationship ($p > 0.05$).

References

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Sažetak

ODNOS KONCENTRACIJE OLOVA I MANGANA U KRVI PROFESIONALNO NEEKSPONIRANIH LJUDI

U 25 muškaraca i 13 žena koji nisu bili profesionalno eksponirani olovu ili manganu, izmjerena je koncentracija ovih dvaju metala pomoću besplatne atomske spektrofotometrije. Koncentracija olova u krvi bila je $176,3 \pm 50,8$ $\mu\text{g/L}$ za muškarce i $75,3 \pm 30,8$ $\mu\text{g/L}$ za žene. Koncentracija mangana u krvi muškaraca bila je $131,4 \pm 44,0$ $\mu\text{g/L}$ i u žena $65,5 \pm 29,2$ $\mu\text{g/L}$. Koeficijent korelacije između koncentracije olova i mangana u krvi bio je vrlo nizak i za muškarce i za žene, pa se može zaključiti da nema odnosa između ovih dvaju metala u krvi profesionalno neeksponiranih ljudi.

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