Bull. Environ. Contam. Toxicol. (1989) 42:438–442

Bulletin of Environmental Contamination and Toxicology

Correlation between Lead and Prolactin in Males Exposed and Unexposed to Lead in Buenos Aires (Argentina) Area

O. E. Roses,[1,2] S. Alvarez,[2] M. I. Conti,[1] R. A. Nóbile,[2] and E. C. Villaamil[1]

[1]Cátedra de Toxicología y Química Legal, Facultad de Farmacia y Bioquímica, Universidad de Buenos Aires, Buenos Aires, Argentina and [2]Departamento de Farmacia y Bioquímica, Hospital Naval de Buenos Aires "Cirujano Mayor Dr. Pedro Mallo", Buenos Aires, Argentina

Lead is an important factor in environmental pollution due to its intensive industrial use and in Argentina it is perhpas the main industrial contaminant.

In most cases lead toxicity is related to alterations in heme synthesis. It is also responsible for changes in the central nervous system and the illness among workers called "saturnism". as well as other alterations defined as subjective disturbances and fully described by various authors (Hanninen et al 1980; Moore et al 1986). Govoni et al (1984a) and Missale et al (1984) reported the action of lead on the dopaminergic transmission mechanism in the central nervous system of rats.

The control of prolactin levels by an agent whose identity is still uncertain is known to involve undoubtedly a dopaminergic mechanism by which an increase in dopamine depresses plasma prolactin values.

Govoni et al (1984b) have also demonstrated in rats a decrease in dopamine turnover in hypothalamus with a corresponding increase in prolactin levels.

The purpose of this work was to determine the correlation between blood lead and plasma prolactin levels in humans. Normal plasma prolactin and blood lead values in healthy individuals exposed to lead at work had already been obtained in males and ranged from 1 to 17 ng/ml for prolactin and up to 26 ug/100 ml for lead (Alvarez et al 1987; García Fernández et al 1984).

MATERIAL AND METHODS

The examinees comprised a total of 128 males; 56 subjects (from 20 to 52 years old) had been exposed to lead at work for over 2 years and had not previously received detoxification treatment,

Send reprint requests to O.E. Roses, Junín 956, (1113) Buenos Aires, Argentina.

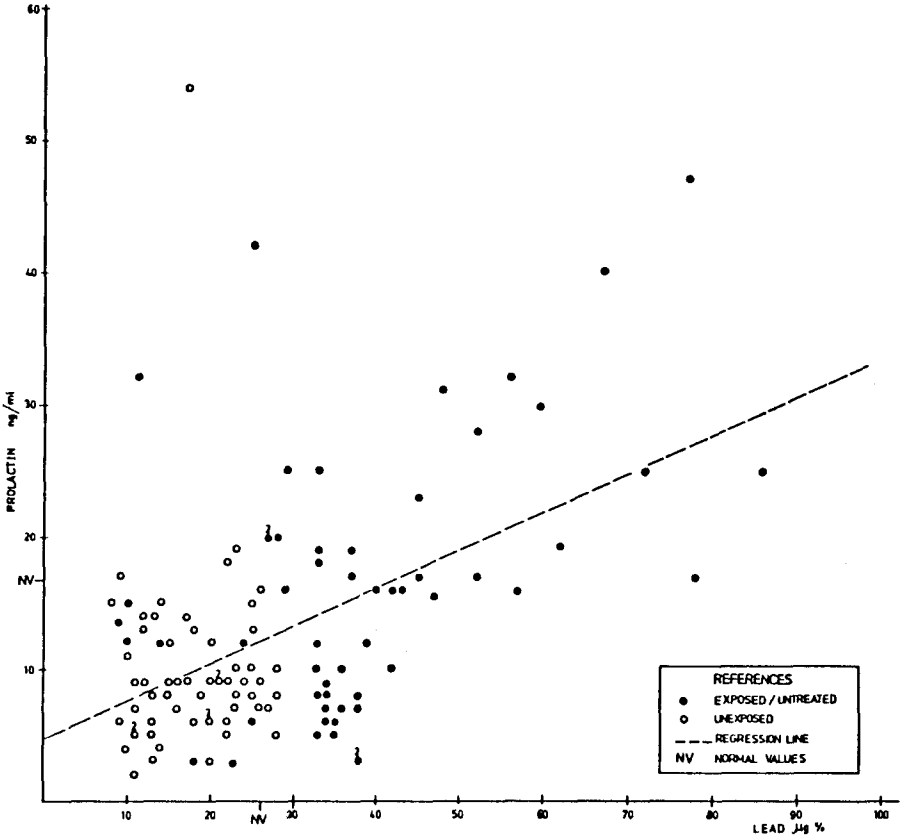

Figure 1. Distribution of prolactin vs lead values in "unexposed" and "exposed/untreated" subjects. Digit "2" on a point indicates the same value twice.

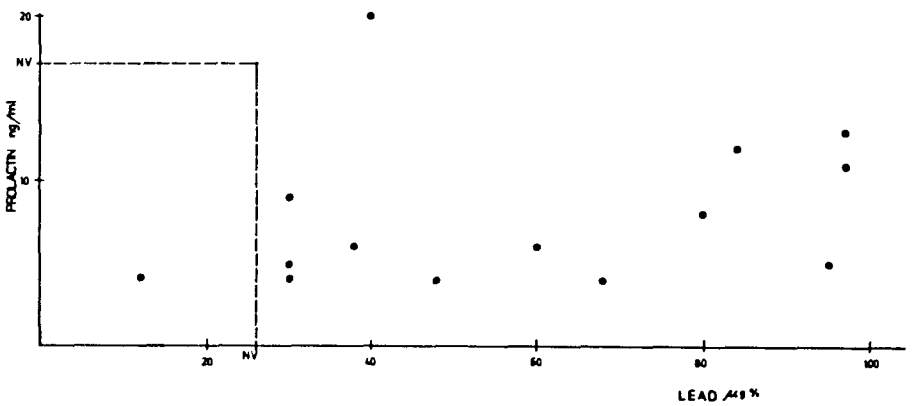

Figure 2. Prolactin vs lead values in "exposed/treated"subjects.

hereinafter referred to as "exposed/untreated"; 58 (from 18 to 49 years old) were not exposed to lead at work, hereinafter referred to as "unexposed"; and 14 (from 25 to 37 years old) had been exposed to lead at work for over 2 years and had received detoxification treatment using the calcium-sodium salt of EDTA and/or Penicillamine, hereinafter referred to as "exposed/treated".

Plasma prolactin was determined by RIA, each sample by duplicate, considering valid values that differed less than 10% from one another. The double antibody-polyethylenglycol method with I^{125} labelled hormone was used.

For prolactin determination, "prolactin Ter" kit reagents from Serono Laboratories (Code N° 10804) and a "Packard" Prias 400 CGD Mod. BPGD Gamma Counter were employed.

Lead was extracted from hemolyzed blood by complexing with APDC (Ammonium Pyrrolidine Dithio Carbamate) dissolved in MID (Methyl Isobutyl Ketone) and determined by air-acetylene flame atomization in a "Varian" Mod. 475 Atomic Absorption Spectrophotometer at 217.0 nm with a 0.5 mm slit and a hollow cathode lamp with a 5 mA current. Double beam readings were made with background correction. Integration time was 1 sec. Determinations were performed by duplicate, applying the same validity criterion employed for prolactin.

For both prolactin and lead, decimal fractions in mean values from .1 to .4 were rounded off to the lower integer; from .6 to .9 to the higher; and alternatively to the lower and higher integer in the case of .5.

RESULTS AND DISCUSSION

Results are presented in Figs. 1, 2 and 3.

Values obtained from the 58 "unexposed" subjects and 56 "exposed/untreated" workers are depicted in Fig. 1. Prolactin values ranged from 6 to 43 ng/ml in "exposed/untreated" and from 2 to 19 ng/ml in "unexposed", except for a single unexplained case with 54 ng/ml among the latter.

Lead values ranged from 9 to 86 ug/100 ml and from 8 to 28 ug/100 ml in "exposed/untreated" and "unexposed" individuals, respectively. Correlation coefficient "r" for prolactin vs lead was .57 for the whole population and the regression line equation was $y = 4.7 + .29x$.

Most "exposed" subjects (50 out of 58) had normal lead and prolactin values, while only 8 out of 56 "exposed/untreated" presented normal levels.

Values obtained for "exposed/treated" individuals are given in

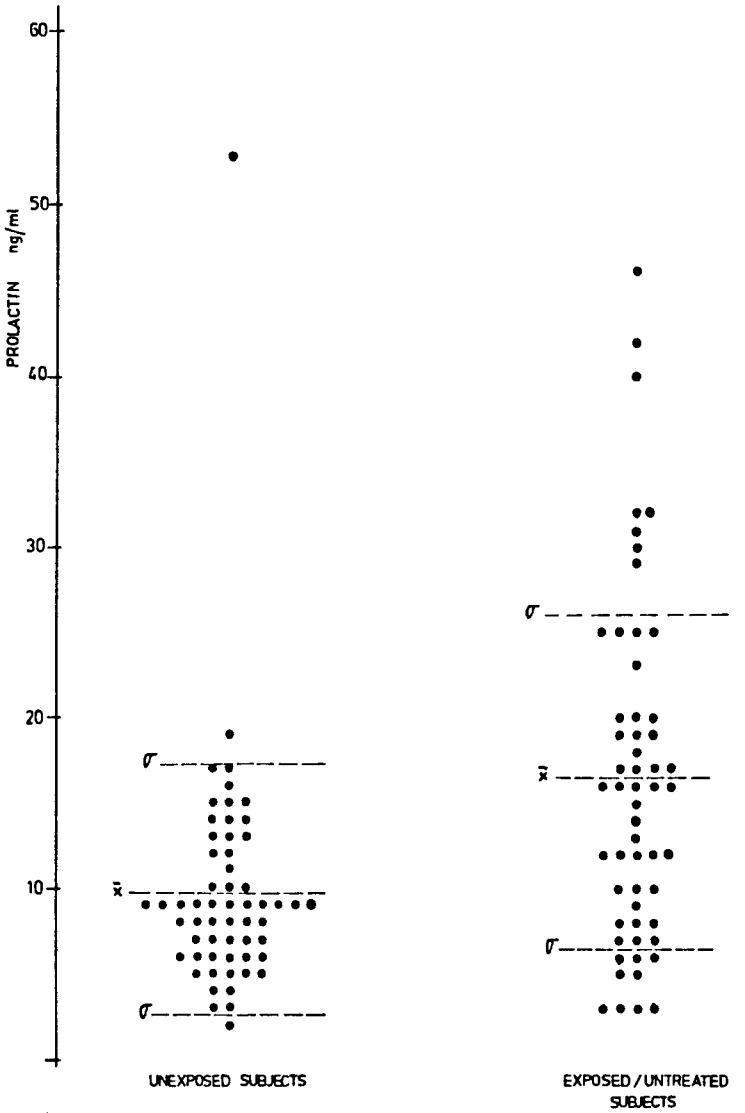

Figure 3. Distribution of prolactin values in "unexposed" and in "exposed/untreated" subjects.

Fig. 2. Prolactin levels ranged from 4 to 13 ng/ml, except for one case with 20 ng/ml.Lead values ranged from 12 to 96 ug/100 ml. In this group, high lead values typically correlated with normal prolactin levels in all but one subject, who was a recently treated worker.

Prolactin levels (mean ± SD) for "exposed/untreated" and "unexposed" were 16.3 ± 10.0 and 9.9 ± 7.3 ng/ml,respectively (Fig.3). There was remarkable individual variation and a suggestive, though not statistically significant prolatin increase in

the "exposed/untreated" group, inderlining potential risks of hormone increase secondary to long-term lead exposure.

Govoni et al (1987) reported similar findings, but differences between "unexposed" and "exposed/untreated" were less noticeable.

To sum up, we found an acceptable correlation between blood lead and plasma prolactin levels in "exposed/untreated" and "unexposed" groups, suggesting that lead may interact with prolactin regulation in plasma.

The fact that treated subjects had high blood lead levels and practically normal prolactin values would imply that, despite the limited number of cases, lead complexed as a result of treatment fails to interfere with the regulatory mechanism of prolactin.

Acknowledgments. The authors are grateful to M. Vousu, B. Durán, B. Bazán, O. Benito, H. Emparán, C. Voena, E. Nardi and J. Ezquerro, as well as to Prof. Stefano Govoni for his encouragement in the course of our work.

REFERENCES

Alvarez S, Nóbile RA, Núñez N, Roses OE (1987) Valores referenciales de prolactina plasmática en varones sanos no expuestos laboralmente al plomo. 52 Triduo Bioquímico Científico Anual, Villa Giardino, Córdoba, Argentina, october 11-16, 1987.

García Fernández JC, Malamud M Zanardi J, Roses OE, Ravenna A, Ridolfi A (1984) Plombenia: Estudio comparativo de dos métodos y determinación de valores en nuestro medio para personas expuestas y no expuestas. 3rd.Congress and 4th. Interdisciplinary Argentine Meeting of Toxicology,Buenos Aires,Argentina, August 13-15, 1984.

Govoni S, Battaini F, Rius RA, Trabucchi M (1984a) Effect of Lead Exposure in the Development of Central Nervous system. In: Caciagli F, Giacobini E, Paoletti R (eds) Development Neuroscience: Physiological, Pharmacological and Clinical Aspects, Elsevier Science Publishers, Amsterdam, p 225-228.

Govoni S, Lucchi L, Battaini F, Spano PF, Trabucchi M (1984b) Chronic lead treatment affects dopaminergic control of prolactin in rat pituitary. Toxicol Lett 20:237-241.

Govoni S, Battaini F, Fernicola C, Castelletti L, Trabucchi M (1987) Plasma prolactin concentrations in lead exposed workers. J Environ Pathol Toxicol Oncol 7:13-16

Hanninen H, Mantere P, Hernberg S, Seppalainen AM, Koch B (1980) Subjective symptoms in low level exposure to lead. Neurotoxicology 1:333-347

Missale C, Battaini F, Govoni S, Castelletti L, Spano PF,Trabucchi M (1984) Chronic lead exposure differentially affects dopamine transport in rat striatum and nucleus accumbens. Toxicol 33:81-90

Moore MR, Mc Intosch MJ, Bushnell WR (1986) The neurotoxicology of lead. Neurotoxicology 7:541-556

Received May 5, 1988; accepted June 28, 1988.