

Effect of Lead on Serum Sialic Acids and Proteins Resistant to Perchloric Acid in Rats

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Industrial use of lead (Pb) and its hazardous effects on man have been well documented (Hunter 1978, Kehoe 1980). The diagnosis of the exposed workers is described in detail (Hernberg 1979, WHO (1980) which includes the tests like Pb in blood or urine, δ -ALA and coproporphyrin in urine, δ -ALA-D activity and zinc-protoporphyrin in blood mostly based on the effect of Pb on the hematopoietic system. In the present investigation an attempt has been made to explore its effects on non-hematopoietic factors i.e. total and perchloric acid (PCA)-soluble sialic acids and PCA-soluble proteins using rats in consideration of our study wherein we reported increased levels of serum sialic acid and various sialoglycoconjugates after intoxication to lead, zinc, cadmium, mercury or manganese (Patel et al 1989, 1991). The present study was carried out with 0.6 N serum PCA-fraction (0.4N PCA was used in the previous study) keeping in mind the solubility of serum glycoproteins (Winzler 1975).

MATERIALS AND METHODS

Healthy male albino rats, weighing around 370 g were used in the study and were fed ad libitum a staple diet and water. The animals were divided into two groups. The rats of the experimental group (N=5) received a 75% LD₅₀ dose of lead acetate (BDH, India) (LD₅₀, 150 mg/kg i.p. in rat) individually and those of control group (N=5) were administered normal saline at 1 ml/kg. The solutions were prepared in sterile distilled water. Blood was collected by cardiac puncture at 48 h of the metal treatment using ether anaesthesia. Serum was separated by keeping the blood samples initially at room temperature and then at 4°C both for the intervals of 20 min followed by a cold centrifugation at 500xg, 10 min. All samples were stored at -20°C till the analysis was performed. PCA-soluble fractions (0.6N) of the sera were prepared (Winzler 1975) by dropwise addition of 1 N PCA in cold and centrifuging at 3500xg for 15 min. Levels of sialic acids from sera and PCA fractions were estimated by the modified thiobarbituric acid assay (Skoza et al 1976) and PCA-soluble proteins with the folin phenol reagent (Lowry et al 1951).

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RESULTS AND DISCUSSION

Significantly raised levels of serum total and PCA-soluble sialic acids were observed in the Pb-treated group. The changes were more marked (increased by about two-fold) in the PCA-soluble sialic acid. The levels of serum PCA-soluble proteins were also found increased significantly, the change being 72% from the control.

Sialic acids are acyl derivatives of a parent acid, D-neuraminic acid which has not been found in biological material (Kent 1967). Their implication in a variety of surface related vital cell functions in various tissues is well documented (Olden et al 1982). The levels of various sialoglycoconjugates in blood/urine have been considered as an index of staging, prognosis and detection of early recurrence of cancer (Erbil 1985). Previous studies from this laboratory have shown that exposure to Pb and other heavy metals like Mn, Zn, Cd or Hg resulted in the elevation of serum sialic acids and various sialoglycoconjugates (Sarma et al 1985, Patel et al 1989 & 1991). Since those changes were suspected to be due to their effects on glycoproteins, we have used 0.6 N PCA as per the method of Winzler (Winzler 1975). In fact, 0.6 N PCA soluble sialoglycoproteins have been used as one of the parameters in sarcoma (Osinaga 1985). Seromucoid (mucoprotein), α_1 -glycoprotein, 3.5 S heptoglobin, β -globulin (MP₃ of Winzler), peptones and albumoses are resistant to PCA (Henry et al 1974). With the observed increase in the levels of serum PCA-soluble proteins and sialic acid in the present study, it seems that at least carbohydrate containing proteins are increased by Pb intoxication. It would be of greater interest to study the effect of Pb on carbohydrate containing proteins which are soluble in PCA, particularly sialic

Table 1. Changes in the levels of serum sialic acids and PCA-soluble proteins after acute exposure to Pb in Rats.

	Control group	Experimental group	Percentage change ^a
Total sialic acids	83.09±14.80	102.02±9.97 *	22.9
PCA-soluble sialic acids	3.90±0.38	10.95±0.67 ***	180.7
PCA-soluble proteins	198.80±19.26	341.94±37.76 ***	72.0

^a Percentage change of experimental from the control group has been calculated.

All values are Mean±SD (N=5) and are expressed as mg/100 ml.

Statistical significance evaluated by student's t-test.

* p < 0.05 *** p < 0.001

acid containing proteins like Seromucoid, α_1 -glycoprotein and 3.5 S haptoglobin and to determine the validity of this method in known cases of lead poisoning.

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