Influence of Pyridoxine (Vitamin B₆) on Lead Intoxication in Rats

Key words: Lead—Toxicity—Pyridoxine—Protection—Rats

Various studies have shown the important interrelationship between dietary nutrients and the toxicity of heavy metals. Antagonism or synergism may occur between lead (Pb) and nutritional factors at the sites of absorption or at the sites of effects. A diet low in protein, minerals and certain vitamins may not only enhance the circulating dose of Pb but may also reduce the general health status, particularly of children. Supplementation of vitamin B complexes has been shown to protect against toxic effects of Pb. However, the possible protective effects of various members of vitamin B complex on Pb intoxication have not been extensively studied. Supplementation of nicotinic acid and of thiamine has been shown to reduce Pb poisoning in experimental animals. In the present study, the influence of pyridoxine (vitamin B₆) on Pb intoxication was investigated in rats.

Twentyfour male albino rats (70±10 g) of ITRC colony housed in stainless steel cages maintained on standard pellet diet (MF: Hindustan Lever Ltd., India) and water ad-libitum were divided equally into 4 groups. The animals of all the groups were orally administered aqueous solutions (4 ml/kg body weight) of NaOOCCH₃ (pH 6.0), pyridoxine. HCl (pH 4.0) (Analytical Reagent, Biogen Chemicals, India) and Pb (OOCCH₃)₂. 3H₂O (pH 6.0) (Analytical grade, BDH, U.K.). The administration was performed through a gastric tube down the oesophagus daily for four weeks as follows.

Group 1—8 mg/kg of NaOOCCH₃ (Normal control).
Group 2—10 mg/kg of pyridoxine. HCl.
Group 3—10 mg/kg of Pb.
Group 4—10 mg/kg of Pb followed by 10 mg/kg of pyridoxine. HCl.

The animals in each group were kept in metabolic cages for 24 hr urine collection after the last administration. After urine collection, the animals were sacrificed by decapitation and the kidneys, liver and brain were removed: the blood was collected in heparinized vials. The tissues were cleaned free of extraneous materials and weighed.

Standard procedures were used to determine the activity of blood δ-amino-levulinic acid dehydratase (δ-ALAD), blood haemoglobin, haematocrit (PCV), zinc protoporphyrin (ZPP), and urinary δ-amino-levulinic acid (δ-ALA) and lead. The lead contents of the kidneys, liver, brain and of blood were estimated using atomic absorption spectrophotometer (Perkin Elmer 5000, U.S.A.) following digestion with HNO₃.
The exposure to Pb caused significant increases in the urinary excretion of Pb and δ-ALA. The mean urinary δ-ALA level for the animals treated with both Pb and pyridoxine was markedly lower than that for the group treated with only Pb, while the mean urinary excretion of Pb significantly increased more in the former (Table 1). The administration of Pb inhibited the activity of blood δ-ALAD, lowered the Hb level and PCV, while it enhanced the ZPP level. However, the simultaneous supplementation of pyridoxine significantly reduced the inhibition of δ-ALAD activity and enhancement of ZPP level (Table 2). The simultaneous supplementation of pyridoxine with Pb decreased the levels of Pb in the blood, kidneys and liver, while no effect on the level of Pb in the brain was observed (Table 3).

Inhibition in the activity of blood δ-ALAD, increase in the urinary excretion
of Pb and δ-ALA, increase in blood ZPP level, and decrease in blood Hb and PCV as observed in the present study are recognized as biological indicators of Pb intoxication.

Various vitamins have been shown to influence the Pb metabolism. Dietary supplementation with these vitamins often lessens the severity of Pb poisoning by inhibiting the Pb absorption or interaction at the macromolecular site of physiological action.\(^{13}\)

In the present study, pyridoxine (vitamin B\(_6\)) was found to be effective in reducing the levels of Pb in the blood, kidneys and liver and in reducing the Pb-induced alterations in the blood and urinary parameters in rats. The beneficial effects of pyridoxine might be due to the participation of the ring N atom in chelation of Pb or its interference with the absorption of Pb.

![Pyridoxine](image)

It may be suggested that toxic effects of Pb can be minimized by an adequate increase in the intake of pyridoxine (vitamin B\(_6\)).

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**REFERENCES**