

THE INFLUENCE OF MILK IN THE DIET ON THE RETENTION OF ORALLY-INGESTED  
LEAD IN THE RAT

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Individuals appear to differ in their susceptibility to lead toxication. There is increasing evidence that nutritional status and diet composition can influence lead absorption and its ultimate toxicity. The following studies were undertaken to investigate the influence of dietary milk on the tissue retention of orally-ingested lead. Three groups of male weanling rats were fed semi-purified diets based on soy protein, dehydrated whole milk or lactose hydrolysed milk (LH milk). All diets contained equal amounts of protein, fat, Ca, P, vitamin D and Fe and provided other nutrients in amounts necessary for the growing rat. Half of the animals in each diet group received 20  $\mu\text{g.g}^{-1}$  Pb as lead acetate in the diet. After 8 weeks standard tests for Pb toxicity, free erythrocyte protoporphyrin (FEP), erythrocyte  $\delta$ -aminolevulinic acid dehydratase activity (ALAD), urinary  $\delta$ -aminolevulinic acid (ALAU) excretion were performed and the Pb content of bone, tooth, brain, liver, kidney and blood was measured. The low levels of Pb supplementation significantly increased the Pb content of all tissues. However, the increase was greater in rats fed milk compared to those fed soy or LH milk (Table 1).

TABLE 1. Tissue lead concentrations

Diet	Femur Pb ( $\mu\text{g.g}^{-1}$ )		Kidney Pb ( $\mu\text{g.g}^{-1}$ )	
	-Pb	+Pb	-Pb	+Pb
Soy	0.36 $\pm$ 0.10*	32.72 $\pm$ 4.13 <sup>a</sup>	0.02 $\pm$ 0.02	1.76 $\pm$ 0.53 <sup>a</sup>
Milk	0.31 $\pm$ 0.15	44.78 $\pm$ 5.76 <sup>ab</sup>	0.03 $\pm$ 0.02	2.85 $\pm$ 0.34 <sup>ab</sup>
LH Milk	0.33 $\pm$ 0.12	28.94 $\pm$ 3.86 <sup>a</sup>	0.03 $\pm$ 0.02	1.86 $\pm$ 0.38 <sup>a</sup>

\* Mean  $\pm$  SD

a All +Pb groups are significantly greater than their corresponding unsupplemented groups,  $p < 0.001$

b Milk + Pb values are greater than soy + Pb or LH milk + Pb,  $p < 0.001$  for both femur and kidney

Lead supplementation did not increase ALAU or FEP but did decrease ALAD. These tests were not significantly different for the milk-fed group +Pb compared to the soy +Pb or the LH milk +Pb groups.

Since rats fed lactose containing milk +Pb accumulate more tissue Pb than other groups, a second experiment was conducted to determine if milk would influence tissue Pb if the milk and Pb were not consumed at the same time. Two groups of rats were fed 2 meals per day. Both groups received 5g soy-based diet containing 60  $\mu\text{g.g}^{-1}$  Pb in the morning. In the evening one group received soy-based diet without added Pb and the other received milk-based diet without added Pb. There was no difference in tissue Pb concentrations between the 2 groups, indicating that milk must be present in the gastrointestinal tract at the same time as Pb in order to have its effect.

These studies show that milk consumption increases tissue Pb concentrations in rats exposed to low concentrations of Pb. Lactose appears to be the factor in milk responsible for this increase. These studies indicate the need for further research on the interaction of diet and Pb toxicity in organisms exposed to chronic low levels of Pb.

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