

## Protective effect of tannic acid in mice receiving dietary lead

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**Summary.** Mice fed a diet containing both tannic acid and lead acetate showed increased weight gain and greater fecundity when compared with those on a diet containing lead acetate alone. The most significant improvement was provided by adding 2% tannic acid (wt/wt) to ground food containing 3% lead acetate. The affinity of tannic acid for heavy metals is suggested as a reason for this protective effect.

Tannic acid is a plant polyphenol found in many dietary plant materials such as grain sorghum<sup>2</sup>, coffee, tea and cocoa<sup>3</sup>. Its growth depressive effects have been attributed to a non-specific protein binding activity and it also possesses an affinity for heavy metals. We have found mice to be more tolerant to dietary tannic acid than are either rats or chickens with a concentration of 8% necessary to achieve growth depression<sup>4</sup>. Lead poisoning in adult humans is usually occupational due mainly to inhalation of lead dust or fumes but is common in children with a history of pica. Adult laboratory animals show a high degree of resistance to the central nervous system effects of inorganic lead<sup>5</sup> and thus the introduction of relatively high amounts in the diet is necessary in order to induce symptoms of lead poisoning.

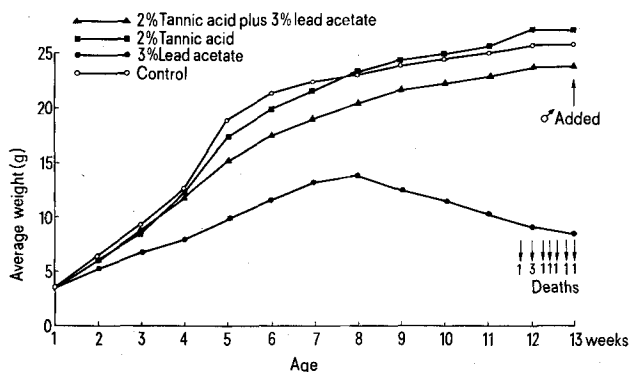
In each experiment female mice were fed either ground Purina lab chow or this (control) diet plus lead acetate, tannic acid or lead acetate with tannic acid. The table summarizes the experimental designs as well as the results obtained. In each experiment the tannic acid diet was administered at least 4 weeks before feeding of lead acetate began. A single proven male was introduced into each cage containing 2 or 3 females which had reached approximately 13 weeks of age. By this time, as can be visualized in the figure, the mice on the lead diets had succumbed and those on the other 3 diets had reached a plateau with respect to weight gain. The figure shows animal weight data collected from the experiment (exp. 3) which proved most successful in terms of animal growth and fecundity. Since each point on the graph represents the average of all females of that group weighed together, standard errors for each point could not be calculated. Visual inspection, however, would indicate that the 2 groups, control diet and tannic acid diet, were almost identical in weight gain and that the combination-diet

mice grew much more successfully than did those on lead alone. It would appear that administration of tannic acid in a lead-containing diet has an ameliorating effect in female mice. Both growth and reproductive capacity were improved when the concentration of each dietary additive was optimal. Tannic acid, at low levels, appears to have a beneficial effect upon the parameters measured here which is consistent with the findings of other workers<sup>6</sup>.

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Survival and fecundity of female mice fed diets containing tannic acid, lead acetate, or a combination of tannic acid with lead acetate

Treatment diet (on a wt/wt basis)	Survival during 140-day test period (days $\pm$ SE <sub>m</sub> )	Percent of maximum survival	No. offspring/ reproducing females (1st breeding cycle)
<b>Experiment 1</b> (8 mice/group)			
Control	140	(100)	75/7
2% tannic acid	140	(100)	92/8
5% lead acetate	67.5 $\pm$ 1.9	(48.2)	0/0
2% tannic acid plus 5% lead acetate	73.9 $\pm$ 2.9*	(52.8)	0/0
<b>Experiment 2</b> (6 mice/group)			
Control	140	(100)	80/6
5% tannic acid	140	(100)	67/6
5% lead acetate	55.8 $\pm$ 4.1	(39.9)	0/0
5% tannic acid plus 5% lead acetate	95.2 $\pm$ 6.0**	(68.0)	1/1
<b>Experiment 3</b> (9 mice/group)			
Control	140	(100)	73/8
2% tannic acid	140	(100)	104/9
3% lead acetate	86.0 $\pm$ 1.0	(61.4)	0/0
2% tannic acid plus 3% lead acetate	128.7 $\pm$ 3.9**	(91.9)	22/4



Growth curve of female mice in experiment 3 receiving either Purina laboratory chow (control diet) or control diet plus 2% tannic acid, 3% lead acetate or a combination of 2% tannic acid plus 3% lead acetate (wt/wt basis). Lead acetate feeding began 4 weeks after the tannic acid diet was started. Each point represents 9 mice except where deaths are indicated. At 13 weeks of age, adult male mice were introduced for breeding purposes.

Lead acetate feeding began 4 weeks after the tannic acid diet was started. Mean values are expressed  $\pm$  SE. Student's t-test. Survival of combination-diet mice differs significantly from mice on lead-containing diet. \* $p < 0.05$ ; \*\* $p < 0.001$ .