

METHIONINE AND SELENIUM TOXICITY IN RATS^{1,2}

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Reports from several laboratories (1-6) have generally agreed that selenium poisoning in animals is less severe on a ration with a high protein content than on one with a low protein content. Of the commercial proteins fed to rats along with selenium, crude casein and linseed meal were the only ones capable of preventing the characteristic liver lesions (7). Species differences were strikingly shown when dogs were used for experimental animals.

The responsible factor (or factors) in the protein that decreases the selenium toxicity is not known but recent work (8) showed that methionine was capable of alleviating selenium toxicity in yeast. This supported several other observations (9-10) wherein methionine gave protection against liver damage but the limited literature concerning selenium toxicity and methionine in rats presented conflicting data. Lewis, Schultz and Gortner (5) added methionine to a 6 per cent casein or a 15 per cent arachin diet (methionine deficient diets) containing selenium and found that it protected against the toxicity. Smith and Stohlman (3) using a 7 per cent protein seleniferous diet, not deficient in methionine failed to find a protective effect of methionine in experiments extending over a period of 4 months. This paper, although reporting preliminary work with mature rats confirms the conclusion of Smith and Stohlman.

Experimental

Eight female rats weighing from 210 to 300 gm. were placed in separate cages and given the following diets:

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Rats 1 and 2 received a control diet.

Rats 3 and 4 received a control diet plus 2 per cent methionine mixed in the diet.

Rats 5 and 6 received a seleniferous diet containing 19 parts per million of naturally occurring selenium.

Rats 7 and 8 received the toxic diet plus 2 per cent methionine mixed in the diet.

The control diet had the following composition:

	per cent	
Wheat	84.25	
Casein	10.00	
Salts	1.00	Phillip-Hart Mix.
Yeast	1.00	
Lard	3.00	
Cod liver oil	0.75	

The toxic diet had the same composition as the control diet except a naturally seleniferous wheat assaying 23 parts

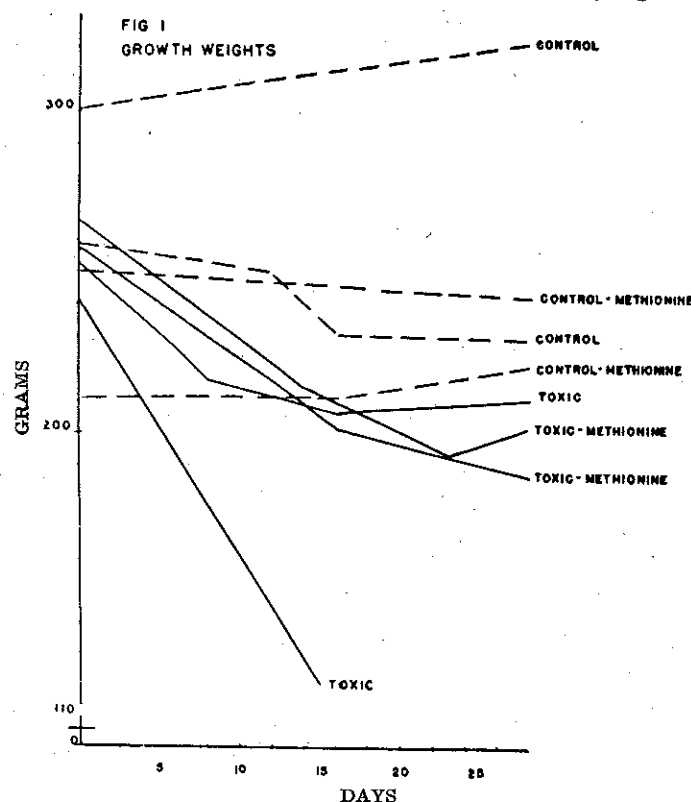


Fig. 1. Growth curve for rats on the Selenium-methionine Experiment.

per million of selenium was substituted for the control wheat. The methionine diets consisted of 2 gm. of DL-methionine added to 98 gm. of control or toxic diet. The diets were fed *ad. lib.* and daily measurements were made of the amount of food consumed per animal. Other measurements included the daily weight gain or loss and the total water consumption.

Results

The growth curves are shown in Figure 1. Clearly methionine does not, under these conditions, protect the rat against selenium toxicity or at least, the protection is not reflected in the growth curves. Analyses of the livers from one animal in each group showed a decrease from 8 ppm. of selenium in the selenium group to 3 ppm. in the selenium-methionine group. This is a significant guide and will be explored more fully in future work.

The average daily food and water consumptions for each rat are shown in Table I.

TABLE I
The average daily food and water consumption per rat

Group	Rat No.	Food Consumption (in gms.)	Water Consumption (in ml.)
Control	1	12.3	27.8
	2	8.4	20.5
Control and Methionine	3	7.5	29.5
	4	9.2	35.0
Selenium	5	0.0	18.8
	6	6.1	30.5
Selenium and Methionine	7	5.6	14.6
	8	7.8	19.0

The presence of methionine in the control diet apparently did not affect the food or water intakes significantly, nor did it change the lowered food consumptions commonly associated with the ingestion of a seleniferous diet.

Apparently the protection afforded by high protein diets does not depend on the methionine content of the protein above the needs of the body.

Summary

Preliminary experiments under the described conditions do not show a protective effect by methionine against selenium toxicity in rats.

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Addendum:

A duplicate of the above experiment using four rats (initial weight about 50 gm.) per group showed conflicting evidence. The experiment is being repeated at a lower dietary level of methionine for the 2 per cent level proved to be somewhat toxic for rats of this age.