NEGATIVE RELATION OF THE SELENIUM PROTECTIVE FACTOR AND THE ANTI-VITAMIN B_6 PRINCIPLE OF LINSEED OIL MEAL[1]

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In studies on chronic selenium poisoning with rats, it was considered desirable to determine whether the selenium protective agent in linseed oil meal (1) was related to the anti-vitamin B_6 principle of the meal (2, 3). It had previously been shown that linseed oil meal exerts a growth depressing effect upon chick growth even at low levels and that said effect can be reversed either by addition of a greater than optimum amount of vitamin B_6 to the diet or by treatment of the meal with water to inactivate the anti-vitamin B_6 principle (2, 3). Since vitamin B_6 is known to play an important role in several amino acid reactions, one of which is concerned with methionine detoxification (4), it appeared possible that linseed oil meal might be exerting protection against selenium poisoning through inhibition of some reaction involving Se-analogues of methionine.

The work undertaken involved study of the response of rats receiving seleniferous diets to a synthetic vitamin B_6 antagonist, to linseed oil meal plus added vitamin B_6 and to linseed oil meal which had been water-treated to inactivate the anti-vitamin B_6 principle.

EXPERIMENTAL

Young male albino rats (6 animals per group) of the Sprague-Dawley strain were fed the diets shown in Table I for a six week experimental period. The animals were housed in individual wire mesh cages and allowed feed and water **ab libitum.** The animals, which had mean average weights of 66 grams per animal at the onset of the experiment, were weighed biweekly. When deaths occurred during the experimental period, the animals' livers were excised, examined grossly, and weighed. At the termination of the experiment, all remaining animals were sacrificed by ether anesthesia and the livers were excised, examined, and weighed.

RESULTS AND DISCUSSION

The data (Table II), which compare growth, survival, relative liver weight, and liver damage among the groups, show no relation between the selenium protective factor and the anti-vitamin B_6 principle of linseed oil meal. The addition of the vitamin B_6 antagonist (desoxypyridoxine hyrochloride) to the diet to simulate linseed oil meal's anti-vitamin B_6

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characteristic did not prevent the selenium poisoning symptoms (compare results with diets II and IV). Also, addition of vitamin B_6 (pyridoxine hydrochloride) to the linseed oil meal diet failed to negate the selenium protective property of linseed oil meal (compare results with diets VI and VIII). Further, water treatment of linseed oil meal to inactivate the vitamin B_6 antagonist (diet IX) also had no tendency to decrease the selenium protective quality of the meal. Certain other noncritical differences in growth and liver weights are also evident, especially with the linseed oil meal and vitamin B_6 diets, but the observations are limited and no special significance is attributed to them.

TABLE I

DIETS EMPLOYED FOR STUDYING EFFECTS OF VITAMIN B_6 AND ANTI-VITAMIN B_6 ON CHRONIC SELENIUM POISONING

Ingredients	I	II	III	IV	V	VI	VII	VIII	IX
Corn	%	%	%	%	%	%	%	%	%
Toxic[1]		42.9		42.9		42.9		42.9	42.9
Non-toxic	85.0	42.1	85.0	42.1	72.6	29.7	72.6	29.7	29.7
Casein	7.9	7.9	7.9	7.9					
Linseed oil meal									
Untreated[2]					20.3	20.3	20.3	20.3	
Treated[3]									20.3
Yeast	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lard	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Salts (5)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Animal Protein factor[4]	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Anti-vitamin B_6 (desoxypyridoxine : HCl)			0.01	0.01					
Vitamin B_6 (pyridoxine : HCl)							0.01	0.01	
Vitamins A and D[5]									

[1]Toxic corn contained 23.3 p.p.m. of selenium. Diets II, IV, VI, VIII and IX were compounded to contain 10 p.p.m. of selenium.

[2]Linseed oil meal (untreated) was a petroleum ether extracted product which had not been heated.

[3]Treated linseed oil meal was prepared by mixing untreated meal with 3 parts of water (by weight) and then letting stand at room temperature for 24 hours after which the product was dried at room temperature by spreading thin and fanning. The dried product was ground before being used in the diet (2).

[4]Contained 12.5 mg. vitamin B_{12} and 2.0 grams procaine penicillin per pound.

[5]Diluted haliver oil: 2 drops per rat per week.

TABLE II

DATA WITH RATS ON THE POSSIBLE RELATION OF VITAMIN B_6 AND ANTI-VITAMIN B_6 TO THE SELENIUM PROTECTIVE AGENT OF LINSEED OIL MEAL

Diet Description	Growth and Survival Data		Liver Data	
	Mean weight gain of survivors	Percent survival	Mean weight per 100 g. body weight	Gross damage
	g.		g.	
I. Casein basal	258	100	4.8	None
II. Se-Casein basal[1]	134	17	2.9	Atrophy & mottling
Anti-vitamin B_6				
III. Casein basal + Anti-B_6	232	100	5.4	None
IV. Se-Casein basal + Anti-B_6	---	0	2.3	Atrophy & mottling
Linseed oil meal (LOM) and Vitamin B_6		100	5.1	None
V. LOM basal	198	100	5.7	None
VI. Se-LOM basal	144	100	5.1	None
VII. LOM basal + B_6	178	100	5.9	None
VIII. Se-LOM basal + B_6	188	100	6.0	None
Treated linseed oil meal				
IX.Se-LOM basal	174			

[1]All Se-diets contained 10 p.p.m. of selenium.

SUMMARY

A negative relation between the selenium protective factor and the anti-vitamin B_6 principle of linseed oil meal was obtained with rats using growth, survival, liver weight, and liver damage data as criteria.

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