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THE REPARATIVE EFFECT OF ANTABUSE (TETRAETHYLTHIURAM DISULFIDE) UPON DENTAL CHANGES IN VITAMIN E DEFICIENT RATS

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INTRODUCTION

AFTER it was found that vitamin E deficiency causes lack of pigmentation of the rat incisors, some investigators tried to find substances other than tocopherol which would restore pigmentation or prevent lack of pigmentation. Successful results have been obtained by adding nordihydroguaiaretic acid, manganese, and methylene blue to the vitamin E deficient diet.^{1, 3} Furthermore, Aaes-Jorgensen, Dam, and Granados¹ found that 0.025 per cent Antabuse (tetraethylthiuram disulfide) incorporated in a vitamin E deficient diet provided good protection against lack of pigmentation of the incisors.

This observation was confirmed using a different vitamin E deficient diet in the present series of experiments and was extended by a histologic examination of the enamel organ.

MATERIAL AND METHODS

This study is based on the gross anatomic and histologic examination of 20 white rats of the Wistar strain, 1 month of age. The animals were kept in individual cages and weighed every week.

The basal vitamin E deficient diet used was of the composition shown in Table I.

After 4 months on this diet the color of the upper incisors was recorded (3/8/51). Ten rats continued to receive the original diet for an additional 3 months (Group I). The remaining 10 rats received for the same period of 3 months 0.025 per cent Antabuse mixed into the experimental diet (Group II).

After 3 months, all the animals were sacrificed and the color of the upper incisors was recorded (6/16/51). The incisors were then decalcified, embedded in paraffin, sectioned, and stained with hematoxylin-eosin and van Gieson-Hansen's connective tissue stain.

FINDINGS

Weight.—The addition of Antabuse to the diet caused at first in all 10 rats a slight decrease in weight. However, after 4 weeks the Antabuse-treated rats gained more in weight than the rats given the basal diet.

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TABLE I
COMPOSITION OF THE BASAL DIET

Glucose	70	Vitamin mixture:	
Casein, purified	20	Choline HCl	1 Gm.
Salt mixture (McCormack No. 185)	4	Nicotinic acid	50 mg.
Groundnut oil and 1600 I.U.)	3	Thiamine HCl	10 mg.
Vitamin A and 150 I.U. and)		Riboflavin	10 mg.
Vitamin D)		Ca pantothenate	50 mg.
Vitamin mixture	2	Pyridoxine HCl	10 mg.
Succinylsulfathiazole	1	P-aminobenzoic acid	10 mg.
	100	Vitamin K	5 mg.
		Glucose to make	20 Gm.

Pigmentation.—Table II shows the changes in color of the incisors of the experimental rats. After 4 months on the vitamin E deficient diet all the rats, except one (No. 450), showed lack of pigmentation. The rats in Group I, continued on the original vitamin E deficient diet, exhibited after 3 more months an almost total lack of incisor pigmentation. When, however, Antabuse was added to the diet for 3 more months, the rats (Group II) showed complete restoration of the pigmentation of the incisors.

TABLE II
THE INFLUENCE OF VITAMIN E DEFICIENT DIETS WITH AND WITHOUT ADDITION OF ANTABUSE UPON THE COLOR AND HISTOLOGY OF THE UPPER RAT INCISOR

VITAMIN E DEFICIENT DIET				VITAMIN E DEFICIENT DIET PLUS 0.025% ANTABUSE			
NO.	COLOR OF THE UPPER INCISORS*		HISTOLOGIC SYMPTOMS OF VITAMIN E DEFICIENCY	NO.	COLOR OF THE UPPER INCISORS*		HISTOLOGIC SYMPTOMS OF VITAMIN E DEFICIENCY
	3/8/51	6/16/51			3/8/51	6/16/51	
432	3	2	+	434	6	10	-
433	3	3	+	438	3	9	-
435	2	2	+	439	4	9	-
436	2	3	+	440	3	10	-
437	3	1	+	441	4	10	-
442	5	3	+	446	6	10	-
443	7	1	+	447	4	10	-
444	6	3	+	448	6	10	-
445	4	1	+	449	5	10	-
450	10	2	+	451	9	10	-

*The color was graded after a scale where 10 represents the color of a normal upper incisor and 1 the complete lack of pigmentation.

Histology.—All the upper incisors from rats in Group I showed the changes typical for vitamin E deficiency⁵: damage of the capillary walls in the papillary layer, development of an edema in the papillary layer, and folding of the ameloblasts into the adjacent edematous connective tissue with formation of cysts. In contrast to this, none of the rats receiving Antabuse in the vitamin E deficient diet (Group II) showed any changes in their enamel organ.

DISCUSSION

From the present study and the report by Aaes-Jorgensen, Dam, and Granados, it appears that Antabuse restores the disturbances in pigmentation of the incisor in rats kept on a vitamin E deficient diet. Furthermore the

present histologic investigation indicated that the changes of the enamel organ typical for vitamin E deficiency are prevented by addition of Antabuse to the diet. In other words, Antabuse is able to replace vitamin E or tocopherol in preventing the changes of the rat incisor.

Rats kept on a vitamin E deficient diet containing highly unsaturated fatty acids develop a brown coloration of the adipose tissue which can be prevented by the addition of Antabuse to the diet. It has been shown that the changes of the enamel organ in vitamin E deficient rats are due to a preceding damage of the capillaries.⁵ The ability of Antabuse to counteract a damaging effect upon the capillaries in rats has not previously been reported. However, in vitamin E deficient chicks, Antabuse affords a partial protection against an exudative diathesis due to increased capillary permeability.²

The mechanism by which Antabuse imitates the action of α -tocopherol is not clear. However, it is known that Antabuse has, similar to vitamin E, an antioxidant property. It is interesting that Antabuse, which is used as a drug producing hypersensitivity to alcohol,⁴ is able to prevent some of the clinical and histologic symptoms of vitamin E deficiency.

SUMMARY

The present study is based on the anatomic and histologic examination of 20 rats. One-month-old rats were kept on a vitamin E deficient diet for a period of 3 months. Ten of the rats then received 0.025 per cent Antabuse in addition to the experimental diet for a period of 4 months, while the other 10 were continued on the experimental diet alone.

The rats receiving the vitamin E deficient diet showed lack of pigmentation and typical histologic changes in the enamel organ. Rats receiving Antabuse added to vitamin E deficient diet did not show any changes in the incisors.

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