

TABLE II.

Age in years	No.	Systolic mm. Hg.	Diastolic mm. Hg.
6-19	30	14.2	13.4
20-39	141	16.4	16.2
40-	34	15.2	13.1
	(From Hines and Brown)		
0-20	89	13.4	12.3
20-40	201	12.9	11.8
40-	98	19.6	18.4

age response to cold in patients 40 or more years of age in the series of Hines and Brown is greater than the average of their younger age groups, and that there is no significant difference in the present series.

It must be emphasized that the number of reported cases of non-hypertensive individuals studied with the cold water test is too small for any conclusion. The findings of the present study indicate that non-hypertensive older persons are as likely to give "excessive" responses to the test as non-hypertensive younger persons. This suggests that as many of the younger subjects with normal responses may develop hypertension as those with "excessive" responses. If this be true the original contentions of Hines and Brown would be invalidated.

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Limitation of Fluorine Toxicosis in the Rat with Aluminum Chloride.*

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Fluorine fed in low concentration has been shown to cause defective teeth in guinea pigs, rats, dogs, and cattle. In higher concentrations it causes inferior reproduction, poor bones and inferior growth or death.¹ Recently it has been shown that mottled enamel of human teeth is caused by the toxic action of fluorides present in drinking water.²

* Read before the American Institute of Nutrition, Washington, D. C., March 25, 1936.

¹ McClure, F. J., *Physiol. Rev.*, 1933, **13**, 277.

² Smith, M. C., Lantz, E. L., and Smith, H. V., *Arizona Agr. Exp. Sta. Tech. Bull.*, 1931, **32**.

This is a report of some work done in the search for a substance that would limit the toxic action of fluorine. Salts of lanthanum, cerium, thorium, and boron, which form insoluble or complex fluorides were found to give either no protection or, as in the case of lanthanum, only slight protection. Aluminum chloride was found to inhibit to a large extent the toxic effect of fluorine.

The basal diet used was as follows: yellow corn meal 30.0 parts, ground whole wheat 30.0 parts, whole milk powder 30.0 parts, linseed meal 5.0 parts, alfalfa meal 3.0 parts, and wheat germ 1.0 part.

Fluorine was added to this diet as a solution of sodium fluoride. Aluminum chloride was also added in solution. When both were added the solutions were combined.

Sodium fluoride was fed in 2 concentrations, 0.025 and 0.1% of the diet. Aluminum chloride was fed in concentrations of 0.5% and 2.0%, which is equivalent to 0.056 and 0.224% aluminum respectively.

Effect upon Growth. Sodium fluoride fed at a level of 0.025% of the diet had no effect on the rate of growth. Animals fed the diet containing 0.1% sodium fluoride grew at approximately two-thirds the normal rate. By adding 0.056% aluminum to the diet as the chloride, normal growth was obtained.

Since it has been shown that calcium fluoride is less toxic to growth than sodium fluoride³ the effect of calcium salts added in place of the aluminum was also studied. Calcium was added as calcium carbonate, and as calcium chloride. One percent calcium carbonate gave some protection and 2% caused normal growth. The addition of 1% calcium chloride caused a lower rate of growth than that obtained from sodium fluoride alone.

Effect upon Incisors. The most delicate evidence of fluorine toxicosis in rats is its effect upon the incisors.³ The surface of the incisors of rats fed a diet containing 0.025% sodium fluoride appeared dull and white, the lowers had a tendency to wear excessively, and allow the uppers to overgrow. The incisors of rats fed the same diet containing 0.5% aluminum chloride appeared normal for 5 to 6 weeks, when the uppers began to bleach and the lowers showed orange and white bands which could be distinguished with the naked eye. With 2.0% aluminum chloride they appeared normal to the naked eye (Fig. 1) (observed 6 mos.), but when examined with a hand lens, fine alternate dark and light pigment lines could be seen.

³ Smith, M. C., and Leverton, R. M., *Ind. and Eng. Chem.*, 1934, **26**, 791.

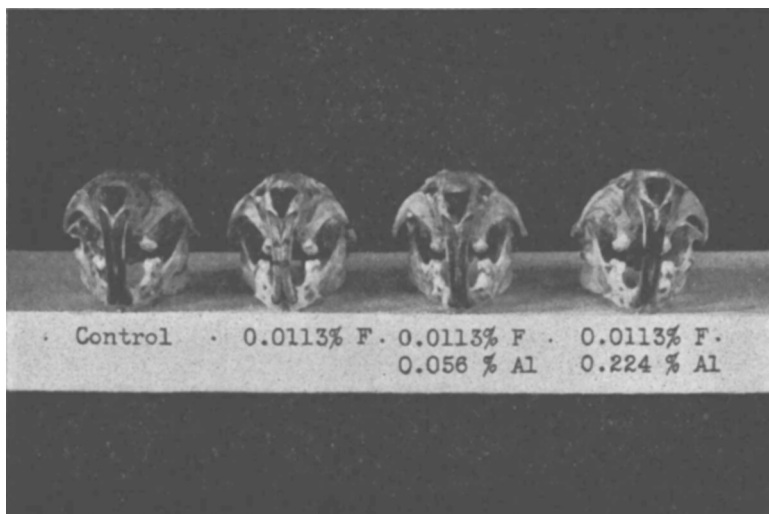


FIG. 1.

Showing toxic effect of fluorine on incisors and prevention by aluminum.

Rats fed the diet containing 0.1% sodium fluoride had incisors with a rough and often pitted surface, and sections of the enamel were often chipped off. Rats fed this diet with 0.5% aluminum chloride had incisors with a smooth surface but they were bleached and the lowers wore down rapidly. Two percent aluminum chloride produced incisors with a smooth pale yellow surface which sometimes showed broad white and yellow bands. Two percent calcium carbonate gave no significant protection to the incisors. However, 2.0% calcium carbonate and 2.0% aluminum chloride produced incisors which appeared nearly normal to the naked eye. With a hand lens fine orange and white bands could be seen.

Since aluminum is not absorbed by the rat, it is assumed that this protective action must take place in the intestinal tract, probably by the formation of an aluminum and fluorine containing compound which is very slightly dissociated.

Experiments are in progress using smaller concentrations of fluorine and also studies using other aluminum salts.†

† Dr. E. K. Nelson, Iowa State College, Ames, Iowa, has obtained similar results with aluminum sulphate. (Private communication.)