U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Public Health Service

Health Resources Administration

Refer: PPB-67
June 1974

FLUORIDE: AN ESSENTIAL MINERAL NUTRIENT

The essentiality of fluoride as a mineral nutrient has been re-emphasized and confirmed in statements by competent authorities and in reports of recent research as indicated below:

1. Food and Nutrition Board, National Research Council, National Academy of Sciences
2. United States Food and Drug Administration
3. Dartmouth Medical School
4. Department of Biochemistry, University of Minnesota
5. Laboratory of Experimental Metabolic Diseases, Veterans Administration Hospital, Long Beach, California and Department of Biological Chemistry, School of Medicine, University of California, Los Angeles

Specific information on the statements and research is contained in the enclosure.

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CENTER FOR DISEASE CONTROL
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Atlanta, Georgia 30333

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1. NATIONAL ACADEMY OF SCIENCES:

Recommended Dietary Allowances, pages 98-9, 126, Food and Nutrition Board, National Research Council, National Academy of Sciences, Washington, D.C., 1974.

> "Fluoride is present in small but widely varying concentrations in practically all soils, water supplies, plants, and animals. It is therefore a constituent of all normal diets. Fluoride is incorporated in the structure of the teeth and is required for maximal resistance to dental caries (Sognnaes, 1965; Bernstein et al., 1966). Because of the ubiquity of this element, a fluoride deficiency severe enough to result in growth depression is very difficult to produce. Growth stimulation by fluoride in rats fed low-F diets has been observed in some, but not all, experiments (Muhler, 1970). More recently, growth effects have been consistently observed in rats raised in an isolated environment and fed diets containing less than 0.5 µg/kg fluorine. The addition of 2.5 µg/g of diet gave optimal results (Schwarz and Milne, 1972). Fluorine can therefore be considered an essential element. The requirement of fluoride for optimal dental health in man is easier to demonstrate and is well-documented. Its protective effect is particularly evident during infancy and early childhood, but persists through adult life (Gedalia et al., 1966). Some studies have suggested a possible function of fluoride in the maintenance of bone structure (British Ministry of Health, 1962), but further investigation of this point is required. The value of fluoride in the treatment of osteoporosis and Paget's disease is still under investigation (Stevenson and Watson, 1960; Rich and Ensinck, 1961; Purves, 1962; Gedalia et al., 1966; De Gubareff and Platt, 1969).
>
> The daily intake in the diet, exclusive of that from drinking water, varies from 0.3 mg in low-fluoride areas to 3.1 mg in high-fluoride areas (Muhler, 1970). Most animal products provide about 1 µg/g, whereas small fish that are consumed with the bones provide more fluoride. Tea is also a good source of the element. It is

evident that the daily fluoride intake in many areas of the United States is not sufficient to afford optimal protection against dental caries. Standardization of water supplies by addition of fluoride to bring the concentration to 1 mg/liter has proved to be a safe, economical, and efficient way to reduce the incidence of tooth decay - a very important nutritional public health measure in areas where natural water supplies contain less than this amount.

Concentration of fluoride in public water supplies should be adjusted to allow for differences in water consumption with seasonal temperature changes. The range of safety in fluoride intake is wide enough to accommodate normal fluctuations in the fluoride content of foods without risk of inducing that first identifiable indication of an excess - slight mottling of the enamel (FNB, 1953; Waldbott, 1963).

Fluorine, like other trace elements, is toxic when consumed in excessive amounts. However, the daily intakes required to produce symptoms of chronic toxicity after years of consumption are 20-80 mg or more, far in excess of the average intake in the United States. Mottling of the teeth in children has been observed at fluoride concentrations in diet and drinking water of 2-8 parts per million (BEAP, 1971).

Extensive medical and public health studies have clearly demonstrated the safety and nutritional advantages that result from fluoridation of the water supply (AAP, 1972). In communities where fluoridation has been introduced, the incidence of tooth decay in children has been decreased by 50 percent or more. The Food and Nutrition Board recommends fluoridation of public water supplies where it is needed because of low natural fluoride levels."

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References

AAP (American Academy of Pediatrics, Committee on Nutrition). 1972. Fluoride as a nutrient. Pediatrics 49:456-460.

BEAP (Committee on Biologic Effects of Atmospheric Pollutants, National Research Council). 1971. Fluorides. National Academy of Sciences, Washington, D.C., 295 pp.

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Sognnaes, R. F. 1965. Fluoride protection of bones and teeth. Science 150:989-993.

Stevenson, C. A., and A. R. Watson. 1960. Roentgenologic findings in fluoride osteosclerosis. Summary of a report. Arch. Ind. Health 21:340.

Waldbott, G. L. 1963. Fluoride in food. Amer. J. Clin. Nutr. 12:455-462.

2. UNITED STATES FOOD AND DRUG ADMINISTRATION:

U.S. Federal Register 38:20713, No. 148, August 2, 1973, Superintendent of Documents, Government Printing Office, Washington, D.C., (FDA Regulation 125.1, para. (c)).

The findings of fact published by the United States Food and Drug Administration in the Federal Register of August 2, 1973, relative to nutritional labeling of food and dietary supplements identify fluorine as an essential nutrient as follows:

> "12. The essential mineral nutrients are: Calcium, chlorine, iron, magnesium, phosphorus, potassium, sodium, sulfur, copper, fluorine, iodine, manganese, and zinc."

3. DARTMOUTH MEDICAL SCHOOL:

Excerpts from letter to Senator Hart from Henry A. Schroeder, M.D., Professor of Physiology Emeritus, Dartmouth Medical School, Brattleboro, Vermont, May 25, 1973, as printed on pages 201 and 202 of "Safe Drinking Water Act of 1973, Hearing before the Subcommittee on Environment of the Committee on Commerce, United States Senate, Ninety-Third Congress," May 31, 1973.

> ". . . I am sending you a summary of our experience in feeding low doses of some 35 trace elements to rats and mice for life.
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> . . .
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> "In no way are these data to be construed as recommending actual limits. They merely show which elements showed recondite toxicity in small mammals in the doses given and which did not, as far as could be ascertained.
>
> . . .
>
> "Standards for the Essential elements, except selenium, which is toxic, are unimportant and can be based on other characteristics (taste, color, staining of enamel) than toxicity.
>
> . . .

"TABLE 58. - INCREMENT OF BULK AND TRACE ELEMENTS IN WATER TO TOTAL DAILY DIETARY INTAKES

Elements	Water		Food (milligrams per day)	Percent from water	
	Median (milligrams per day)	Maximum[1] (milligrams per day)		Median	Maximum
Essential:					
		. . .			
Fluorine	0.4	1.0	1.8	22.2	55.5
		. . .			

[1]Maximum value for 87-98 percent of cities. Individual values can be much higher in very hard water areas.

. . .

"TABLE - TOXIC AND NONTOXIC LEVELS OF TRACE ELEMENTS IN DRINKING WATER, LIFE-TERM EXPOSURES TO RATS AND MICE IN METAL-FREE LABORATORY, AND PRINCIPAL SIGN OF TOXICITY

Element	Dose (parts per million)	Rats	Mice
	. . .		
Nontoxic:			
	. . .		
Fluorine	10	Not done	No effect. Essential. Growth enhanced, females.
	. . .		

Note. - These results were on life-term exposures of 54 male and 54 female mice, and 52 male and 52 female rats, to element in drinking water, each group being compared to litter mate controls of the same number. They represent 13 yr. experience. The data show the levels found toxic or inert. Sections were made of tissues and analyses for trace elements. Only 3 were carcinogenic: selenate (strongly), rhodium (weakly), and palladium (weakly). Many of the toxic ones accumulated in tissues: titanium, germanium, arsenic, selenium, zirconium, niobium, molybdenum, cadmium, tin, antimony, methyl mercury, lead: analyses are incomplete for barium, beryllium, boron, aluminum, tungsten."

4. DEPARTMENT OF BIOCHEMISTRY, UNIVERSITY OF MINNESOTA:

"Influence of Fluoride Intake on Reproduction in Mice," H. H. Messer, W. D. Armstrong, and L. Singer, Department of Biochemistry (Health Sciences), University of Minnesota, Journal of Nutrition 103:1319-26, September 1973.

> "Female mice maintained on a low fluoride diet developed signs of fluorine deficiency, with a progressive development of infertility in two successive generations." The authors have indicated that their study demonstrated that "fluorine satisfies the major criteria for an essential trace element."

5. LABORATORY OF EXPERIMENTAL METABOLIC DISEASES:

"Fluorine Requirement for Growth in the Rat," Klaus Schwarz and David B. Milne, Laboratory of Experimental Metabolic Diseases, Veterans Administration Hospital, Long Beach, California, and Department of Biological Chemistry, School of Medicine, University of California at Los Angeles, Bioinorganic Chemistry 1:331-38, 1972.

> "The data show that fluorine is required for growth of rats on highly purified amino acid diets containing very low levels of the element.
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> . . .
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> "The metabolism of fluorine in mammals presents several features which support the concept that it is essential.
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> . . .
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> "While fluorine previously has been defined as essential only in the light of its effects on human dental caries and in the maintenance of a normal skeleton, our data show that it is essential for growth and overall development."