

ASSESSMENT OF THE FLUORIDE CONTENT OF WEANING FOOD ITEMS IN WESTERN UGANDA.

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SUMMARY: The fluoride intake through weaning food was assessed with reference to the Kasese district in Western Uganda. Thirty one mothers with children less than five years of age participated in the study and provided food samples. The fluoride content of the food items on dry basis weigh basis varied from 1.8 mg F/kg to 24 mg F/kg with a median of 2.7 mg F/kg. The highest concentrations were found in millet and sorghum. As these cereals are part of the standard diet, it is discussed that staple weaning food may contribute considerably to the total fluoride load in toddlers in the Kasese district. The findings are in agreement with the fact that fluorosis may be prevalent in areas of low fluoride content in the water.

Key words: Fluoride; Weaning; Food, Fluorosis, Western Uganda, Millet, Sorghum.

INTRODUCTION

An excessive intake of fluoride during early childhood may cause damage to the formation and calcification of teeth; resulting in dental fluorosis. Dental fluorosis is endemic in the African Rift Valley, including certain areas of Uganda.¹ In areas with high fluoride content in the drinking water, water is considered to be the main source of ingested fluoride.² Other ingredients of the diet may, however, contribute to the total daily fluoride intake, and need to be investigated.³ The present study was made to assess the fluoride content of staple weaning foods in the Kasese district of Western Uganda, an area known for high prevalence of dental fluorosis in areas of both low (0.6 mg/L) and high (2-3 mg/L) water fluoride levels.¹ The weaning food is defined as that food consumed by children during the period the child is introduced to foods other than breast milk.⁴

MATERIALS AND METHODS

In collaboration with local community health workers, 31 homes were randomly selected for the investigation. The basis for inclusion was the presence of at least one child below the age of five. The mothers (age 18 to 42), who were interviewed following a standard questionnaire, provided samples of the weaning food used in the household, as well as samples of drinking water.

The mothers also provided the investigators with an estimate of the average amount of food a child ate or drank at a meal. The estimates were measured using a top balance scale for solids and a measuring cylinder for liquids.

The food items were sun-dried and brought to University of Bergen, Norway for analysis. Fluoride analyses were performed by use of a combined fluoride electrode (Orion 96 09 00) connected to an Orion 920A ISE Meter. An ashing method described by Malde *et al*⁵ was used to assay the fluoride in the food items.

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RESULTS

Water. The fluoride concentration of 13 samples ranged from 0.2 mg/L to 0.7 mg/L. The mean value was calculated as 0.4 mg/L (s.d = 0.17).

Weaning period. Weaning of Kasese children started on an average at 4 months of age (range 1-6) and lasted until the children were 22 months (range 8 - 40).

Weaning food. The food samples obtained from the mothers consisted of cereals, legumes, bananas, roots (tubers), and leafy vegetables. The food items that were more commonly mentioned in the interviews are given in Table 1.

The fluoride content of the food ranged from 1.8 mg/kg to 24 mg/kg dry weight (d.w.) cf. Table 2. The median concentration was 2.7 mg/kg. Lowest value of 1.8 mg/kg was found in legumes (beans and groundnuts) and highest of 24 mg/kg was found in the cereal millet. Based on the estimates given by the mothers, the fluoride content of the average child's daily food intake was calculated for the various age groups- as shown in Table 3.

TABLE 1. Food type mentioned as the principal food to which a child was weaned.

Food	Number of children*
Millet	23
Banana	15
Roots (tubers)	7
Others**	12

* A child can be weaned to more than one food type.

** Some food types were mentioned only once, this is a total of all those mentioned less than 5 times.

TABLE 2. Mean fluoride concentrations from food groups.

Food Group	Number of Samples	Mean F conc mg/kg (d.w.)	Standard deviation
Legumes	11	1.8	0.4
Banana	4	2.1	0.5
Leafy vegetables	5	2.7	0.6
Roots/Tubers:	6	1.9	0.4
	2	2.0	0.5
	2	2.3	0.3
Cereal*: Sorghum	1	5.6	
Millet	1	24.0	

* Samples were measured in duplicate to obtain the result with standard deviations of: millet = 1.5, Sorghum = 6.1.

TABLE 3. Theoretical children intakes of fluoride though porridge based on Sorghum or millet containing respectively 5.6 and 24 mg F/kg. It is assumed that the porridge is prepared by using of 250 g dry weight /L.

Age (months)	N	Average consumption (mL/day) ¹	Sorghum ² 5.6 mg F/kg	Millet ² 24 mg F/kg	Upper ³ limit fluoride intake (mg F/day)
<6	13	600	0.84	3.6	0.33
7- 12	17	900	1.26	5.4	0.40
13 - 36	48	900	1.26	5.4	0.65

¹Estimates made by mothers

²250 g of flour are used to prepare 1 L of porridge

³Upper limit based on Calorie needs and recommended intake of 0.05 mg per 100 kcal.⁶

DISCUSSION

The average fluoride concentration of the water samples from the 31 households was 0.4 mg/L (range 0.2 - 0.7). According to accepted standards an upper level of 0.7 mg/L is recommended for tropical countries.⁷ We should, consequently, expect to see little or no dental fluorosis in this population. However, a recent study by Rwenyonyi *et al*⁸ found a dental fluorosis prevalence of 25 % in low-water-fluoride areas (0.5 mg F/L) in the Kasese district. A previous study by Møller *et al*¹ reported even higher prevalence of dental fluorosis (72.7 %) at a water fluoride level of 0.6 mg/L in the same area. The high prevalence of dental fluorosis in these low fluoride areas seems to indicate the presence of alternative fluoride sources perhaps present in the diet.

The weaning food in rural Africa comprises of locally available products. Thus, it is the traditional staple food that is made into weaning food.⁹ Analyses have shown that *commercially available* weaning foods may substantially add to the fluoride load of infants and toddlers.^{10,11} There is, however, very little work done previously focusing on unprocessed foods (such as these used in Kasese) as to their possible role as a source of fluoride in the diet of infants and toddlers.

The median fluoride concentration found in Kasese, 2.7 mg F/kg), is well above what is considered *low* (0.1-2.5 mg F/kg) and above what is reportedly the level found in unprocessed foods.⁶ The Kasese weaning foods may, consequently, contribute considerably to the total fluoride intake in children, especially where sorghum and millet are used. The influence of nutritional fluoride may start early, as the mean age for weaning of children of the Kasese district is 4 months.

The bio-availability and amount of daily intake of fluoride from the relevant food items needs to be further examined. Further studies should also be done to assess the possible contribution of tea and trona in areas with endemic dental fluorosis.

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