

Fluoride Intake, Diet and Health Status of Children Residing in Low Endemic Fluoride Afflicted Areas of Chittoor District

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Abstract: *The fluoride (F) intake, diet, and health status of children in the dental fluorosis-afflicted areas in chittoor district were studied in an attempt to correlate nutritional status with dental fluorosis. The relationship between dietary consumption and the incidence of dental fluorosis among the children was stressed in this study. Average body weight of the children approximated that of the national standard and average height was outlying the standards. Protein intake was above the national standard of 0.75 g/kg body weight/day, but the protein was derived mainly from plant sources. Calcium intake was found to be insufficient. Based on the diet and fluoride intake of the studied groups, the areas with a poor nutritional status were found to have a higher incidence of dental fluorosis. The incidence among nutritious diet consuming children was lower than that of nutrient deficit diet consuming children.*

Keywords: Dental fluorosis; Nutrition survey; Calcium; Protein; Health status.

1. Introduction

Defluoridation of drinking water alone shall not bring the fluoride level to a safe limit. It would be necessary to overcome the toxic effects of the fluoride ingested in to the body through other sources. This can be done by accepting minor changes in the diet and dietary habits of the population compatible with their social system and available resources.

Considering the various studies conducted related to nutrition and their contribution to fluorosis, the following conclusions were drawn:

- 1) The observations indicated that food fluoride plays a vital role in causation of Dental fluorosis even in areas with low fluoride in drinking water. Whereas it has substantial role in causing clinical and skeletal fluorosis where drinking water fluoride is playing its major role.
- 2) Simple restriction of dietary fluoride in areas with less fluoride concentration in drinking water will prevent people from developing the dental fluorosis.
- 3) In areas with high fluoride concentration in drinking water, restriction of dietary fluoride has to be supplemented with defluoridation of drinking water along with the Calcium and Vitamin-C rich diet.

2. Review of Literature

An interest in the importance of fluorine in nutrition was created by the discovery of high incidence of chronic endemic fluorosis in man and farm animals in 1931 in certain parts of India (Short et al., 1937). The plane of nutrition appeared to play a crucial role in deciding the susceptibility of a person chronically exposed to excessive intakes of fluoride to its toxic effects. Epidemiological studies in India by Pandit et al., (1940) and in Japan by

Takamori (1955) suggested that the incidence and severity of fluorosis are related to the economic and nutritional status of the community. Such an association was confirmed by subsequent investigators from India and elsewhere.

Venkateswara Rao and Mahajan (1990) established the recommended level of fluoride in India to be about 0.5 mg/l as many foods grown in India contain appreciably higher concentration of fluoride. Food fluoride content is an entity which should not be overlooked. In food the fluoride is present in organically bound form and inorganic form in liquid form of foods. Levy et al., (1995) considered that the essential remedial measure to combat fluorosis is withdrawal of fluoride through the various avenues (food, water, cosmetics and drugs) and intake of essential nutrients like Calcium, Iron, Folic acid, Vitamin-C, D, E and other antioxidants (Jackson et al., 2002). Role of diet on fluorosis has a double sword action. Intake of high fluoride diet increases the toxic manifestations of fluorosis, whereas intake of diet rich in calcium and vitamin-C helps in overcoming the toxicity of fluorosis (Susheela and Bhatnagar, 2002).

Presence of calcium, protein and vitamin-C in food has preventive role in fluorosis. A study conducted in fluoride endemic villages of Dharward district by Pushpa et al., (2003) showed that the intake of protein and calcium adequacy are the important factors in determining the severity of disease.

3. Materials and Methods

A dietary survey was conducted as described by Swaminathan, (2002). Dietary survey was carried by using 24-hour recall method along with food frequency questionnaire for a period of 15 days. The calculated daily nutrient intake of Energy, Protein, and Fat, Calcium, Iron and Ascorbic acid were then compared against

Recommended Dietary Allowances for Indians and expressed as per cent of RDA (ICMR, 2007). The fluoride analysis of the foods and water consumed in 24 hrs was done in an attempt to estimate the exact fluoride intake levels of the target group.

To assess the health and nutritional status anthropometric assessment was done. Height was measured with an anthropometric rod. The height was expressed in centimetres and recorded to an accuracy of 0.1 cm. Body weight is the most widely used and the simplest reproducible anthropometric measurement for the evaluation of nutritional status. Weight was measured using level beam balance. The weight was recorded avoiding parallax error. The observed heights and weights of the children were compared with the heights and weights of their well to do counterparts.

4. Results and Discussion

4.1. Dietary profile

The macro nutrient intake of the subjects assessed includes carbohydrate, proteins and fat. The major functions of these nutrients are by and large supply of energy, growth and developmental processes. Age and sex wise nutrient intakes of the children are presented in fig:1 &2. The diets of the children were predominantly deficit in Calcium and Vitamin-C content which are essential nutrients that aid in mitigating fluorosis.

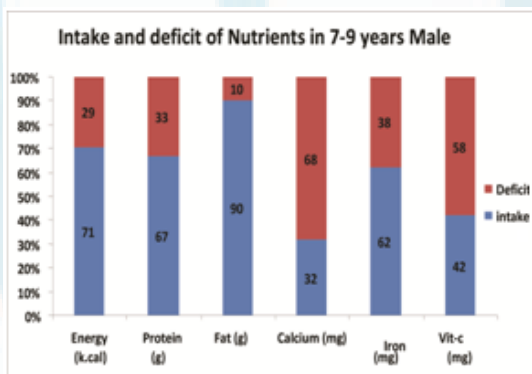


Figure 1: Show the mean intake and deficit of nutrients in 7-9 years male

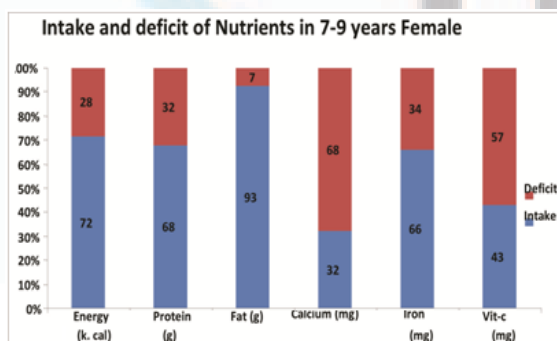


Figure 2: Show the mean intake and deficit of nutrients in 7-9 years female

4.2 Total fluoride intake through food and water

The total fluoride intake through food and water was calculated for three different days in a week and average was taken. The age and gender wise average total fluoride intake results of the children per day through food and water (ppm) are shown in table: 1.

Table 1: Quantity of fluoride intake by the children through food and water per day

Age group	Gender	Average Fluoride intake from Food (ppm)	Average Fluoride intake from water (ppm)	Average Total Fluoride intake (ppm)
7 - 9 Years	Male	3.028	2.471	5.4991
	Female	3.148	2.489	5.6214
	Total	3.091	2.480	5.5628

4.3 Anthropometric Profile

Table 2: Mean height of Boys and Girls as per age compared against NCHS standards

Age (yrs)	Height (cms)	NCHS Std. (Boys)	Height (cms)	NCHS Std. (Girls)
	S.D (Boys)		S.D (Girls)	
7	111.8 ± 2.45	121.5	110.5 ± 2.85	121.5
8	118.7 ± 2.00	127.5	119.1 ± 1.78	127.5
9	122.8 ± 1.49	133.5	121.1 ± 1.50	133.0

The variation in mean and standard height as seen in table: 2 possibly may be due to under nutrition and poor nutritional status of particular nutrients like protein and calcium that aid in body growth and development. Several researchers (Hays and Swenson, 1985) have shown that dietary and environmental constraints are the major determinants of growth disparities between children from fluorotic and non-fluorotic areas. This is because Fluorine is an enzyme inhibitor and when this happens in odontoblasts and osteoblasts, teeth and bone deformities occur. Exostoses of the jaw and long bones develop and the joints become thickened and ankylosed resulting in lameness. This could further result in reduction in food consumption accompanied by reduced height or weight loss

Table 3: Mean weight of Boys and Girls as per age compared against NCHS standards

Age (yrs)	Weight(kgs)	NCHS Std. (Boys)	Weight(kgs)	NCHS Std. (Girls)
	S.D (Boys)		S.D (Girls)	
7	18.4 ± 0.92	23	17.8 ± 0.88	22.5
8	19.3 ± 1.29	25.5	18.6 ± 0.85	25.0
9	20.3 ± 1.7	28.5	20.5 ± 0.79	29.0

The weight of the children from 7-9 years boys and girls is compared against NCHS reference standards in table: 3. To determine whether an adult's weight is appropriate for height, the individual is usually compared with a reference standard. The mean weight for each of the corresponding ages for the children was lower than the values of NCHS. The deficits in weights ranged from 20 to 40 per cent.

These findings clearly reflect the adverse effects of environmental, economical & educational “3e’s” constraints on growth status of the children in the present study. The stability of access to food (e.g.: stable income) is important in terms of food security. The deficit in height and weight observed in the present study indicate the environmental factors, low or inadequate food consumption and consequent poor nutritional status often operating in combination may be responsible for the sub-optimal growth performance among the low socio-economic sections of the children. Educational levels and cultural values also play a role in shaping food habits and frequency consumption patterns. The degree of efficiency with which the body utilizes the food consumed is a key to determine the nutritional status. That efficiency is generally affected by poor health condition and reduced significantly by specific diseases (Infections, intestinal, parasites, diarrhoea etc.,

5. Conclusion

Guidance is particularly needed because fluoride is found in all natural waters at some concentration. Low concentrations are good for teeth, but excessive concentrations can lead to debilitating disease, such as fluorosis, which has devastated some communities. This suffering caused by high levels of fluoride can be prevented through diet. It is important that local authorities consider the causes of fluorosis carefully and choose the best and most appropriate means of dealing with excess fluoride exposure taking into account the local conditions and sensitivities. Thus, the study indicated that fluorosis can be reversed, at least in children, by a therapeutic regimen without any side effects.

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