

# Dental Fluorosis Prevalence among Children in Endemic Fluoride Areas of Chittoor District

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**Abstract:** Fluorosis is the result of fluoride rearranging the crystalline structure of a tooth's enamel as it is still growing. It is evidence of fluoride's potency and ability to cause physiologic changes within the body and raises concerns about similar damage that may be occurring in the bones. Fluoride causes dental fluorosis by damaging the enamel-forming cells, called ameloblasts. The damage to these cells results in a mineralization disorder of the teeth, whereby the porosity of the sub-surface enamel is increased. Over the past 50 years, the prevalence of dental fluorosis has increased quite dramatically in the United States and other fluoridated countries. Not only is the prevalence of fluorosis increasing, but so is its severity. There is a growing body of evidence which indicates that the prevalence and, in some cases, the severity of dental fluorosis is increasing in both fluoridated and non-fluoridated regions. According to recent estimates 2 to 12% of children living in fluoridated communities have dental fluorosis of "esthetic concern". Dental fluorosis, of esthetic concern, is an expensive condition to treat. If left untreated, it can cause embarrassment for school-aged children, resulting in psychological stress and damaged self-esteem.

**Key words:** Fluoride, Fluorosis, Dental fluorosis, symptoms, prevalence

## 1. Introduction

Dental fluorosis is a serious health problem caused by ingestion of fluoride in excess through water, food and air. Fluoride is a controversial trace element on the one hand for its widely beneficial uses, especially in improving dental health and on the other hand for its toxic effects. The toxic effects of fluorosis take three forms: Clinical, Skeletal and Dental. Research thus far indicates that the manifestations of fluorosis are irreversible.

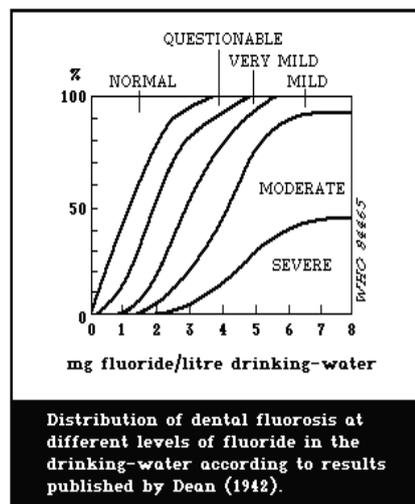
Dental fluorosis symptoms include white opacities, faint yellow to brown stains, pitting and chipped off teeth, black discolouration of enamel, hypoplasia and delayed eruption [11]. The above manifestations seen in an adult indicate that the person has been exposed to high fluoride levels during his or her childhood. The severity of Dental fluorosis varies with the period of exposure and quantity of fluoride intake per Kg body weight by the children. Permanent teeth are mostly affected and the area of infestation also varies depending on the above factors.

The objective of the study was to identify the rural endemic fluoride affected areas in and around Chittoor district by estimating the quantity of fluoride present in drinking water. To assess the prevalence of clinical findings of dental fluorosis in children (7-9 years) in the selected endemic fluorotic villages.

## 2. Literature Survey

Dental fluorosis also called "mottled enamel" occurs when the fluoride level in drinking water is marginally above 1.0 mg/l. Dental fluorosis develops in children born and brought up in endemic areas of fluorosis [10]. Incidence of mottled teeth was observed even with range of 0.7-1.5 mg/l in drinking water. The "questionable" changes occur with increasing frequency at higher fluoride exposure levels (fig: 1), their relationship to fluoride exposure in population studies is therefore not questionable, although the aesthetic

significance may be. Thus, being an effect of fluoride on the enamel, the "questionable" changes may more properly be given more statistical weight than 0.5, when assessing the community index of enamel changes according to Dean's method [1].



Source: Publications of Dean (1942)

**Figure 1:** Distribution of dental fluorosis at different levels of fluoride in drinking water

### 2.1. Prevalence of Dental Fluorosis in Children

Fluorosis is a crippling disability and has a major public health and socio-economic impact affecting millions of people in India. In India 2 per cent of the children are affected by Dental fluorosis. According to a recent estimate in India the problem has reached alarming proportions affecting 20 out of the 35 states and Union Territories affecting 62 million people [9].

Manji (1990) studied the prevalence of dental fluorosis in an area of Kenya with 2 ppm fluoride in drinking water in 102 school children in the age group 10-15 years using Thylstrup

and Fejerskov index (TFI) (1978). The prevalence was 100 per cent; 92 per cent of all teeth exhibited a TFI score of four or higher and 50 per cent of the children had pitting or more severe damage. The fluorotic changes showed a high degree of bilateral symmetry, and they concluded that unexpected high prevalence and severity of fluorosis may be due to unknown variables[6].

The minimal daily fluoride intake in infants that may cause very mild or mild fluorosis in human beings has been estimated to be about 0.1 mg per kg body weight [3]. This figure was derived from examination of 1094 children from areas with water-fluoride concentrations of 0.2-2.75 mg/l. Children in the age group of 0 to 12 years are most prone to fluorosis as their body tissues are in formative/ growing stage during this period. The critical period of exposure is between 1 and 4 years old (UNICEF, 1999).

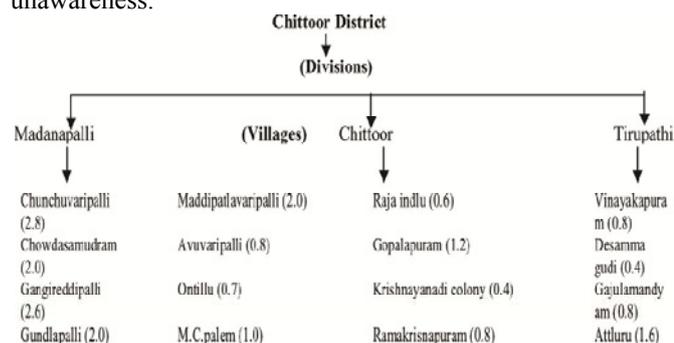
### 3. Methods

Dental fluorosis is endemic and continues to occur at an alarmingly higher rate. Chittoor district belongs to Rayalaseema (a rocky region) has the scarcity for water. Water obtained from in depth sources is the cause for the elevated levels of fluoride in some of the regions of this district. Much to the surprise, the people living over here are not aware of the disease of this kind for which act their drinking water is the main causative agent. With the problem continuing to be unrecognized and neglected, guidance is sorely needed.

Primary data regarding the fluorosis prevalent areas was gathered from the respective municipalities. Based on the available information a pilot study was conducted covering the entire district which included water sample collection and analysis using Orion Ion 930 Analyzer method.

#### 3.1 Selection of the Study Area

Reports of the water samples analysis revealed that among the three divisions (Tirupathi, Chittoor, Madanapalli). Madanapalli is the most endemic in chittoor district and among this the two heavily affected mandals; Thamballapalli and Mulakalacheruvu, were selected for the present study. The area of the study was limited to eight nearby villages as the subjects of the same socio-demographic characteristics lead a similar life pattern and that there would not be much variation in their life style and dietary habits. In addition majority of them are socio-economically backward and the intensity of the problem is aggravated due to illiteracy and unawareness.



**Figure 2:** Represents the fluoride content of the selected villages in Chittoor district

#### 3.2. Criteria for Selection of the Sample

Sample selected for the study included children in the age group of 7-9 years. As the disease is most prevalent in children of 0-12 years and the same time the disease can be easily prevented or controlled at this stage if detected at this early age.

#### 3.3 Development and Standardization of Questionnaire

A questionnaire was developed indicating the socio-demographic characteristics and clinical survey. Data collection involved accomplishment of oral examination for diagnosis of the presence or absence of clinical symptoms of dental fluorosis and classification of positive cases according to the Dean's Index, which is the widely accepted classification system. Depending on the severity of symptoms the subjects were distributed into Grade-I, Grade-II and Grade-III also designated as mild, moderate and severe forms of fluorosis respectively. This stated that 77 percent of the evaluated children aged 7-9 years exhibited signs of dental fluorosis as measured by the surface appearance of the symptoms indicative of dental fluorosis.

**Table 1:** Classification of Dental fluorosis using Dean's Index

Dean's Index	
Classification	Criteria – description of enamel
Grade-I (Mild)	Opaque white areas covering less than 50% of the tooth surface
Grade-II (Moderate)	All tooth surfaces affected; marked wear on biting surfaces; brown stain may be present
Grade-III (Severe)	All tooth surfaces affected; discrete or confluent pitting; brown stain present

### 4. Results and Discussion

The results obtained are tabulated under two sections. Section-I deals with the socio-demographic characteristics and section-II deals with the findings of clinical examination.

#### 4.1. Age and Sex

The percent distribution of the sample according to age and sex is presented in table no: The results enumerated for the present study showed that from the total sample (n=242), 52.1 percent were female and 47.9 percent were male.

#### 4.2. Period of Habitation

The period of habitat of the subjects in their respective villages were recorded from the school records and also confirmed from their parents. The percent distribution of children according to the period of stay is illustrated in Fig: 3. The results revealed that 72 percent of the children were continuant residents of the respective villages and resided for more than 4 years and 18 percent of the children are residents of the village from 2 to 4 years and 10 percent of them resided for less than 2 years and were in continuant residents.

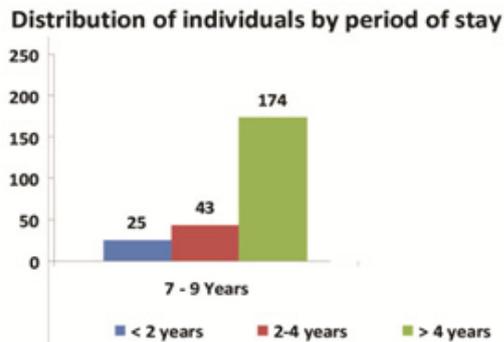


Figure 3: Per cent distribution of individuals by period of stay

#### 4.3 Percent distribution of individuals according to the Grade of Dental fluorosis

Table 2: Percent distribution of individuals according to the Grade of Dental fluorosis

Age	Gender	Grade-I	Grade-II	No symptoms
7 - 9 Years	Male [n=116]	101 (18.0)	-	15 (2.7)
	Female [n=126]	87 (15.5)	-	39 (6.9)
	Total [n=242]	188 (33.5)	-	54 (9.6)

The results disclosed in table no: 2 reveal that from the total subjects, Grade-I was prevalent in 77.6 percent of the sample and among them the symptoms were rampant in 41.7 percent of male and 35.9 percent of female children. Grade-II was not prevailing in any of them and no symptoms were seen in 22.4 percent of the subjects. A correlation between average water fluoride concentration and prevalence of Dental fluorosis was found among children. In a clinical survey for fluorosis in a random sample of residents in five areas in Tamil Nadu, South India, the drinking-water fluoride concentration was directly related to the prevalence of dental fluorosis in children (8–15 years of age) and adults. Among children, no skeletal fluorosis (no information on diagnostic criteria provided) was observed; among adults, the prevalence of fluorosis was 34% (157 individuals surveyed) in the area with the highest drinking-water fluoride concentration (summer month average 6.8 mg/litre, non-summer month average 5.6 mg/litre) (estimated total daily fluoride intake 20 mg), while no skeletal fluorosis was observed in the other areas, where the mean fluoride concentrations were 2.2 (summer months) and 1.8 (non-summer months) mg/litre or lower, with estimated total daily fluoride intakes less than 10 mg [6]. Similar results were seen in a study conducted by Pandit et al., (1940) were 74 percent of the children residing in the endemic fluorotic areas showed the symptoms of mottled enamel. Ray et al., (1981) performed a study in Rostampur village near Varanasi and they found association between fluoride concentration of drinking water and dental fluorosis. The incidence of dental fluorosis was 28.21 per cent. The prevalence rate was highest in this age group 13-18 years and was higher in males than females with a raising trend associated with an increase in fluoride content of the water. At a concentration of less than 0.5 ppm fluoride in water, the incidence of dental fluorosis was 16.98 per cent. The lowest prevalence of dental fluorosis was noted in the group 1-6 years of age [7].

## 5. Summary and Conclusion

Re-evaluation of classical fluorosis data has shown that even at low fluoride intake from water, a certain level of dental fluorosis will be found. A habitat–response relationship was also demonstrated. The data established an increase in the prevalence of fluorosis index for ppm increase in intake of fluoride.

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