

Research Article

Prevalence and Severity of Dental Fluorosis among Primary School Children Aged 12–14 Years in Abosied and Alfetehab Localities, Omdurman, Sudan

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Abstract

Background: Dental fluorosis is a disease of dental hard tissues resulting from excess fluoride intake during the developmental stages of teeth causing hypomineralization of the enamel. This study aimed to assess the prevalence of dental fluorosis among school children in Omdurman locality.

Methods: Students in the sixth grade of school were examined to determine the prevalence of dental fluorosis using Dean's index.

Results: The prevalence of dental fluorosis was 68.3%. The majority of students were diagnosed with very mild (23.2%) and mild (26.5%) forms. There was no difference in the grade of fluorosis between children who were born outside and in Omdurman.

Conclusion: Prevalence of dental fluoride was found to be very high among school children with no difference between males and females.

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1. Introduction

Fluoride is a natural element found in drinking water. Consumption of fluoride is essential because of its impact on dental health. Fluoride ions replace the hydroxyl in the hydroxyapatite crystals resulting in fluorapatite crystals which decreases the solubility of tooth structures [1].

The optimal fluoride concentration in drinking water which promotes dental health is 0.5–1.5 mg/L [2, 3]. However, there are areas with low fluoride levels, so these individual communities added fluoride to their drinking water in a procedure called fluoridation [4]. This was done to increase the concentration of fluoride in drinking water to prevent dental caries and protect tooth development in young children.

On the other hand, fluoride content of 1.5–4 mg/L in drinking water leads to dental fluorosis, and concentrations >4 mg/L lead to dental, skeletal, and crippling fluorosis

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[2, 3]. Dental fluorosis is a developmental disease caused by excessive intake of fluoride during the periods of tooth development leading to hypomineralization of the enamel [5, 6].

In most areas of Sudan, water from wells is used for domestic and livestock consumption, and as high concentration of fluoride in water are generally found in groundwater, this study therefore aims to assess the prevalence of dental fluorosis.

2. Materials and Methods

This school-based, cross-sectional study was conducted during the school health program held by the Faculty of Dentistry, Karary University. The program targeted 13 public schools in Abosied and Alfetehab localities in Omdurman city. The target group was students studying in the sixth grade of school excluding children with orthodontic brackets, crowns, or fractured anterior teeth. The clinical examination was carried out in the school premises by the researcher. Children were seated on ordinary chair under natural day light, the examinations were carried out without prior cleaning or drying of the teeth and the instruments used were sterilized mouth mirror, probe, and dental tweezer. The severity of the fluorosis was assessed using Dean's index which is a six-point ordinal scale [7] (Table 1).

TABLE 1: Dean's Index for dental fluorosis [7].

Classification	Criteria
Normal (0)	The enamel represents the usual translucency with smooth and glossy surface with a pale, creamy color.
Questionable (0.5)	A definitive diagnosis of the mildest form of fluorosis is not warranted and a classification of "normal" not justified.
Very mild (1)	Small opaque, white areas that are scattered or streaked over the tooth, but not involving as much as approximately 25% of the tooth surface.
Mild (2)	The white opaque areas in the enamel of the teeth are more extensive, but do not involve as much as 50% of the tooth surface.
Moderate (3)	All enamel surfaces of the teeth are affected, and surfaces subject to attrition show wear. Brown stain is frequently a disfiguring feature.
Severe (4)	All enamel surfaces are affected and hypoplasia is marked that the general form of the tooth may be affected. Discrete or confluent pits are extensive and Brown stains are widespread.

3. Results

The study was performed on 578 students of which 411 (71.1%) were girls and 167 (28.9%) were boys. The mean age of subjects surveyed was 11.6 ± 1 years ranging from 10 to 16 years. 401 (69.4%) children were born in Omdurman locality.

Dental fluorosis was detected in approximately 68.3% of the students examined ($n = 395$), and the community fluorosis index was 1.10 ± 1.02 . The majority of students were diagnosed as having very mild (23.2%) and mild (26.5%) forms of fluorosis (Figure 1). It was observed that students having severe fluorosis status were 80% boys and 20% girls. There was no difference in the grade of dental fluorosis between children who were born outside and in Omdurman (Table 2).

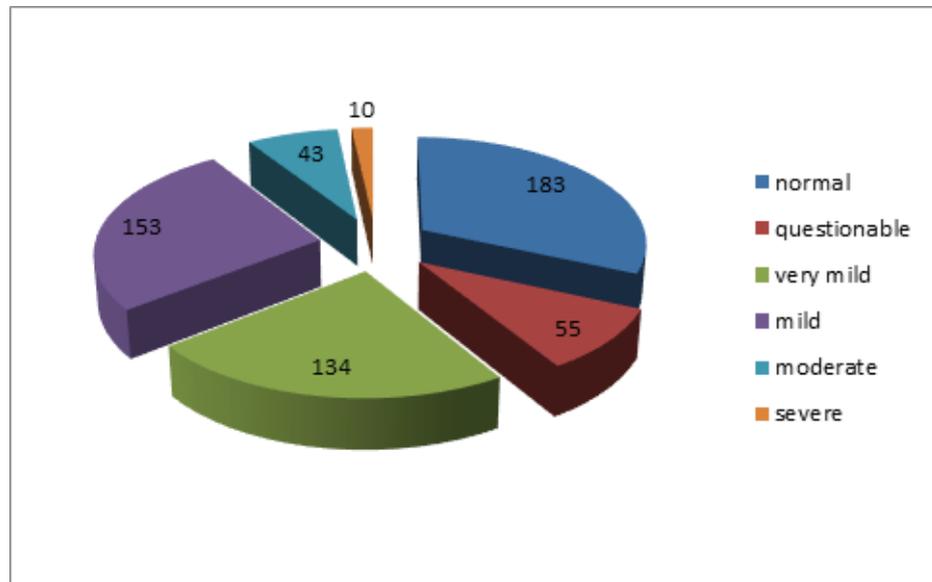


Figure 1: Prevalence of dental fluorosis among school students.

TABLE 2: Comparison of the Dean's index with respect to the students' gender and place of birth.

		Fluorosis level						P-value
		Normal	Questionable	Very mild	Mild	Moderate	Severe	
Gender	Male	51 (27.9%)	13 (23.6%)	36 (26.9%)	45 (29.4%)	14 (32.6%)	8 (80.0%)	0.015
	Female	132 (72.1%)	42 (76.4%)	98 (73.1%)	108 (70.6%)	29 (67.4%)	2 (20.0%)	
Birthplace	Omdurman	130 (71.0%)	40 (72.7%)	95 (70.9%)	102 (66.7%)	28 (65.1%)	6 (60.0%)	0.851
	Outside Omdurman	53 (29.0%)	15 (27.3%)	39 (29.1%)	51 (33.3%)	15 (34.9%)	4 (40.0%)	

*Chi-square test.

TABLE 3: Summary of previous studies on the prevalence of dental fluorosis.

Country	Fluoride level	Study population	Number	Prevalence of fluorosis	Gender
Butana Sudan [10]	1.1–4.0 mg/L	Students 7–14 years	134	60.6%	Not mentioned
Treitel Biga Sudan [11]	0.25 ppm	Students 6–12 years	55	91%	Males
Abu Groom Sudan [11]	2.56 ppm	Students 6–12 years	58	100%	Equal
Tiraat El-Bijah Sudan [12]	0.24–1.31 mg/L	All ages	400	42.5%	Equal
UmDuwanban Sudan [12]	1.29–1.43 mg/L	All ages	400	70%	Equal
India [13]	≤1.5 mg/L	Students 12 & 15 years	1875	29.8%	Equal
India [14]	≤1.5 mg/L	All ages	6093	39.2%	Males
India [15]	2.42 mg/dL	Students 6–12 years	1008	69.84%	Not mentioned
India [16]	Not mentioned	Students 12–15 years	840	82.04%	Equal
India [17]	0.53–5 ppm	students 6–14 year	178	78%	Females
India [18]	<0.2–6.5 ppm	Students 5–12 years	1800	4.1%	Females
India [19]	<0.1 ppm	Students 5–12 years	525	31.4%	Equal
Ghana [20]	1.50 ppm	Children 7–18 years	200	63%	Equal
Saudi Arabia [21]	Not mentioned	All ages	253	73.5%	Equal
Mexico [22]	1.41 mg/L	Students 12–15 years	101	85%	Equal
Mexico [23]	1.95 ppm	Students 12 & 15 years	1024	83.8%	Equal
Mexico [24]	Not mentioned	Students 10–12 years	239	59%	Equal
Brazil [25]	Not mentioned	students 12 & 15–19 years	535	25%	Females
Brazil [26]	0.9 mg/L	Students 7 & 15 years	52	33%	Not mentioned

4. Discussion

This study was conducted in Aboseid and Alftihab localities which covers an area of 49 km². There were a total of 50 governmental primary schools. The water sources in this area are wells and the Nile. The average fluoride concentration in the water wells was 0.675 ppm, while the fluoride concentration in the Nile was 0.35 ppm. This fluoride level was below the level recommended by the WHO [8].

4.1. Fluorosis

Several studies have been conducted across the world regarding the degree of dental fluorosis compared to the fluoride levels in drinking water, these studies are summarized in Table 3.

In the present study, nearly two-thirds (68.3%) of children experienced dental fluorosis, this showed a high prevalence despite the fluoride level being ≤ 1 mg-F/L. Other studies from Sudan also showed high fluorosis incidence, however, they were conducted in areas with high fluoride level like Butana [9, 10]. Many areas in Al-Butana region had a high concentration of fluoride; a study aimed at measuring fluoride level in different wells in Al-Butana region showed that in the northern part, the levels ranged from 0.5 to 1.5 mg/L, while in the southern part, the level was <0.5 mg/L, and the levels of 1.5 mg/L were limited and scattered throughout the area [9].

A study in Butana showed that the prevalence of fluorosis was about 60.6%, with a fluoride level in drinking water ranging from 1.1 to 4.0 mg-F/L [10]. Ibrahim *et al.* studied the fluoride levels of drinking water and assessed the prevalence of dental fluorosis among children in Treitel Biga and Abu Groom areas. The level of fluoride in Treitel Biga was 0.25 ppm, while in Abu Groom it was 2.56 ppm. The study reported a 91% and 100% prevalence of dental fluorosis in Treitel Biga and Abu Groom areas, respectively [11]. Another study from Tiraat El-Bijah and UmDuwanban reported a prevalence of about 42.5% and 70% dental fluorosis with a fluoride level of 0.45 mg/L and 1.36 mg/L, respectively [12].

The high dental fluorosis in this study could be explained by the fact that in hot areas, the amount of consumed water is increased, thus increasing the amount of fluoride ingested leading to dental fluorosis. This was supported by another study from Sudan which calculated the higher allowed fluoride level in drinkable water as 0.35 ppm [27].

Similar results from an Indian studies which were conducted in low fluoride areas (≤ 1.5 mg/L) showed a dental fluorosis prevalence of 29.8% [13] and 39.2% [14]. Studies from different parts of the world showed diverse fluorosis prevalence, high prevalence was reported by many studies; Indian studies reported a prevalence of 69.8–82.04% [13, 15–17]. A study was carried in Bongo community of Ghana reported a 63% prevalence [20]. Moreover, a 73.5% prevalence was recorded from Hail, Saudi Arabia [21], two studies from Mexico reported a prevalence of 85% [22] and 83.8%, respectively [23], and a study of students living in Mexico City reported a prevalence 58.6% [24]. However, many studies showed lower rates for fluorosis; a Brazilian study reported a prevalence

of 25% [25] and two studies from India showed dental fluorosis to be 4.1% [18] and 31.4% [19].

Of note, females and males have the similar likelihood of developing dental fluorosis [22]. Similar results were found in this study with no significant difference between genders, this is consistent with other studies conducted in Sudan [12], and among Bongo community of Ghana [20], Saudi Arabia [21], Mexico City [24], and India [13, 16, 19]. However, some studies have concluded that gender was associated with dental fluorosis, with some studies showing fluorosis to be more prevalent in females [17, 18, 25]. One study of children from Omdurman reported a 64% and 50% prevalence of dental fluorosis among boys and girls, respectively [28], another study showed that in Treitel Biga, the prevalence and severity of fluorosis was higher among boys than girls [11]; in addition, another study from India reported that the overall percentage of dental fluorosis was more in males than in females [14].

The predominant categories of fluorosis were very mild and mild (49.7%), and only 9.1% were in the moderate and severe types, respectively; those few children with increased severity may have had an overexposure to fluoride from other sources like toothpastes. These results are consistent with the results of a Sudanese study that found that the predominant categories in their study were very mild and mild [12] and a study from Mexico City that reported very mild and mild fluorosis in 51.9% of their students and moderate or severe levels in only 6.69% [24]. Similarly, an Indian study didn't report severe fluorosis and the prevalence of moderate fluorosis was 0.2% [18]. However, another Indian study showed a more severe results with 29.8% students showing moderate and 6.7% severe fluorosis [17].

5. Conclusion

Prevalence of dental fluoride was found to be very high among school children with no difference between males and females. Although the majority of dental fluorosis were in the categories of very mild and mild, concerns regarding its growing prevalence underscores the need for careful observation.

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Ethical Considerations

Ethical approval was obtained from the ethical committee at the Faculty of Oral and Dental Medicine. Agreement to examine the children was abstained from the school's principals as this examination was part of a school health program carried out by the Ministry of Health.

Competing Interests

There is no competing interest.

Availability of Data and Material

All data used in this study are available upon reasonable request with the corresponding author.

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