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## Perceptions of dental fluorosis among community members in the Sudano-Sahelian Cameroon

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### Abstract

**Introduction:** Dental fluorosis is a hypomineralisation of the enamel resulting from chronic ingestion of high levels of fluoride (above 1 mg/l) during amelogenesis. The disease affects the social relations, psychosocial wellbeing and quality of life of affected persons. Endemic areas of dental fluorosis have been reported in Cameroon and several people would be affected.

**Objective:** To determine the perceptions of dental fluorosis in the Sudano-Sahelian part of Cameroon.

**Materials and Method:** Cross-sectional study was conducted in 25 communities in the Sudano-Sahelian Region of Cameroon, from 30 December 2019 to 31 March 2020. Community members aged 12 years and above, who consented to participate were examined for the assessment of dental fluorosis. Participants were submitted to a questionnaire adapted from the Internalized Stigma for Mental Illness (ISMI) scale, adjusted for dental fluorosis.

**Results:** Out of the 1665 participants examined, 1215 presented signs of dental fluorosis, for a prevalence of 73%. Persons with dental fluorosis demonstrated an overall mild level of internalized stigma (ISS) ( $2.04 \pm 0.47$ ). The highest score was noted for the stigma resistance ( $2.24 \pm 0.58$ ), social withdrawal ( $2.12 \pm 0.48$ ) and alienation ( $2.11 \pm 0.49$ ). The highest score ( $2.94 \pm 0.69$ ) was recorded among persons with severe dental fluorosis. Persons aged 26-30 years experienced the highest score ( $2.22 \pm 0.92$ ). Females ( $2.16 \pm 0.79$ ) exhibited higher internalized stigma levels than males ( $1.98 \pm 0.65$ ) ( $p < 0.001$ ).

**Conclusion:** The level of internalized stigma increases with the degree of dental fluorosis.

**Keywords:** Dental fluorosis, perception, internalized stigma, ISMI scale

### Introduction

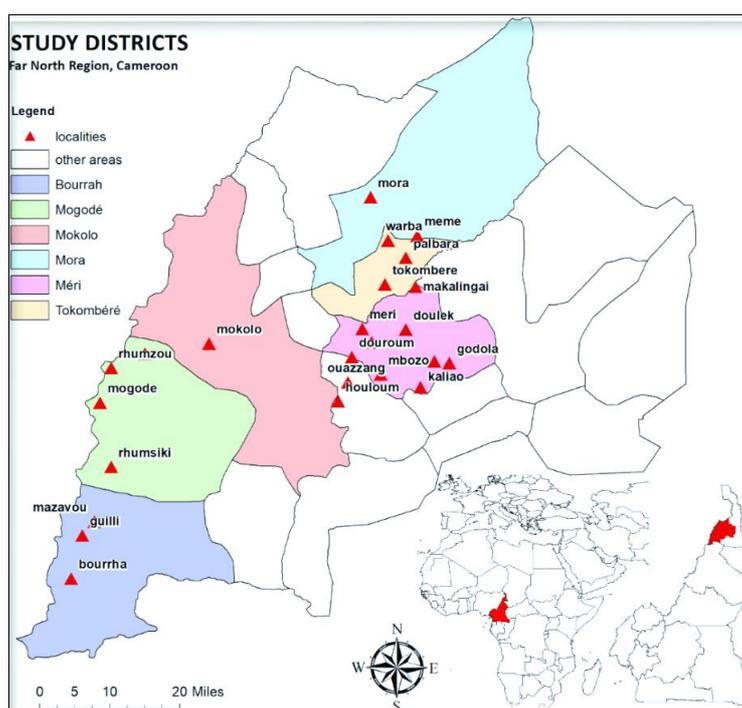
Dental fluorosis is a hypomineralisation of dental enamel caused by chronic ingestion of high levels (above 1 mg/l) of fluoride during amelogenesis [1]. Consumptions of higher levels of fluoride leads to disruption of secretory ameloblasts, resulting in increased porosity of the surface enamel [2]. In milder forms, porosity is limited to the subsurface enamel, while in severe forms the porosity extends to the surface causing excessive pitting, chipping and subsequently tooth decay [2, 3]. Dental fluorosis is endemic in at least 25 countries and over 200 million persons are at risk across the globe [4]. Dental fluorosis belts include the Syria stretch extending to Jordan, Egypt, Libya, Algeria, Chad, Cameroon, Sudan, Kenya, Ethiopia and Tanzania, the Turkey through Iraq, Iran, Afghanistan, India, northern Thailand and China. There are minor foci in the Americas and Japan. Its global prevalence is 3.2% [5]. Endemic dental fluorosis has been reported in Cameroon, in its Sahelian part affecting several communities [6]. Manifestations of fluorosis may extend to skeletal fluorosis and neurological signs [7]. Endemic fluorosis has been coined to fluorides content of drinking water, leading to dental and skeletal fluorosis. The perceptions of the open smile is an indicator of the personal attractiveness as facial expression and attractiveness affect how people perceive their overall attractiveness [8]. As the spots on the fluorosis affected teeth give the impression of poor oral hygiene, persons with dental fluorosis avoid smiling and are affected by self-reject, psychological and behavioral trauma [8]. In adolescence, smiling has a significant impact on self-esteem, self-confidence and well-being [9, 10]. Few studies have assessed the perceptions of dental fluorosis. Poor perceptions of esthetics and appearance have unfavorable effects on individual's personality and generates perceived and internalized stigmatization [11].

The present study was designed to assess the influence of dental fluorosis on the perceptions of afflicted individuals and other community members. The specific objectives of the study were: to determine the prevalence and severity of dental fluorosis in the afflicted area, to assess the level of internalized stigma (self-perception) and stigma resistance (SR) among persons with dental fluorosis. The information generated would assist in designing strategies to enhance participation in interventions targeting dental fluorosis.

## Methods

The present cross-sectional descriptive study was carried out in 25 purposefully selected communities in the Mandara Mountainous Region, covering the 3 administrative divisions of Mayo Sava, Mayo Tsanaga and Diamare, in the sahelian zone of Cameroon (Fig.1) from 30 December 2019 to 31

March 2020. The Mandara basin-Region is one of the hardest hit by endemic dental fluorosis, with prevalences ranging from 80% to 83% [6]. The Mandara basin lies between latitudes 10°30'00"N and 10°45'00"N and longitudes 13°45'00"E and 14°45'00"E. The climate is of the Sudano-Sahelian type with two main seasons. The dry season extends from October to May, while the rainy season lasts from May to September. The hydrography presents with temporary rivers (mayos) and ponds observed mainly during the rainy season. The weather is relatively hot over the year and the water consumption rate high, in the order of 3-4 l/day. The main ethnic groups are the Mandaras, Kapsiki, Foulbes, Mofous, Mafas, Banas, Madas (Zoglous). Drinking water is obtained from wells and deep wells which are either protected or not. In urban areas, pipe borne water is distributed by the Cameroon Water Corporation (CDE) [6, 12].



**Fig 1:** Geolocalisation of Study Communities for the Assessment of the Perceptions of Dental Fluorosis in Sudano-Sahelian Cameroon.

We purposefully selected communities based on the high prevalence of dental fluorosis. Our study included participants aged 12 years and above who had resided in the area for at least the first 8 years of their childhood. Participants with numerous missing teeth, dentures and orthodontic appliances were excluded. Participants were submitted to a clinical dental examination and to a questionnaire, after informed consent. We sought the consent of parents/guardians for participants that were less than 18 years and their assentment obtained. Ethical clearance was obtained from the Ethical Review Board of the Faculty of Medicine and Biomedical Sciences - University of Yaoundé 1 (N° 388/UY1/FMSB/VDRC/DAASR/CSD). Administrative authorization was obtained from the Regional Delegation of Public Health (N°069/L/20/MINSANTE/SG/DRSP/EN/MRA). Participating individuals were submitted to a clinical dental examination for fluoretic lesions, and submitted to a questionnaire related to internalized stigma. The intra-oral examination followed a standard and rigorous aseptic procedures, respecting COVID-19 barrier measures. The participant and operator were seated. The teeth were dried with sterile gauze for 30 seconds and a wooden tongue depressor used to retract oral soft tissues.

Natural lighting was used to determine the level of translucency of the enamel. Scoring was done using the modified Dean's fluorosis index [13]. Based on the structure and appearance of the enamel, each tooth was score as smooth, even surface, and white or pale creamy white in color as Normal (normal: score =0); Altered glossiness with few white spots on enamel surface (questionable: score =1); Irregular white opaque flecks on < 25% of enamel surface (very mild: Score =2); White opaque flecks on <50% but >25% of enamel surface (score = 3); Distinctive enamel attrition like wear with brown stain (moderate: score = 4); Enamel hypoplasia due to severe fluorosis, pitted and corroded-like enamel, or brown stain all over the enamel (severe: score = 5).

Following dental examination, participants with dental fluorosis were submitted to a structured questionnaire to gather information related to self-rated perceptions using a modified Internalized Stigmatization of Mental Illness scale (ISMI), adjusted for dental fluorosis [14]. Internalized stigma is a subjective process, embedded within a socio-cultural context, characterized by negative feelings (about self), maladaptive behavior, identity transformation or stereotype endorsement resulting from individual's experiences,

perceptions, or anticipation of negative social reaction. Internalized stigma responses were rated on a five-point Likert-scale as not at all (score=1), a little (score=2), frequently (score=3) and very frequently (score=4). The questionnaire addressed five themes including alienation, stereotype endorsement, discrimination experience, social withdrawal and stigma resistance.

Statistical analyses were carried out using epi info 7.2.3.1 and charts drawn using Microsoft Excel 2013. Mapping and Geolocalisation was done using Arc Map 10.7 version of the GIS software. Semi-quantitative analyses was done to bring out the perceptions towards people with dental fluorosis. Descriptive analyses of teeth with fluorosis distributed according to the Dean’s Fluorosis index. Means and standard deviations were computed for each thematic domain and the Internalized stigma scores were interpreted using the 4-category method [15], and presented as minimal (1, 00-2,00);

mild (2,01-2,50); moderate (2,51-3,00) and severe (3,01-4,00) internalized stigma.

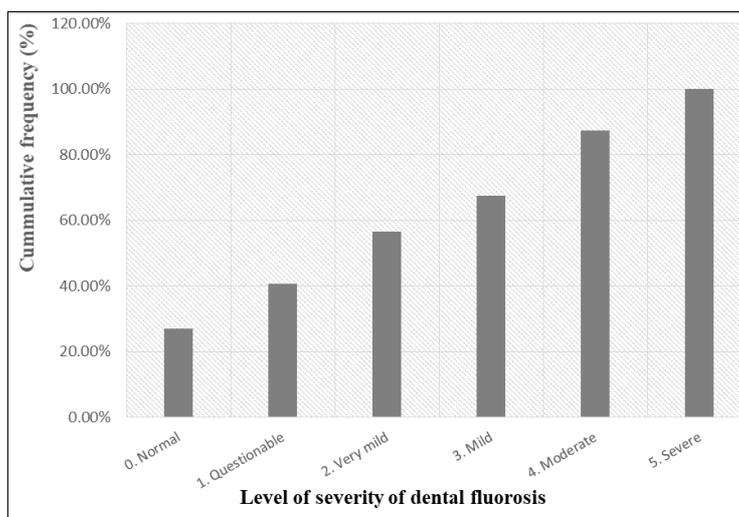
The ISMI domain scores of stigma were compared with clinical and sociodemographic variables, using parametric and non-parametric statistics (Mann-Whitney, Krustal-Wallis). Statistical significance was determined at  $p < 0.05$ .

**Results**

We examined 1665 participants, 875 (53%) were males for a sex ratio of 1, 11. The 16-25 years age group was the most represented (46%).

**Distribution of dental fluorosis**

Overall, dental fluorosis was found in 73% (n=1215) of participants. The intensity of dental fluorosis was moderate (27%), very mild (22%) and 17% of severe dental fluorosis (Fig.2).

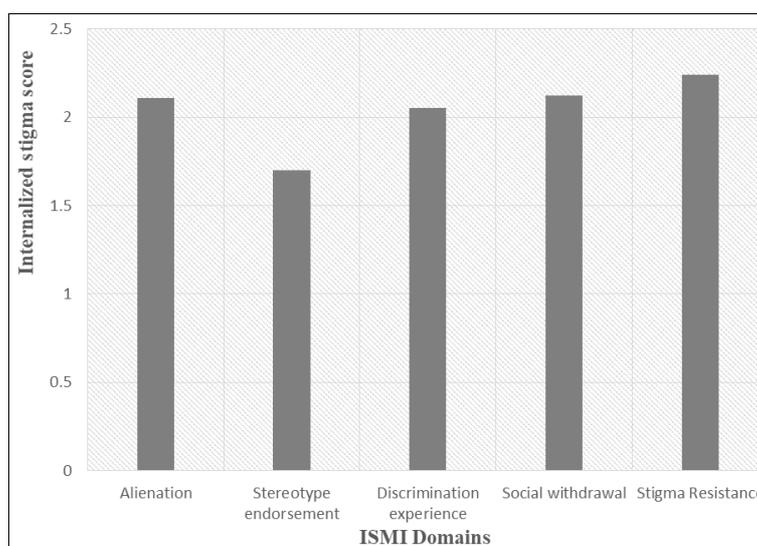


**Fig 2:** Cumulative Frequency of Dental Fluorosis by Level of Severity in Selected Localities of Sahelian Cameroon (December 2019- March 2020).

**Internalized stigma in persons with dental fluorosis**

The overall internalized stigma level was  $2,04 \pm 0,47$ . The stigma resistance domain had the highest score ( $2,24 \pm 0,58$ )

followed by social withdrawal ( $2,12 \pm 0,48$ ), while stereotype endorsement had the lowest ( $1,70 \pm 0,32$ ). (Fig.3).



**Fig 3:** Mean Internalized Stigma Scores among Persons with Dental Fluorosis in Selected Communities of Sahelian Cameroon (December 2019 – March 2020).

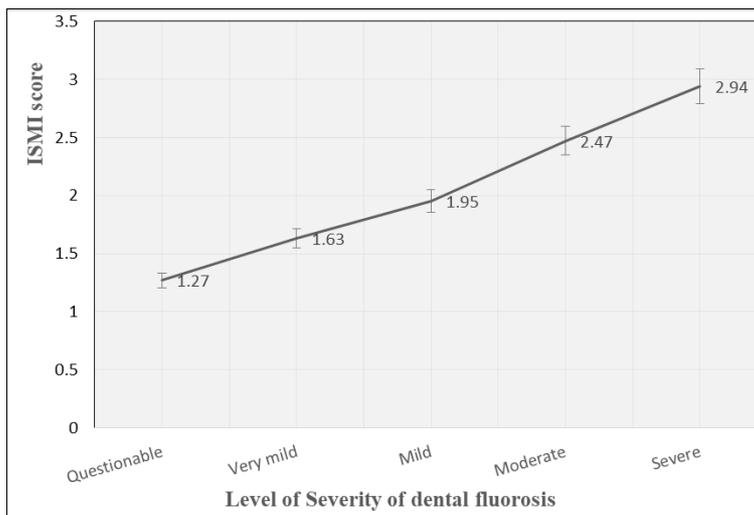
**Severity of dental fluorosis and internalized stigma scores**

Persons manifesting severe dental fluorosis had an

internalized stigma score of  $2,94 \pm 0,69$ , while those with questionable dental fluorosis had a score of  $0,23 \pm 0,05$ . It was

found that the level of internalized stigma increased as the severity of dental fluorosis increases. There was a linear relationship between the severity of dental fluorosis and the

internalized stigma scores ( $F= 4, 1210 = 516.35, p < 0.001$ ) (Fig. 4)



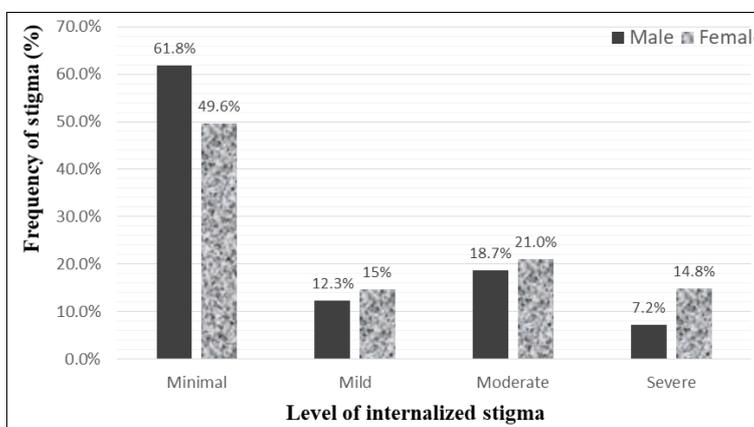
**Fig 4:** Mean Internalized Stigma Scores (ISMI) by Severity of Dental Fluorosis among Affected Community Members in Sudano-Sahelian Cameroon.

**Internalized stigma scores and sociodemographic characteristics**

Participants aged 26-30 years had a stigma score of  $2.22 \pm 0.92$ . The lowest score was found among those aged 12-15 years, while persons aged 26-30 years experienced the highest level of internalized stigma. In this study, 56% of Participants showed a minimal stigma while 20% demonstrated moderate stigma. Moderate to severe internalized stigma was found in 31% of participants, with 11% of them exhibiting severe internalized stigma levels.

Participants aged 26-30 years had a stigma score of  $22 \pm 0.92$ , showing the highest recorded score. The lowest score was found among those aged 12-15 years, while persons aged 26-30 years experienced the highest level of internalized stigma. This implies that adolescences within this age group felt more stigmatised than their peers.

Fluorosis affected females experienced greater internalized stigma in the mild, moderate and severe levels of internalized stigma (Fig.5).



**Fig 5:** Frequency of Internalized Stigma by Sex among Affected Members (December 2019- March 2020).

**Severity of Internalized stigma in persons with dental fluorosis**

Participants with moderate to severe internalized stigma in the population were found to be 31%, with 11% of them exhibiting severe internalized stigma levels.

In our study 56% of Participants showed a minimal stigma while 20% demonstrated moderate stigma. Moderate to severe internalized stigma was found in 31% of participants, with 11% of them exhibiting severe internalized stigma levels.



**Fig 6:** Dental fluorosis severity spectrum among in Sudano-Sahelian Cameroon, (December 2019–March 2020)

### Discussion

The prevalence of dental fluorosis was highly variable (12-100%), with several hyperendemic communities. The level of endemicity of dental fluorosis could be related to the high levels of fluorides contained in natural drinking water [6]. Natural surface and groundwaters waters may be fluoridated [16-17]. The documented high endemicity of dental fluorosis could also be related to dietary habits, as was the case in Tanzania, where a locally consumed salt "magadi" was associated with endemic fluorosis [18].

Moderate fluoretic lesions were a source of aesthetic affliction, negatively affecting the psychosocial wellbeing of affected persons [19]. These findings were not consistent with observations in Tanzania, as severe forms of dental fluorosis were predominant [20]. The high prevalence of severe cases reported in the Tanzanian study could be due to the methodological approach used, as the Thylstrup Fejerskov Index (TFI) is more sensitive the Deans Index [18].

The high prevalence of the severe forms of dental fluorosis (17%) reported in our study constitutes a social issue as afflicted individuals have difficulties smiling and maintaining social exchanges and engaging close interpersonal relationships [21].

The reverse-coded stigma resistance theme (subscale) had the highest, followed by social withdrawal, indicating that persons with dental fluorosis were less resistant to internalized stigma. As the severity of dental fluorosis increased, so did feelings of distress, isolation and low integration in society. A lesser impact of the disease was reported in Senegal [22]. This might be related to the fact as most persons living in the same communities have the severe forms, stereotyping endorsement is lower, as the affection is perceived as normal. Persons with severe dental fluorosis portrayed an elevated internalized stigma (mean >2.5), with impairments mental function [23]. A related study in Brazil provided evidence of an impact in the functional domain [24].

There was a dose-response relationship between the severity of dental fluorosis and the level of internalized stigma as participants with severe dental fluorosis experienced higher levels of internalized stigma. Most persons with severe dental fluorosis isolated themselves and avoided social interactions. These findings are similar to observations in Tanzania, Canada, Australia and Brazil [9, 25, 26]. Shyness, feelings of inferiority, decreased self-confidence were reported among

persons with dental fluorosis.

Participants with age group 26-30 years experienced the highest stigma score. Most of the young adults of this age group engage in romantic relationships and start families. In Canada [27], children 11-13 years of age were more critical about their teeth appearance than older persons.

Females experienced higher stigma levels than males. This corroborates observations in Canada and Ethiopia [27, 28]. In Ethiopia, some people had the misconceptions that women can transmit dental fluorosis to their offsprings.

Some females reported that dental fluorosis have made them less attractive to suitors and early romantic relationships. More girls experienced twice as elevated stigma levels (moderate to severe internalized stigma) than males. This means that females perceive 2 times more severe stigma than males. This finding was in line with an iranian study [29], as the quality of life and satisfaction of females aged 15-18 years decreased with increasing severity of dental fluorosis.

### Conclusion

The prevalence of dental fluorosis was highly variable (12-100%), with several hyperendemic communities of sahelian C. The level of internalized stigma was associated with the severity of dental fluorosis, age and gender. Females aged 26-30 years, persons with severe dental fluorosis experienced higher internalized stigma levels. Persons with dental fluorosis reported feelings of shyness, inferiority, decreased self-confidence, there is the need for intervention programs against dental fluorosis in the affected communities.

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