SUITABILITY OF THE TF-DENTAL FLUOROSIS INDEX FOR DETECTION OF FLUORIDE SOURCES

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SUMMARY: A study was conducted in three Tanzanian populations to investigate the prevalence and severity of dental fluorosis using the Thylstrup-Fejerskov Index (TFI). The study also aimed at establishing to which extent the TFI score follows an interval scale. The distribution of TFI scores for the 3 sub-samples was analyzed as one population. A bimodal distribution of the TFI scores was observed. When the analysis was done separately for each of the sub-samples, the distribution in the low fluorosis sub-sample (Tanga) was skewed, in the high fluorosis (Iramba) it was normal while the moderate fluorosis sub-sample (Singida) demonstrated a bimodal distribution similar to that observed in the overall sample. The bimodal distribution in the moderate fluorosis area was considered to be indicative of possible sub-samples with different fluoride exposures. In the present study the sub-sample from the moderate fluorosis area was sub-divided further into 4 groups according to the geographical locations. Among children in Sepuka 54% had fluorosis and the mean TFI score was 1.9, while 81% of the children in Kinyeto had fluorosis and the mean TFI score was 3.3. Samples of "Magadi" (a salt commonly used) were collected from Sepuka and Kinyeto. The fluoride content of the salt collected from the two locations differed greatly explaining the difference in fluoride exposure for the two groups. Application of the TFI was found to allow detection of possible variations in fluoride exposure therefore allowing to track other sources of fluoride in addition to water-borne fluoride.

Key words: Thylstrup-Fejerskov Index, fluorosis, fluoride, magadi.

INTRODUCTION

When an Index with an interval scale is used to detect exposure to a variable which is rather on a uniform level, two clear cut situations can occur: (a) if the exposure is generally high, a symmetric distribution should be observed; (b), in the case of very low exposure a skewed distribution should be found.

The Thylstrup and Fejerskov Index[1] of dental fluorosis was applied in three populations in Tanzania. The combined data demonstrated a bimodal distribution of dental fluorosis. When the data were separately analyzed for each population, the population with low dental fluorosis (Tanga) demonstrated a skewed distribution, the population with high dental fluorosis (Iramba) demonstrated a symmetric distribution, while the population with moderate dental fluorosis (Singida) demonstrated a bimodal distribution similar to that observed for the 3 mixed populations. The bimodal distribution in the moderate fluorosis population was considered to be indicative of a mixed sub-group with different fluoride exposure. To detect whether there was difference in exposure to fluoride, the population with moderate fluorosis was divided into 4 sub-groups corresponding to the location of the schools.

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The purpose of this study was to examine to which extent the TFI was close to an interval scale and to test the suability of the TFI to detect groups with different exposure to fluoride.

MATERIALS AND METHODS

Three areas in Tanzania which had low fluoride concentrations in drinking water were identified and were investigated for dental fluorosis. The number of children who participated in this study was 1556, of which 520 were from Tanga, 586 were from Singida and 450 were from Iramba. All 11 to 18 years old children in the study population were interrogated about their intake of fluoride containing foods and drinks which was measured using a one week recall questionnaire. The fluoride intake was estimated on the basis of reported frequencies of intake of certain foods and drinks mainly fish, tea, magadi, fluoridated tooth pastes and fluoride tablets. The frequency of milk intake was asked as it is known to slow and reduce the rate of fluoride uptake.

The fluoride content of the drinking water was measured from water samples collected over a period of about one year from most drinking water sources. Magadi samples were collected from two villages out of five in Singida and in Iramba from three out of four villages. Samples of magadi were collected from the household stocks and from village markets which served the study population. A total of 35 samples were collected from Singida and 9 samples from Iramba. Fluoride concentrations in magadi were determined by laboratory analysis. Detailed information on dietary fluoride sources which was later compared to dental fluorosis conditions was collected from Sepuka and Kinyeto in Singida District and in Kiomobi in Iramba District.

RESULTS

Reproducibility of the TFI is reported in another publication using the same data[2]. The prevalence of dental fluorosis for the studied population was 72% and the mean TFI score was 2.7. The prevalence of dental fluorosis and the mean TFI score varied between the sub-groups (Table 1).

TABLE 1. Prevalence of dental fluorosis and fluoride in food additive (salt - magadi).

Location	Prevalence of dental fluorosis (%)	Mean TFI	Fluoride in magadi (µg-F/g)
Sepuka	53.8	1.9	111
Kinyeto	80.6	3.3	1160

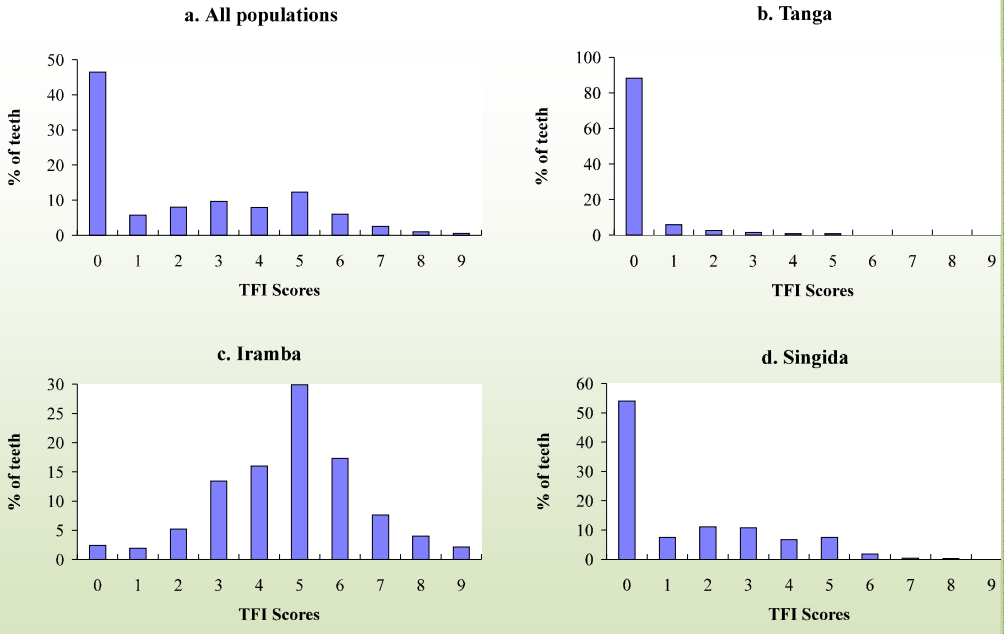

FIGURE 1. Distribution of TFI Scores. a: For all the three populations. b: In Tanga at sea level. c: In Iramba at 1,500 m altitude. d: In Singida at 1,500 m altitude.

The initial stage in analyzing and interpreting the data in this study was to establish the distribution of the TFI scores for all three populations. A bimodal distribution was observed (Figure 1a). The second stage was again to establish the distribution of TFI scores for each community separately. A skewed distribution was seen for the population from Tanga (Figure 1b), and a normal distribution for the population from Iramba (Figure 1c) whereas a bimodal distribution was observed for the population from Singida (Figure 1d). It was decided to further analyze the data from Singida. To determine whether the TFI was closer to an interval scale, two places in Singida (Sepuka and Kinyeto) were separated from the overall Singida population because variation of fluoride ingested through the volcanic salt (magadi) was known (Table 1).

The prevalence of dental fluorosis was 53.8% in Sepuka and 80.6% in Kinyeto with mean mouth scores of TFI 1.9 (st.dev. 2.1) and 3.3 (st.dev. 2.2) for Sepuka and Kinyeto respectively (Table 1).

In Sepuka most of the teeth were not affected by dental fluorosis and the majority of the teeth which were affected had TFI scores between 1 and 2. In Kinyeto the majority of the teeth were affected with fluorosis and the predominant TFI scores were between 1 and 5. Figure 2 shows the distribution of TFI scores in Kinyeto and Sepuka.

DISCUSSION

More teeth were affected by dental fluorosis in Kinyeto than in Sepuka and higher TFI scores were observed in Kinyeto (Figure 2). Since teeth are not equally exposed to the effect of fluoride an analysis of the prevalence of dental fluorosis was carried out and found different in Sepuka and Kinyeto. Sepuka had lower prevalence of dental fluorosis as compared to Kinyeto. The severity of the condition of mouth TFI scores for each sup-group corresponded to the increasing prevalence of dental fluorosis. The number of subjects with TFI ≥5 was found to be high in Kinyeto lower in Sepuka.

In an attempt to explain the within population variation, which was detected after splitting the population, dietary history and fluoride concentration in magadi samples were used.

The mean weekly frequency of magadi consumption as reported by mothers from this population was 4.5 times (st.dev. 1.4). Fluoride concentration in magadi varied, the median was 112 mg-F/L and 174 mg-F/L, while the mean was 111 mg-F/L and 1160 mg-F/L for magadi collected from Sepuka and Kinyeto respectively. The similar mean and median fluoride concentration in samples obtained from Sepuka indicated that there was little variation in fluoride concentration in the magadi, whereas the mean and median fluoride content in magadi samples from Kinyeto varied markedly.

Thus the results indicate that the relatively low prevalence of dental fluorosis in Sepuka is attributed to the low exposure to fluoride from both water and magadi, while the high prevalence and more severe dental fluorosis observed in Kinyeto is attributed to exposure to magadi with relatively high fluoride concentration.

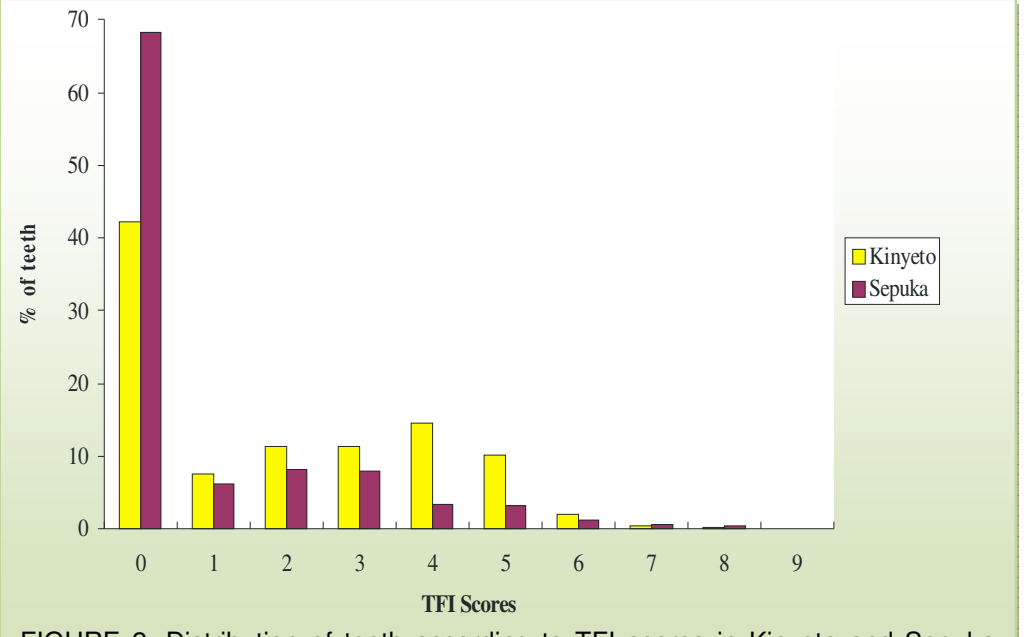

FIGURE 2. Distribution of teeth according to TFI scores in Kinyeto and Sepuka districts of Singida.

The prevalence and severity of dental fluorosis was found to vary between two locations, Sepuka demonstrated low prevalence and severity and Kinyeto was found to have more dental fluorosis both reported by prevalence and severity. The severity correspondingly increased with increase of the prevalence of dental fluorosis.

In conclusion, the TFI has demonstrated the ability to detect variation in fluoride exposure between populations due to its ability to categorize clinical changes of dental fluorosis logically and precisely. By utilizing the TFI it is considered possible to identity variations to fluoride exposure.

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