

Risk Factors of Dental Fluorosis in Thai Children

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SUMMARY: In total 840 school children, age 6-12 years, in two districts of Songkhla province of Thailand are examined for dental fluorosis. The children's drinking water are collected and analysed for the contents of fluoride. The results show that 30.5 % of the selected children had dental fluorosis characterised as preliminary or higher degree, about 4.8 % had dental fluorosis of moderate or higher degree and only few, 0.5 % of the children, had severe dental fluorosis. In parallel 28 % of the children's drinking waters had fluoride concentrations more than the Thai standard of 0.7 mg/L. About 22 % of the drinking waters contained fluoride in concentrations that were more than double the standard and about 15 % of the children's drinking water was more than 3 times the Thai standard. Interviews were conducted and six parameters were case-control analysed for eventual association with the dental fluorosis. This revealed that dental fluorosis prevailing in Thai children was highly associated with the fluoride in excess to this standard, Odds Ratio being 3.49. Also the age of start tooth brushing, the age of start using toothpaste and the habit of eating toothpaste were all found to be moderately associated to the prevalence of dental fluorosis, OR were between 1.8 and 2.9. The relations seem to be significant independent of whether the fluoride concentration in the water was more or less than 0.7 mg/L. Also the type of utilised toothpaste seem to be associated to the prevailing dental fluorosis, however, the association was statistically relatively weak, OR was 0.35 and 0.49, respectively for the high and low fluoride concentrations in the drinking water. The type and the amount of toothpaste used for brushing and the use of other fluoride supplies did not seem to be associated to the prevailing fluorosis.

Key words: Dental fluorosis, risk factors, Thailand, Songkhla province, fluoride occurrence, toothpaste, eating behaviour, fluoride supplements.

INTRODUCTION

Many parts of Thailand, cf. figure 1, are reported to be potentially fluorotic due to geological formations that contain fluorite (fluorspar~CaF₂) and cryolite (NaAlF₃), which in some cases are mined¹. In some areas the fluoride is also in excess in the drinking water and dental fluorosis is endemic. Apart for this "background pollutional exposure" people are using fluoridated toothpaste and other fluoride supplement. The children have their own habits of using the toothpaste and in some cases even to eat it. Literature review shows that factors associated to dental fluorosis as often stated are excessive fluoride in drinking water, the use of fluoride supplement, the use of

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fluoride toothpaste and taking infant formula ². Some study revealed that dental fluorosis in permanent teeth related to the resident in water fluoridation area and the use of fluoride adult toothpaste ³. Other factors related to dental fluorosis in permanent incisors teeth were the use of fluoride toothpaste in children before 14 months and taking fluoride supplement regularly ⁴. While another study that children got fluoride only one source from toothpaste showed that dental fluorosis was related to the use of toothpaste before six years old and the age of start brushing teeth before 2 years old ⁵.

The objective of this study was to identify the risk factors of the dental fluorosis as it prevailed in Thailand.

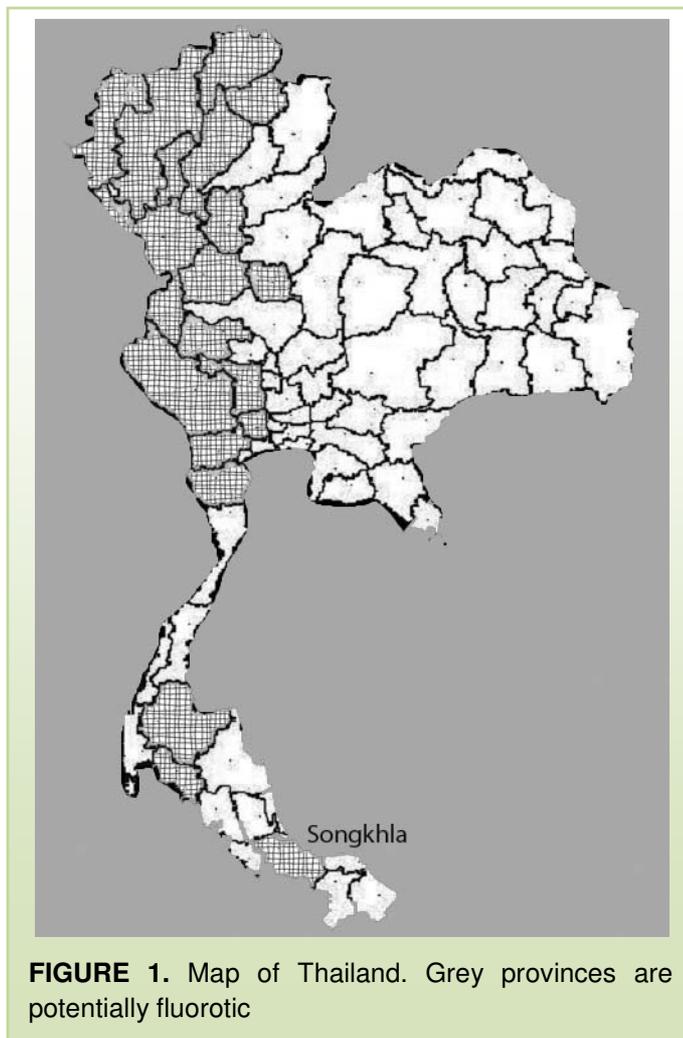


FIGURE 1. Map of Thailand. Grey provinces are potentially fluorotic

MATERIALS AND METHODS

Two districts of Songkhla province in the southern part of Thailand were selected. The study sites were purposively selected according to the number of dental fluorosis cases and variation of fluoride concentration in water supply. In total 840 children in 6 primary schools in the age of 6-12 years were examined by calibrated dentists for dental fluorosis according to modified Dean's Index. The Dean's score 1 was given to cases of preliminary fluorosis instead of to questionable. The children's drinking

water was collected from their respective households and the samples were examined in the laboratory for contents of fluoride using the Orion Selectrode.

The households of the school children were interviewed by trained and standardised workers from the village. In the interview the children's parents or the principal responsible family member was requested to give information about the following:

- Age of start brushing teeth.
- Age of start using toothpaste.
- Quantity of toothpaste use.
- Type of toothpaste; fluoridated, not-fluoridated.
- Toothpaste eating behaviour.
- Use of fluoride supplement i.e. fluoride drops or tablets.

The children who have not been in the community for the last 5 years were sorted out and a case-control analysis was made including 662 remaining children.

RESULTS

Out of the 840 examined children in the two districts of the Songkhla province 256 children had dental fluorosis, indicating a prevalence of 30.5 %. The children were consuming drinking water with a fluoride concentration of 0.02 – 5.45 mg/L. Figures 2 and 3 illustrate the distribution of fluoride in the drinking water samples and the corresponding distribution of fluorosis.

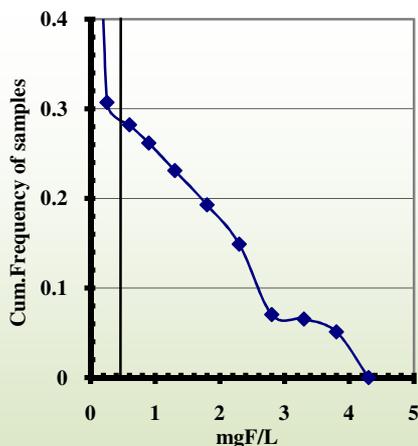


FIGURE 2. Cumulative frequency of drinking water sample versus the fluoride concentration.

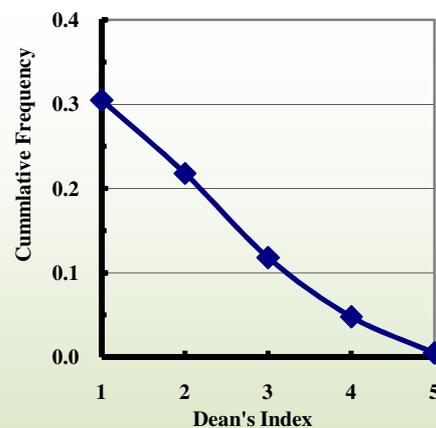


FIGURE 3. Cumulative frequency of dental fluorosis in the school children versus Dean's Index.

TABLE 1. The Odds Ratio, OR, and the 95 % Confidence Interval, CI, for the investigated fluorosis risk factors among Thai Children.

Risk Factor /Criteria	Case	Control	OR	95 %-CI	
Drinking water fluoride					
> 0.7 mg/L	130	101	3.49	2.49-4.89	
≤ 0.7 mg/L	116	315			
Age of start brushing teeth					
> 0.7 mg/L	≤ 2 yrs	60	25	2.61	1.48-4.60
	> 2 yrs	70	76		
≤ 0.7 mg/L	≤ 2 yrs	53	95	1.95	1.26-3.02
	> 2 yrs	63	220		
Age of start using toothpaste					
> 0.7 mg/L	≤ 2 years	47	17	2.79	1.49-5.26
	>2 years	83	84		
≤ 0.7 mg/L	≤ 2 years	37	65	1.8	1.12-2.90
	> 2 years	79	250		
Habit of eating toothpaste					
> 0.7 mg/L	Do	43	30	1.15	0.64-2.08
	Don't	67	54		
≤ 0.7 mg/L	Do	56	95	2.47	1.54-3.96
	Don't	42	176		
Type of toothpaste					
> 0.7 mg/L	Adult T.P.	45	61	0.35	0.20-0.59
	Child T.P.	85	40		
≤ 0.7 mg/L	Adult T.P.	44	174	0.49	0.32-0.76
	Child T.P.	72	141		
Amount of toothpaste					
> 0.7 mg/L	≥ ½ brush	38	20	1.68	0.90-3.13
	¼ brush	88	78		
≤ 0.7 mg/L	≥ ½ brush	33	94	0.94	0.59-1.50
	¼ brush	82	219		
Fluoride supplement					
> 0.7 mg/L	Yes	48	34	0.92	0.40-2.09
	No	20	13		
≤ 0.7 mg/L	Yes	38	79	1.01	0.53-1.90
	No	22	46		

By excluding the children who have not been using the same water for 5 years and those whose parents could not provide required information, the total number of study children was reduced to 662. Among those the dental fluorosis prevalence was 37.2 % and the consumed water had fluoride concentration of 0.02 – 4.38 mg/L. The results of the case-control analysis of the study parameters are shown in table 1.

DISCUSSION

Figure 3 shows that 30.5 % of the selected children had dental fluorosis characterised preliminary or higher degree, about 4.8 % had dental fluorosis of moderate or higher degree and only few, 0.5 % of the children, had severe dental fluorosis. These findings correspond to the occurrence of fluoride in excess to Thai standard of 0.7 mgF/L⁶ in 28 % of the Children's drinking waters, figure 2. About 22 % of the drinking waters contain fluoride in concentrations that are more than double the standard and about 15 % of the children's drinking water is more than 3 times the Thai standard.

It is seen from table 1 that the fluoride concentration in water of 0.7 mg/L was used as a cut point for grouping the subjects in the study. This is in agreement with the Thai Health Department that uses this concentration as a standard for drinking water. The study confirms that dental fluorosis prevailing in Thai children is highly associated with the fluoride in excess to this standard, OR is 3.49 and the 95 % CI 2.49-4.89.

Of the other investigated factors the age of start tooth brushing, the age of start using toothpaste and the habit of eating toothpaste are all found to be moderately associated to the prevalence of dental fluorosis, OR are between 1.8 and 2.9. The relations seem to be significant independent of whether the fluoride concentration in the water is more or less than 0.7 mg/L. Also the type of utilised toothpaste seems to be associated to the prevailing dental fluorosis, however, the association is statistically relatively weak, OR is 0.35 and 0.49, respectively for the high and low fluoride concentrations in the drinking water.

Table 1 shows that the type and amount of toothpaste used for brushing and the use of other fluoride supplies do not seem to be associated to the prevailing fluorosis, OR being between too close to 1 (0.9-1.6).

Thus this study reveals that dental fluorosis does prevail among children in the examined area and that especially the fluoride concentration in the children's drinking water is a strongly related risk factor. Also the age of start tooth brushing, the age of start using toothpaste and the habit of eating toothpaste are all found to be moderately associated risk factors of the prevailing dental fluorosis.

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