

Domestic Defluoridation Using Brick Chips in Sri Lanka

J P Padmasiri *
Sri Lanka

SUMMARY: Dental surveys carried out in the fluoride rich, dry zone areas in Sri Lanka have shown a prevalence of 55 - 71 percent fluorosis. Excessive fluoride in drinking water is found to be the principal causative factor in the development of the fluorosis. Nearly 40 percent of the wells in these areas have fluoride content of more than 1.0 mg/L. Several cases of skeletal fluorosis have been reported from these areas and it has been found that they have been drinking water from wells with a fluoride content of around 6- 8mg/L.

The National Water Supply and Drainage Board in collaboration with several other organisations and community leaders, carried out a fluorosis awareness and defluoridation programme. As an initial step the consumers of wells with fluoride content about 3 mg/L were informed not to use this water for drinking and cooking. They were helped in finding alternative sources.

Since 1994, domestic defluoridators based on brick chips as a medium were introduced to consumers using wells with fluoride content of 1- 3 mg/L. Presently there are about 3000 domestic defluoridators in operation.

There is a marked reduction in the incidence of dental fluorosis of children living in the programme areas.

Key words: Fluorosis, Sri Lanka, defluoridation programme, defluoridator, awareness, sustainability, brick chips, fluoride occurrence.

INTRODUCTION

Recent studies carried out by several groups in Sri Lanka, show that seven out of 24 districts have the fluoride problem, cf. Figure1. In these studies it is revealed that more than 50 percent of drinking water wells in the 7 districts have fluoride levels exceeding 1.0 mg/L. In some of villages more than 70 percent of the wells have exceeded fluoride levels. Some of the village wells have fluoride content of 6-8 mg F/L¹.

A dental survey conducted in 1986² revealed that in five communities in Embilipitiya the community fluorosis index, CFI, ranged from 1.30 in Katalgara to 2.35 in Galvanguwa. Other communities in Anuradhapura where the CFI has been determined are Hidogama 1.89, Galkulama 2.29 and Thalawa 1.85, Chandanapokuna in Polonnaruwa had a CFI of 2.17. Table 1 gives the dental fluorosis data carried out in schools more recently (1996)². The dental fluorosis survey carried out in Trincomale district in 2001, showed 22.5 percent in Gomaramkadawalla 7.5 percent in Kantale³.

* National Water Supply and Drainage Board, Peradeniya, Sri Lanka.
Email: midwater@slt.lk

So far about 3000 defluoridation units based on brick chips as a medium ⁴⁵ have been introduced to rural families in these areas, subject to easy operation and maintenance in order to reduce fluoride contents in the drinking water down to acceptable levels.

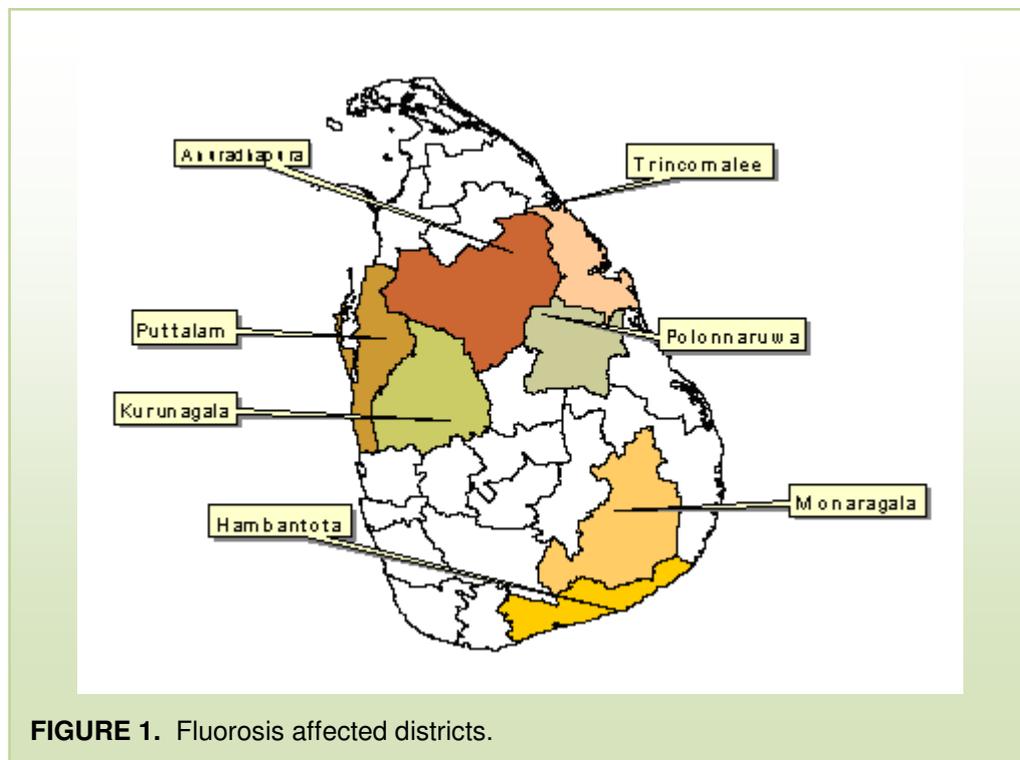
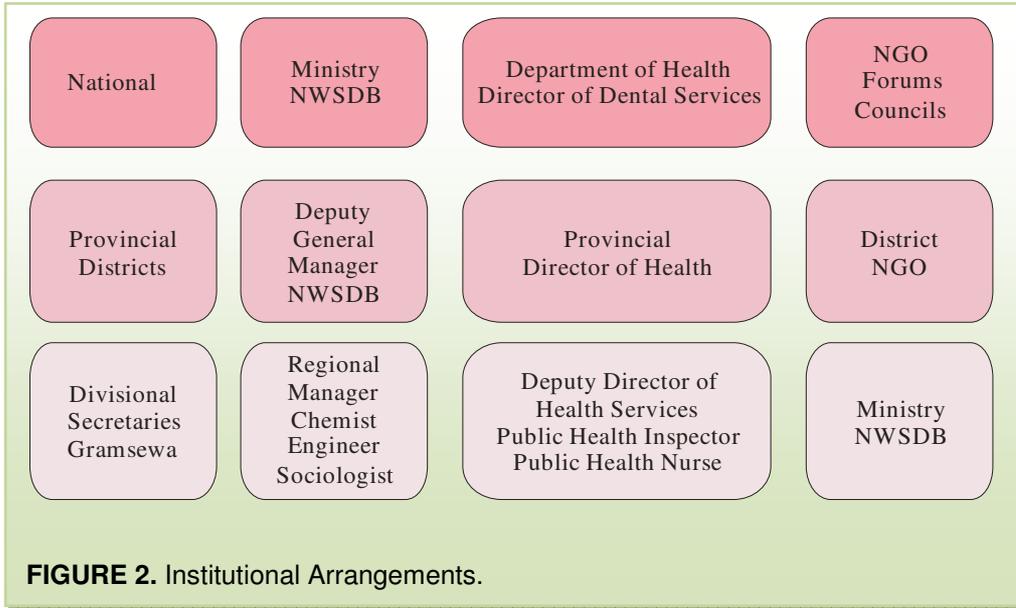


TABLE 1: Dental fluorosis surveys. From Ratnayake, 1996 ².

Location	Number examined	Number of dental fluorosis cases	Percentage affected
Sooriyawewa	2158	546	25.3
Kiri-Ibbanwela	4387	1068	24.3
Mahaweli B,C,H&L	49280	12320	25.0

MATERIALS AND METHODS

Institutional arrangement: A strategy to carry out awareness programmes explaining the gravity of the fluoride problem was adopted at various levels. The institutional arrangements utilised are illustrated in Figure 2.



Awareness programmes: At the divisional/village level school awareness programmes were carried out to educate the students on fluoride in drinking water. Students were requested to bring samples of their drinking water. The fluoride levels of the water samples were measured and the results were discussed.

Further, the primary health care workers carried out similar awareness programmes in the villages. In this programme, once the fluoride levels of the wells are measured, the householders are divided into three categories according to the fluoride content of their wells. The householders using water with fluoride levels less than 1 mg/L were advised to continue using their wells for drinking purposes. Where the fluoride content of the wells was found to be more than 4 mg/L the householders were notified not to use their wells for drinking or cooking purposes. Alternative water sources in the villages were recommended for this category.

Domestic defluoridators: Then the householders using wells with fluoride content of 1 - 4 mg/L, and who have children of the age group less than 4 years, were provided with domestic defluoridators, Table 4.

Fluoride mapping: The obtained fluoride data were further used in the fluoride mapping and future reference, Table 2 and 3.

TABLE 2 Fluoride content of examined wells in Anuradhapura District, 1998/2003.

Divisional Secretary Division	Examined wells No	% of wells with indicated fluoride levels		
		< 1.0 mg/L	1.0 - 2.0 mg/L	> 2.0 mg/L
Padaviya	142	90.9	9.1	0
Medawachchiya	64	60.9	39.1	0
Galenbidunawewa	311	63.7	32.5	3.8
Mihintale	210	53.8	36.2	10.0
Ipalogama	350	52.6	33.1	14.3
Rajangane	473	52.0	38.1	9.9
Kekirawa	1052	47.4	34.7	17.9
Thalawa	276	45.6	43.5	10.9
Nuwaragam P. Central	255	41.9	47.5	10.6
Nachchaduwa	225	41.4	40.4	18.2
Kebitigollewa	210	40.0	46.7	13.3
Thirappane	141	39.7	36.9	23.4
Nuwaragama. P East	164	33.5	53.0	13.4
Thambuttegama	569	32.9	32.0	35.1
Nochchiyagama	138	30.5	23.2	46.3
Palagala	471	28.9	38.6	32.5
Maha Villachchiya	46	28.3	47.8	23.9
Kahatagasdigiliya	209	27.7	49.3	23.0
Galnewa	265	18.5	41.5	40.0
Rambewa				
Horowpathana		Samples were not analysed		
Palugaswewa				

TABLE 3: Fluoride content of wells in Pollonnaruwa District 1998/2003.

Divisional Secretary / Division	Examined Wells No	% of wells with indicated fluoride levels		
		< 1.0 mg/L	1.0 -2.0 mg/L	> 2.0 mg/L
Elahera	16	75.0	25.0	-
Hingurakkgodu	127	44.0	46.0	10.0
Medirigiriya	327	41.9	48.9	9.2
Thamankaduwa	490	37.4	42.2	20.4
Lankapura	194	26.3	44.3	29.4
Dimbulagala	Samples were not analysed			
Welikanda				

RESULTS AND DISCUSSIONS

Fluoride occurrence: Table 2 shows the fluoride content of wells in 19 divisional secretary divisions in Anuradhappura district. Column 3 in the table shows the percentage of wells with fluoride content less than 1.0 mg/L, considered suitable for human consumption. In Padeviya and Medawachchiya fluoride contents of all the wells were less than 2.0 mg/L. Ninety percent of the wells in Padaviya contained acceptable amount of fluoride i.e. less than 1.0 mg/L. On the other hand 46.3 percent of wells in Nochchiyagama were found to have fluoride content of more than 2.0 mg/L. The maximum fluoride content in Nochchiyagama was 8.0 mg/L. In Galnewa, Thambuttegama and Palagala, respectively 40.0, 35.1 and 32.5 percent of wells were found to have fluoride content of more than 2.0 mg/L. The maximum fluoride content in these areas was found to be 6.5 mg/L. More than 50 percent of wells in 13 divisional secretary divisions contain fluoride levels higher than the acceptable level of 1.0 mg/L. In Keekirawa, considering the fact that several skeletal fluorosis cases have been reported, more than 1000 water samples were analysed. Several wells with fluoride content of 6-8 mg/L were thus identified and rejected for drinking and cooking use.

Table 3 shows the fluoride content of wells in 5 divisional secretary divisions in Pollonnaruwa district. 75 percent of wells in Elaherea contained acceptable amount of fluoride less than 1.0 mg/L. In Lankapura and Thamankaduwa, respectively 29.4 and 20.4 percent of the wells were found to be more than 2.0 mg/L.

TABLE 4: Number of distributed domestic defluoridators in 1994-2003.

District	Divisional Secretary division	No
Anuradhapura	Palagala, Galnewa. Kekirawa, Thalawa.	1500
	Kebitigollawa. Gallenbidunuwewa.	
	Thambuttegama. Nochchiyagama	
Pollonnaruwa	Athumlapitiya. Parakrama Samudraya.	500
	Kalahagala. Dakunuela. Patanagama	
Kurunegala	Giribawa. Girillea. Nikarawetiya	500
Puttalam	Karuwalagaswewa	50
Moneragala	Hambegamuwa. Thanamalvila. Balahuruva	350

Achieved benefits: Since 1994 about 3000 domestic defluoridators have been distributed in the affected areas, cf. Table 4. Already in some areas the benefits of the defluoridation programme has been achieved. Thus in villages with defluoridation programmes, there is a low incidence of dental fluorosis in the new generation who reached the age of 7-8 years.

Gained experiences: The salient features observed in this programme are as follows:

- Alternative sources were identified for the wells with high fluoride content of 4-8 mg/L in these areas.
- Musalpitiya in Thambuttegama was identified as fluoride rich area. The water supply in Thambuttegama was extended to this area thus providing low fluoride water.
- At Galewela while the housewife was in Middle East, the husband carried out the defluoridation work in the house.
- Housewife returned from Middle East completely discarded the unit because bricks were used as the filter medium.
- When the husband was in the war front the housewife in Olukarade did the defluoridation and both her children had milky white teeth.
- The low-income groups, who live in daub and wattle houses, carried out the defluoridation.
- Drama and poetry contest was held in Palagala organized by Rajarata Praja Kendaraya to motivate the beneficiaries to use the defluoridators.
- NGOs, such as Rajarata Praja Kendraya in Kekirawa, Janodaya in Thambuttegama, Manava Prabode Padanama in Kahatagasdegiliy, World Vision in Galenbidunuwewa and Sri Lanka Environmental Journalist Forum, helped in this programme.
- Education department helped in carrying out awareness programme in schools.
- Health department helped in all possible ways to initiate and follow up defluoridation programme in villages.
- Though the mother is seriously affected with dental fluorosis, she was not motivated to feed her children with defluoridated water.
- A Teacher by profession, who obtained a defluoridator, used the filter as a step in a partly constructed house.

CONCLUSION

This study shows that the awareness of the fluorosis problem in Sri Lanka can be enhanced thorough proper publicity. It is essential to carry out awareness programmes and further follow up services in order to achieve sustainability. The joint efforts of the National Water Supply and Drainage Board, the Department of Health, Non Government Organizations, the Department of Education and the community leaders are essentially needed in order to eradicate fluorosis from Sri Lanka.

REFERENCES

6. Padmasiri JP. Low cost domestic defluoridation to prevent dental fluorosis in Sri Lanka. *Journal of the Geological Society of Sri Lanka* 1998;7:59-70
7. Ratnayake I. Fluorosis in the settlement schemes. A cause for concern. 52nd Annual sessions- Sri Lanka Association for the advancement of Science p.27-47 – Nov 1996.
8. Lappague J: Evaluation of the risk of dental fluorosis in Trincomalee district. *Action contre la Faim, Trincomalee* 2001. Project Report.
9. Padmasiri JP. Effectiveness of domestic defluoridator in preventing fluorosis in Kekirawa, Sri Lanka. In: *Proceedings of the 3rd International workshop on fluorosis and defluoridators water*, P. 91-96. Eds. E Dahi, S Rajchagool S & N Osiriphan, 2000 November 20-24, Chiang Mai, Thailand. ISFR, EnDeCo & ICOH, Chiang Mai.
10. Padmasiri, JP. Low cost domestic defluoridation. In: *Proceedings of the 2nd workshop on fluorosis and defluoridation of water*, P. 146-155. 1997 Nov. 19-22. Nazreth Ethiopia. Eds. E Dahi & H Bregnhøj. Intern. Soc. Fluoride Res. Dunedin.