Dental fluorosis in domestic animals

High fluoride level in drinking water causes different kinds of toxicosis in humans and animals[1]. One of these, dental fluorosis, characterized by enamel mottling appears clinically at the maximum permissible level of fluoride, i.e. 1.5 ppm in drinking water[2]. However, some workers[3–5] observed this dental deformity in human beings residing in provinces where drinking water contained fluoride below the maximum permissible level (<1.5 ppm). Different forms of dental fluorosis in mature and immature domesticated animals have not been extensively studied[6,7], and these have been observed only in animals inhabiting areas with high level (>1.5 ppm) of fluoride in drinking water[8]. The present investigation was undertaken to observe different forms of enamal mottling in mature and immature domestic animals consuming water containing fluoride below the maximum permissible level.

For the present investigation, three villages, namely Baroda, Kheda and Manpur in Udaipur District, Rajasthan[9] were selected, which showed fluoride below (1.0 ppm) the maximum permissible level (1.5 ppm) in their drinking water sources, hand pumps and bore wells[5]. Dental fluorosis was observed only in native, mature and immature domestic animals (cattle and buffaloes), who had been in these villages from birth. For this, house-to-house surveys were made in the early morning and late evening when the animals are generally available, and in herds during daytime.

Among the 75 calves (<1 year of age), 172 adult cattle and 116 adult buffaloes of either sex, 32 (42.66%), 53 (30.81%) and 40 (34.48%) respectively, were found to be affected with varying degrees of enamel mottling (Figure 1). In calves dental fluorosis appeared only as light to deep yellowish, striated, horizontal lines starting from the base of teeth (Figure 1 *a* and *b*). But in mature animals, dental fluorosis also appeared as deep yellow, fine dots or granules scattered on enamel surface of the anterior teeth. Few mature buffaloes also showed deep black dental fluorosis instead of yellowish, striated, horizontal lines. In most of the mature animals dental fluorosis appeared as diffused forms (hypoplasia) instead of its sharp visualization as in the case of calves. With increasing age of these mature animals the teeth were affected with excessive abrasion (Figure 1 *c* and *d*).

The relatively higher prevalence of dental fluorosis in calves is related to their greater sensitivity and susceptibility and less tolerance to fluoride[10]. Also, they ingest more fluoridated milk and water, and thus have a greater chance of exposure to fluoride. Excessive abrasion of the teeth in older animals was probably due to long exposure to fluoride[6]. However, appearance of dental fluorosis in the form of yellowish, scattered, fine dots or granules as well as blackening of the enamel surface of teeth is not yet clearly understood. The present findings also indicate that fluoride toxicity can appear below the maximum permissible level of fluoride in drinking water and is under the control of certain biological and non-biological factors[6]. Therefore, to ensure the correct assessment of possible fluoride intoxication in different age groups of various animal species in the natural ecosystem where the animals ingest fluoride from water and food, more field investigations and surveys are needed. However, the present findings significantly add to the existing knowledge on fluoride toxicity.

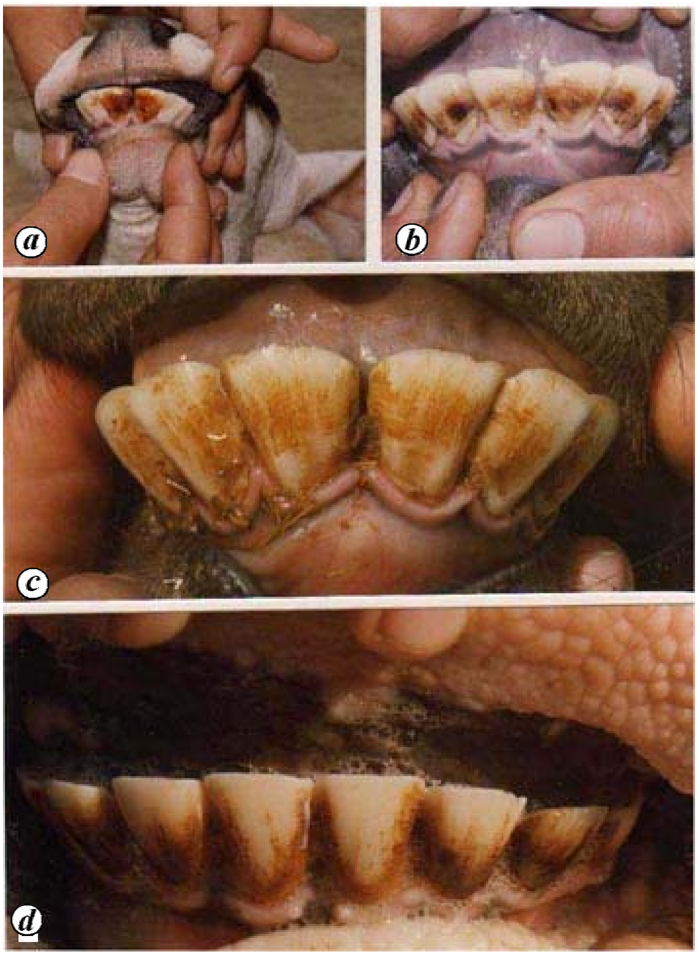

Figure 1. Different grades of dental fluorosis in calves (***a***, ***b***) and mature animals (***c***, ***d***).

1. Choubisa, S. L., *Int. J. Environ. Stud.*, 1999, **56**, 703–716.
2. WHO, Report, World Health Organization, Geneva, 1970, p. 273.
3. Venkaleswarla, P., Rao, D. N. and Rao, K. R., *Indian J. Med. Res.*, 1952, **40**, 353–362.
4. Ray, S. K., Ghosh, S., Nagchauduri, J., Tiwari, I. C. and Kaur, P., *Fluoride*, 1981, **14**, 86–90.

5. Choubisa, S. L., Technical Report, Ministry of Environment and Forests, Government of India, New Delhi, 1996.
6. Choubisa, S. L., *Vet. Res. Commun.*, 1999, **23**, 457–465.
7. Swarup, D. and Dwivedi, S. K., Report, Indian Council of Agricultural Research, New Delhi, 2002.
8. Choubisa, S. L., *Int. J. Environ. Stud.*, 2007, **64**, 151–159.
9. Choubisa, S. L., *J. Environ. Biol.*, 1998, **19**, 341–352.
10. Shupe, J. L., *J. Anim. Sci.*, 1980, **51**, 746–758.

ACKNOWLEDGEMENTS. I thank the Ministry of Environment and Forests, Govt of India for financial assistance. I also thank Drs D. K. Choubisa and Karun Sompura for technical assistance.

Received 26 November 2007; revised accepted 6 November 2008

S. L. CHOUBISA

Department of Zoology,
Government Post Graduate College,
Sirohi 307 001, India
e-mail: choubisasl@yahoo.com

Sinking of ancient Talakad temples on the Kaveri Bank, Mysore Plateau, Karnataka

Devotees and pilgrims periodically notice underneath cover from a mass of riverine sand of the Kaveri river, a temple complex dating back to the times of the Ganga, the Chola, the Hoysala, and the Vijayanagar kingdoms – from the 6th century AD to the later part of the 17th century AD[1,2]. What is remarkable about these structures is that some of the temples built during the Hoysala period (about 1200 AD) are nearly 20 m below the present level of riverine sands[2]. While Srikantia and Anantharamulu[1] attributed their burial under the sand to the lowering of water level in the pointbar deposits of sand near Old Talakad (and the monsoon wind that blew from SW to NE, depositing the sediments over the temples) due to diversion of the Kaveri water through a canal that was constructed in 1336 AD by the Vijayanagar minister Madhavamantri, Ganeshaiah[2] regards the burial of the temple complex as a consequence of 'eco-disaster consequent to development activity (construction of a dam)' following accumulation of sand that began towards the end of the 16th century.

The present author's extensive fieldwork in the Kaveri basin, including the Talakad reach of the river[3–5], shows that the Talakad temple complex of historical antiquity sank as a consequence of subsidence of the ground resulting from movement on an active NNE–SSW oriented fault that passes through the right bank of the Kaveri opposite Talakad (Figure 1).

Talakad, on the left bank of the Kaveri, sits on 5–7 m thick deposit of a lake that stretched tens of kilometres upstream of Kollegal (Figure 2) and had submerged the valleys of the Kaveri, the Kabini, the Shimsha and the Suvarnawati[3,4]. The lake was formed in the Later Quaternary more than 26,500 years ago and lasted until about 4900–5300 yrs BP, as indicated by dating of the lake sediments at Vaddarakuppe, Murugu and Chelukavadi[3–5]. The river blockage followed the uplift of the Biligirirangan Hills (Figure 2) to the east along the active N–S trending Kollegal Fault[4,5].

The palaeolake is represented by flat plains of limited extent in the undulating terrain made up of 5–7 m thick deposits of black carbonaceous clays, characterized by prolific nodules of calcareous concretions. The lacustrine plains are used for intensive cultivation of paddy and sugar. Near the river channels, the lacustrine clays are overlain by and inter-

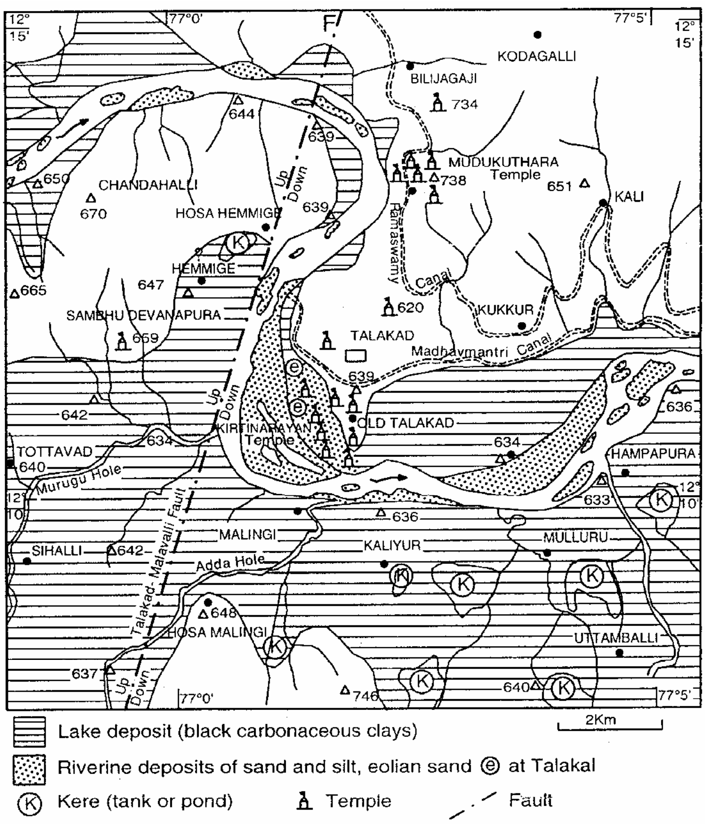

Figure 1. Map of a part of the Kaveri basin showing the abrupt turning south-southwestwards of the Kaveri along a NNE–SSE trending fault, accumulation of large volumes of sand and silt as pointbar deposit at the lower bend of the river, and the eolian sand and silt surrounding and covering the Talakad temples (after Valdiya and Rajagopalan[3], and Valdiya[4]).