

FLUOROSIS IN DROMEDARY CAMELS IN RAJASTHAN, INDIA

SL Choubisa^a

Udaipur, India

SUMMARY: Natural occurrence of fluorosis was observed in a survey of 18 domesticated dromedary camels (*Camelus dromedarius*) living in fluoride (F) endemic areas of the Dungarpur district, Rajasthan, India. Among these camels, 15 were mature (up to 12 years old), and 3 were immature or calves (below age 3). The mean F concentration in the drinking water of these areas ranged between 1.4 and 3.3 ppm. Eight (44.4%) of these camels were afflicted with mild to severe dental fluorosis. Front (incisors) and upper cheek teeth were light brown to deep yellow in color. Irregular wearing of teeth was found, however, only with severe dental fluorosis. Three (16.7%) of the mature camels also showed periosteal exostoses, moderate intermittent lameness, and hardening of tendons in the legs as pathognomonic signs of skeletal fluorosis. In these camels colic was common, and abortions, irregular estrus cycles, and stillbirths were also noted in female camels (camela). However, the severity of F toxicity in camels was found less in comparison with other domestic animals of same F endemic areas. To the best of my knowledge, *endemic chronic F intoxication in camels in the form of dental and skeletal fluorosis has not been reported previously.*

Keywords: *Camelus dromedarius*; Chronic fluoride intoxication; Dental and skeletal fluorosis, Dromedary camels; Rajasthan, India.

INTRODUCTION

Chronic fluoride (F) intoxication or fluorosis, is a world-wide health problem and is endemic in areas where the F content of the drinking water is relatively high. Its primary manifestations in humans and mammals are mottling of teeth and osteosclerosis of the skeleton.¹⁻⁶ In India, although many states are endemic for fluorosis, F intoxication in dromedary camels (*Camelus dromedarius*) does not appear ever to have been reported. In the state of Rajasthan, these animals are commonly found in the sandy plain region (Thar Desert) of western Rajasthan and are also restricted mainly in numbers to the hilly (Arawali) region of the southern part of Rajasthan.

Since Rajasthan is hyperendemic for fluorosis in cattle, buffaloes, sheep, goats, horses, and donkeys,⁷⁻¹⁰ I considered it of interest to investigate F intoxication in camels, especially those living in southern Rajasthan.

MATERIALS, METHODS, AND BACKGROUND

During a recent cross-sectional survey of osteo-dental fluorosis in various species of domestic animals in F endemic areas of the Dungarpur district of southern Rajasthan, India, 15 mature camels (*Camelus dromedarius*) between 3 and 12 years of age) and three immature camels under 3 years of age were examined. These animals were found resting in the agriculture fields of the Ghataudhani village of Dungarpur district. The mean F concentration in the drinking water sources ranged from 1.4 to 3.3 ppm.^{11,12}

^aFor correspondence: Dr SL Choubisa, Associate Professor and Head, Post Graduate Department of Zoology, Government Meera Girls College, Udaipur-313001, India; E-mail: choubisasl@yahoo.com

Relevant information about these animals such as age, medical history, and source of F intake or exposure other than drinking water was also collected. Simultaneously, three buffalo calves resting together with these camels were also examined for further confirmation of chronic F intoxication. In the absence of urinary and blood analyses, identification of dental and skeletal fluorosis in these animals was based on clinical examination only.

Background: All these mature camels living for the last four to six years in the F endemic areas of Dungarpur district were purchased from elsewhere, but the immature camels were born and lived since birth in these areas. Generally, herds of these camels move from one place to other in F endemic areas, but their drinking water sources are hand pumps and dug wells and occasionally pond water. No other source of F exposure was found.

OBSERVATIONS AND DISCUSSION

Dental fluorosis: Of the 15 mature and 3 immature camels, 6 (40.0%) of the former and 2 (66.7%) of the latter were afflicted with varying degrees of dental fluorosis. Enamel of mandibular and maxillary teeth was bilaterally and vertically stained brown to deep yellow in color (Figure 1).

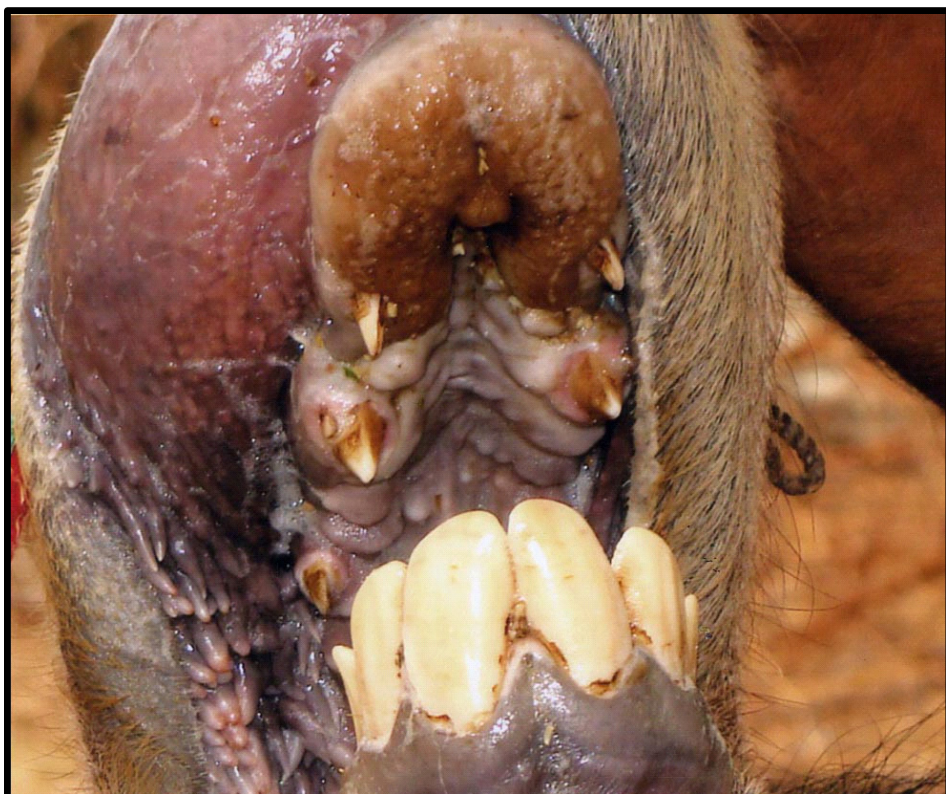


Figure 1. Front mandibular teeth and upper cheek teeth of 11-year-old male dromedary camel (merea) showing mild and severe dental fluorosis, respectively. Incisors show homogenous and vertical light yellowish discoloration, hypoplasia, and fine dots/spots on enamel surface.

In one of the immature camels, scattered deposition of fine light to deep yellowish spots on the enamel surface of the central incisors was also observed (Figure 2).

Figure 2. Teeth of 6-year-old female camel (camela) showing severe dental fluorosis characterised by deep yellowish discoloration, diffused to well-marked spots (central incisors), and irregular wearing. Recession of teeth-supporting bone with recession and bulging of gingival tissue is also present. (Figure is slightly out of focus.)



None of these camels showed well defined condensed, horizontal, stratified brown to yellowish lines on their incisor teeth as found in buffalo calves (Figure 3) living in the same F endemic area or village. Such dental fluorosis has been observed

and reported mostly in cattle and buffalo as well as in human beings.⁶⁻⁸ However, the appearance of dental fluorosis in camels is similar to dental fluorosis in horses and donkeys,¹⁰ but not in cattle, mature buffaloes, or humans. The reason for this difference is not clear.



Figure 3. Mandibular incisor teeth of 6-month-old buffalo calf showing moderately severe dental fluorosis characterised by bilateral, horizontal, condensed and stratified light to deep yellowish discoloration. This appearance of staining is different from dental fluorosis in camels (Figures 1 and 2).

Skeletal fluorosis: Of the 15 mature camels only 3 (20.0%) revealed evidence of skeletal fluorosis. On careful palpation of mandibular, scapular, tarsal, metatarsal, carpal, and cage regions of these camels, diffuse to well marked bony lesions (periosteal exostoses) were found (Figure 4).

Figure 4. Hind legs of 11-year-old male camel showing diffused to well marked bony lesions (periosteal exostoses) on the femoral, fibular, tarsal, and metatarsal regions. This camel also had dental fluorosis (Figure 1).

In these animals mild to moderate intermittent lameness, especially in hind legs, stiffness of leg tendons, and wasting of main mass of hind quarters were also observed. Other signs of F intoxication, as reported in other animals,¹³⁻¹⁷ included colic, intermittent diarrhoea,

and gas formation, together with impaired reproduction, abortions, stillbirths, and irregular estrus cycles in female camels. In general, these animals were weak bodied, indolent, and reluctant to stand (Figure 5). Such conditions were also found in other animals such as buffalo calves (Figure 6) living together with these camels.

The presence of these pathognomonic signs of chronic F intoxication in these camels is further supported by the presence of dental and skeletal fluorosis in other animals living together with them. However, the severity of fluorosis in the camels appears to be less than in these other animals in the same F endemic areas. Possibly, differences in sensitivity to toxic effects of F in the frequency of F intake are involved. Camels are well adapted to desert ecosystems and can survive more than 30 days without water. Secondly, the basic food of these camels is tree leaves, pods, and fruits that are likely to be low in F, but may be rich in calcium and ascorbic acid (not analysed). Both calcium and ascorbic acid have been found to reduce the F toxicity.^{1,18-20} Although various factors besides the amount of F intake are known to affect F intoxication,^{21,22} it is unlikely there is a major difference in susceptibility or tolerance to F toxicity between camel species (*C. dromedarius*) and other species of domestic animals, e.g., *Bos taurus* (cattle), *Bubalus bubalis* (buffalo), *Ovis aries* (sheep), *Capra hirus* (goat), *Equus caballus* (horse), and *E. asinus* (donkey).





Figure 5. Emaciated 11-year-old male camel with dental fluorosis shown in Figure 1 and periosteal bone effects shown in Figure 4. Note wasted thigh and shoulder muscles and bulging lesions on posterior region of the mandible and lacrimal bones.



Figure 6. Emaciated 6-month-old buffalo calf affected with severe dental fluorosis shown in Figure 3. Note wasted body muscles and evidence of diarrhoea.

The significance of the present study is that *it reports, for the first time, in the scientific literature, evidence of natural chronic F toxicity in dromedary camels.* These findings also add and contribute significantly to the present knowledge of F toxicosis in animals.

ACKNOWLEDGEMENTS

I thank the University Grants Commission, New Delhi, India for financial aid (No.F.34-466/2008,SR). The author is grateful to Dr Zulfiya Sheikh, Assistant Professor of Zoology, and Mr Pushkar Mali, Research Fellow, for their assistance. The author is also greatly indebted to the reviewers and editor Professor Emeritus AW Burgstahler for their valuable suggestions.

REFERENCES

- 1 World Health Organization. Fluorides and human health. Monograph series No. 59. Geneva: World Health Organization; 1970.
- 2 Choubisa SL, Choubisa DK, Joshi SC, Choubisa L. Fluorosis in some tribal villages of Dungarpur district of Rajasthan, India. *Fluoride* 1997;30:223-8.
- 3 Choubisa SL, Choubisa L, Choubisa DK. Endemic fluorosis in Rajasthan. *Indian J Environ Hlth* 2001;43:177-89.
- 4 Choubisa SL. Endemic fluorosis in southern Rajasthan, India. *Fluoride* 2001;34:61-70.
- 5 Choubisa SL. Chronic fluoride intoxication (fluorosis) in tribes and their domestic animals. *Int J Environ Stud* 1999;56:703-16.
- 6 Choubisa SL. Some observations on endemic fluorosis in domestic animals in Southern Rajasthan (India). *Vet Res Commun* 1999;23:457-65.
- 7 Choubisa SL. Fluoridated ground water and its toxic effects on domestic animals residing in rural tribal areas of Rajasthan (India). *Int J Environ Stud* 2007;64:151-9.
- 8 Choubisa SL. Dental fluorosis in domestic animals. *Curr Sci* 2008;95:1674-5.
- 9 Choubisa SL, Mali P. Fluoride toxicity in domestic animals. In: Dadhich L, Sultana F, editors. *Proceedings of the National Conference on Environmental Health Hazards; 2009 Dec 17-18; Kota, Rajasthan, India.* 2009. p.103.
- 10 Choubisa SL. Osteo-dental fluorosis in domestic horses and donkeys in Rajasthan, India. *Fluoride* 2010;43:5-12.
- 11 Choubisa SL, Sompura K, Choubisa D, Pandya H, Bhatt SK, Sharma OP, et al. Fluoride content in domestic water sources of Dungarpur district of Rajasthan. *Indian J Environ Hlth* 1995;37:154-60.
- 12 Choubisa SL. An epidemiological study on endemic fluorosis in tribal areas of southern Rajasthan [a technical report]. New Delhi: Ministry of Environment and Forests. Government of India; 1996.
- 13 Udall DH. *The practice of veterinary medicine.* Ithaca, New York: Udall DH;1954.
- 14 Swarup D, Dwivedi SK. Environmental pollution and effects of lead and fluoride on animal health. New Delhi: Indian Council of Agricultural Research; 2002.
- 15 Burgstahler AW, Freeman RF, Jacobs PN. Toxic effects of silicofluoridated water in chinchillas, caimans, alligators, and rats held in captivity. *Fluoride* 2008;41:83-8.
- 16 Spittle B. Fluoride and fertility [editorial]. *Fluoride* 2008;41:98-100.
- 17 Long H, Jin Y, Lin M, Sun Y, Zhang L, Clinch C. Fluoride toxicity in the male reproductive system. *Fluoride* 2009;42:260-76.
- 18 Teotia SPS, Teotia M, Singh DP. Bone static and dynamic histomorphometry in endemic fluorosis. In: Tsunoda H, Yu M-H, editors. *Fluoride research 1985, Studies in environmental science, Vol. 27 [proceedings of the 14th conference of the International Society for Fluoride Research; 1985 Jun 12-15; Morioka, Japan].* Amsterdam: Elsevier Science Publisher B.V.; 1986. p. 347-55.
- 19 Chinoy NJ. Effects of fluoride on some organs of rat and their reversal. *Proc Zool Soc (Calcutta)*. 1991;144:11-5.
- 20 Chinoy NJ, Reddy VVPC, Michael M. Beneficial effects of ascorbic acid and calcium on reproductive functions of sodium fluoride-treated prepubertal male rats. *Fluoride* 1994;27:67-75.
- 21 Choubisa SL, Choubisa L, Choubisa D. Osteo-dental fluorosis in relation to nutritional status, living habits, and occupation in rural tribal areas of Rajasthan, India. *Fluoride* 2009;42:210-15.
- 22 Choubisa SL, Choubisa L, Choubisa D. Osteo-dental fluorosis in relation to age and sex in tribal district of Rajasthan, India. *J Environ Sci Eng* 2010; 52:199-204.