Haya: The Saudi Journal of Life Sciences **ISSN 2415-623X (Print)**
Scholars Middle East Publishers **ISSN 2415-6221 (Online)**
Dubai, United Arab Emirates
Website: http://scholarsmepub.com/

Dental Fluorosis in Domesticated Animals in and Around Umarda Village of Udaipur, Rajasthan, India

Lalita Panchal[1], Zulfiya Sheikh[2*]
[1]Research Scholar, Department of Zoology, Govt. Meera Girls College, Udaipur- 13001, Rajasthan, India
[2]Lecturer, Department of Zoology, Govt. Meera Girls College, Udaipur- 313001, Rajasthan, India

***Corresponding author**
Zulfiya Sheikh

Article History
Received: 21.10.2017
Accepted: 25.10.2017
Published: 30.10.2017

DOI:
10.21276/haya.2017.2.7.3

Abstract: Fluoride is a double edged weapon. It is needed for development of bones and teeth but intake in excess amount is very harmful for humans, animals and plants. Udaipur region is endemic to fluoride and a large number of animals are afflicted with fluorosis. Therefore, a survey was done to assess dental fluorosis in domesticated animals in and around Umarda village of Udaipur, Rajasthan. Cattle (*Bos taurus*), buffaloes (*Bubalus bubalis*) and goats (*Capra hircus*) were selected for the present study. The study revealed that domestic animals had varied degree of dental lesions. Patchy discoloured enamel, receding gums, erosion of teeth with exposed cementum and defective mastication were prominent in animals. Older age animals showed more severe symptoms like total abrasion and loss of teeth, due to long time exposure to fluoride. Severe dental fluorosis was expressed by 44% cattle, 43% buffaloes and 26.9% goats out of 2320 animals.
Keywords: Buffaloes, Cattle, Dental fluorosis, Fluoride, Fluoride toxicity, Goats

INTRODUCTION

Fluorine is a trace element and has a significant role in the development of body. Excess fluoride causes fluorosis in animals and human beings. Major sources of fluoride intake in animals are fluoride contaminated drinking water and fodder. But it can also enter in the body through inhalation of fluoride contaminated air containing gases, fumes and dust emitted from various industries. Groundwater is overexploited in rural regions of India for irrigation and drinking purposes.

Environmental contamination by industrial effluents and gases containing fluorides exert hazardous effects on vegetation, animals and human beings. Fertilizer factories and factories which are producing phosphoric acids are main anthropogenic sources of fluoride. Wastes from these factories are rich in fluoride and can contaminate water, air and soil [1, 2]. Plants grown in the vicinity are also contaminated by fluoride emitted from the industries and act as an additional source of fluoride intake [3, 4].

Excess amount of fluoride in groundwater causes dental and skeletal fluorosis in animals. Staining, irregular enamel pits, patches, receding gums, exposed teeth roots and abnormal wearing of teeth are common symptoms of dental fluorosis [5-7]. Severely affected animals may show abrasion of enamel, loose tooth, fragile and damaged teeth, and total loss of teeth. In these severe conditions animals feel difficulty in mastication and show lack of interest in food intake. It leads to dullness and weakness in animals [8-10].

According to WHO [11], the maximum permissible limit of fluoride in drinking water is 1.5 ppm and highest desirable limit is 1.0 ppm. Fluorosis is a serious health issue in many countries including India. The available data suggest that 19 states in India are endemic to fluorosis [12]. High fluoridated ground water has been reported in various districts of Rajasthan like Ajmer, Barmer, Bharatpur, Bhilwara, Bikaner, Churu, Dungarpur, Jaipur, Jodhpur, Jhunjunu, Kota, Pali, Nagaur, Sikar, Sirohi, Tonk and Udaipur. Tehsils of Udaipur that have fluoride content more than 1.5 ppm are Mavli, Salumbar and Sarada [13].

Therefore the study was planned to assess dental fluorosis in domestic animals in Umarda village of Udaipur, which is surrounded by many phosphate fertilizer factories and brick works.

MATERIALS AND METHODS

For the present study Umarda village was selected which is situated around 15 kms away from Udaipur city. The village is surrounded by many phosphate fertilizer factories and brick works. Cattle *(Bos taurus*), buffaloes (*Bubalus bubalis*) and goats (*Capra hircus*) were selected for the present study. Both immature and mature animals were examined for signs of dental fluorosis. Door to door surveys were made in early mornings and late evening when animals were

generally available. For dental fluorosis anterior teeth of these animals were examined. Teeth colour, staining, pits, lines, patches, different stages of enamel mottling, swollen gums and abruptions were observed carefully. At the same time their food habits, appetite, diarrhea, food supply and water sources were also asked from the owners.

RESULTS AND DISCUSSION

In 2016 a survey was done for the assessment of dental fluorosis in and around Umarda village, Udaipur (Rajasthan). Dental fluorosis was observed in cattle, buffaloes and goats. In the village mainly ground water is used for drinking purpose and same is used for animals. Total 2320 animals were observed for dental fluorosis. Out of 2320 animals 769 cattle, 556 buffaloes and 995 goats were observed. Animals were divided into different age groups for the convenience of the study.

Table 1: Dental fluorosis in cattle

Age group	No. of animals	Mild to moderate	Severe
<1 year	153	104 (68%)	-
1-4 years	334	173 (51.8%)	161 (48.2%)
>4 years	282	105 (37.2%)	177 (62.8%)
Total	769	382 (49.7%)	338 (44%)

*Numbers in parenthesis indicate percentage

Table 1 shows dental fluorosis in cattle of different age group of either sex. Among the age group of less than 1 year, 153 calves were examined and 68% were found affected with dental fluorosis ranging from mild to moderate. Incisors were stained yellowish brown. Horizontal streaks on base of the front and middle incisors were also observed (Figs. 1).

Fig-1: Showing yellow to brownish stained incisors in cattle calves

Although period of exposure to fluoride in young stage was very low as compared to adults but dental fluorosis may also be associated with milk as calves consume milk and gerenerally depend on mother for their food. This indicates that fluoride may be transmitted to calves through mother's milk. Hobbs [14] observed that there was a little transfer of fluoride to young calves by way of maternal milk. Dental fluorosis in calves of less than one year age is probably due to additional intake of fluoride through ground water and fodder, which is grown on fluoride contaminated soil. Fluoride emitting industries act as an additional source of fluoride. The effects of fluoride on developing teeth and bones are enhanced by the short term exposure to high levels of fluoride intake. Dental lesions occur when excessive amounts of fluoride are ingested during the period of tooth formation and calcification [15].

In the age group of 1-4 years, 334 cattle were observed for dental fluorosis and 48.2% of the animals exhibited severe dental fluorosis. Mottled enamel was one of the common symptoms in animals. Patchy brownish to black stained teeth were also observed in animals. Staining was blotchy and darker in colour. Receding gums were also quite noticeable (Figs. 2). Discolouration and difficulty in mastication were also observed in animals in earlier studies due to fluoride contamination [16].

Fig-2: Showing patchy brownish to black stained teeth with receding gums in mature cattle

In animals belonging to age group of more than 4 years, severe dental fluorosis was observed in 62.8% cattle out of 282. With growing age, effects of fluoride on dentine were more severe due to prolonged fluoride intake. With darker staining, abruption and erosion of the crown was very evident. Exposed cementum, receding gingival, bulging gums and teeth loss were pronounced in older age group of animals (Figs. 3). Fragility and damaged edges were also reported in similar studies. Phillips and Suttie [17] reported that cattle are less tolerant to F toxicity than other livestock. Kumar [16] also observed similar symptoms in cattle of Nagaur district of Rajasthan and revealed that due to poor mastication of roughages by unevenly worn teeth resulted in poor digestion and weak body condition. Choubisa [6] also observed that anterior teeth of animals were bilaterally striated, and light to deep yellowish in colour. In severe forms of dental fluorosis, irregular wearing of teeth and recession and swelling of gingival were also present. In older cows pronounced loss of teeth supporting alveolar bone with recession and bulging gingival, and exposed cementum of incisor roots were more common.

Fig-3: Showing fully abrupt teeth and uneven wearing of teeth with exposed cementum of incisor roots in older age cattle

Table 2: Dental fluorosis in buffaloes

Age group	No. of animals	Mild to moderate	Severe
<1 year	126	82 (65.1%)	-
1-4 years	189	103 (54.5%)	86 (45.5%)
>4 years	241	88 (36.5%)	153 (63.5%)
Total	556	273 (49.1%)	239 (43%)

*Numbers in parenthesis indicate percentage

Table 2 depicts dental fluorosis in buffaloes of different age groups. Among the age group of less than 1 year 126 buffaloes were examined and 65.1% exhibited mild to moderate dental fluorosis. Piebald incisors with yellowish colour were noticeable (Figs. 4).

Fig-4: Showing piebald incisors with yellowish colour in buffalo calves

The relatively higher prevalence of dental fluorosis in calves is related to their greater sensitivity, susceptibility and less tolerance to fluoride [18]. The susceptibility is greatly influenced by the availability or presence of Ca and vitamin C nutrients in their food or food chains besides the amount, duration of exposure to and frequency of F intake and other determinants [5, 19]. These calves are not provided with supplements that can combat fluorosis as vitamin C and calcium enriched food.

In the age group of 1-4 years, 45.5% out of 189 buffaloes showed signs of severe dental fluorosis like streaky marbled incisors, brownish to black staining covering the enamel and gingival recession (Figs. 5).

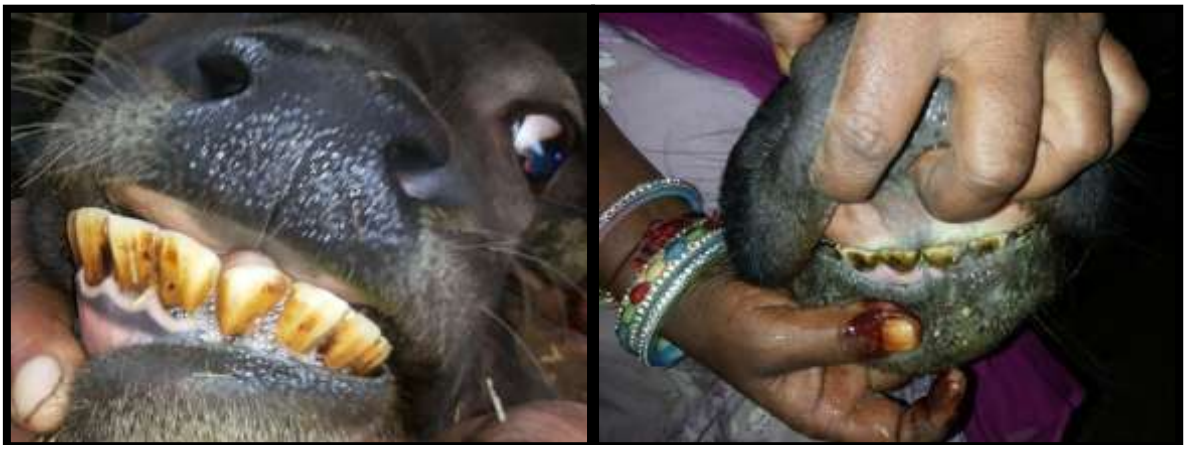

Fig-5: Patchy discoloured incisors with swollen gums in buffaloes

Dark horizontal lines and patches were also quite noticeable. Higher percentage of dental fluorosis was also observed in buffaloes above three years by Trangadia [20] in Gujarat. These animals depend on locally grown fodder for food. The vegetation is dually contaminated by fluoride dust emitted by the industries of the area and fluoride contaminated ground water. In the age group of more than 4 years 241 buffaloes were observed and 63.5% buffaloes of either sex exhibited severe dental fluorosis. Teeth were fragile, patchy and badly damaged with abrupt edges. Retraction of gingival margin from the crown was also evident (Figs. 6).

Fig-6: Showing uneven wearing of teeth and pits with receding gums in older age buffaloes

Excessive abrasion of the teeth in older animals was probably due to longer exposure to fluoride [10, 21]. Loss of appetite and difficulty in mastication were also complained by owners. Choubisa [22] observed highest prevalence in buffaloes (48.3%) of dental fluorosis among different ruminant species.

Table 3: Dental fluorosis in goats

Age group	No. of animals	Mild to moderate	Severe
<1 year	249	182 (73.1%)	-
1-4 years	367	259 (70.6%)	108 (29.4%)
>4 years	379	219 (57.8%)	160 (42.2%)
Total	995	660 (66.3%)	268 (26.9%)

*Numbers in parenthesis indicate percentage

In the age group of less than 1 year, 249 goats were examined and 73.1% exhibited mild to moderate type of dental fluorosis (Table 3). Front and middle incisors were mottled. Staining was yellow to light brown on the base and lateral side of the teeth (Figs. 7). Earlier studies on immature goats also reported similar symptoms [18, 23].

Fig-7: Showing laterally stained incisors in immature goats

In the age group of 1-4 years, 367 goats were observed and 29.4% revealed signs of severe dental fluorosis. Incisors were dark brown to black in colour and completely stained. Damaged crown, exposed roots with receding gums were pronounced in this age group (Figs. 8).

Fig-8: Showing damaged crown with swollen gums in goats

Similar symptoms have been observed by Choubisa [22, 23]. Deep brownish staining on the enamel and excessive abrasion was also observed. Modasiya [18] observed that 13.3% mature goats had dental fluorosis evident by light to a deep yellowish staining and striated lines.

In the age group of more than 4 years, 379 goats were examined for the evidence of dental fluorosis. This age group was found severely affected with fluorosis. Severe dental fluorosis was shown by 42.2% goats out of 379. Streaked, patchy brindled teeth with darker staining were found in goats. Erosion of enamel and teeth, exposed cementum due to recession in gums were evident (Figs. 9).

Fig-9: Showing streaked, patchy brindled teeth and complete erosion of teeth in mature goats

Loose tooth, loss of teeth and excessive and sometimes total abrasion of dentine were observed in these animals. In such severe conditions animals find difficulty in mastication that leads to low food intake, loss of appetite, ultimately malnutrition and lower body weight. These similar observations like saw teeth, excessive abrasion or wearing of enamel and loss of teeth were found prevalent in goats living in an industrial F polluted area [8]. Ruckebusch [24] in a survey on goats observed characteristic lesion of fluorosis at the base of the first incisor. Pitting, rough chalky enamel were common signs of dental fluorosis. Sahoo and Ray [25] observed that increased fluorosis in goats were due to increased fluoride in fodder and water. Emission from aluminium smelter was the reason behind increased fluoride in water and fodder.

CONCLUSION

It was observed that animals reared in and around Umarda village of Udaipur showed varied degree of dental fluorosis. Out of 2320 animals 44% cattle, 43% buffaloes and 26.9% goats showed severe dental fluorosis. Symptoms like discoloration, patchy brindled teeth, abrasion & eruption of dentine, loose tooth, loss of teeth, receding gums, difficulty in mastication were exhibited by animals. Dental fluorosis in these animals was due to highly F contaminated water and fodder. Industries emitting F fumes/gases in such endemic area make the situation more worse. Inhalations of these contaminated fumes serve as an additional source of intake. Excess ingestion of fluoride rich fodder and water in endemic areas leads to development of dental fluorosis in animals. Therefore this area needs preventive measures to combat fluorosis with a balance diet and supplements.

REFERENCES

1. Camargo, J. A. (2003). Fluoride toxicity to aquatic organic organism: A review. *Chemosphere*, *50*, 251-64.
2. Kosma, M. P., Wilk, A., Stogiera, A., Chlubek, D., Radlinska, B., & Wiszniewska, B. (2016). Animals in biomonitoring studies of environmental fluoride pollution. *Fluoride*, *3*(2), 272-79.
3. Baunthiyal, M., Ranghar, S., & Garhwal, P. (2014). Physiochemical and biological responses of plants under stress: an overview. *Fluoride*, *47*(4), 207-93.
4. Smith, F. A., Hodge, H. C., & Dinman, B. D. (1979). Airborne fluorides and man: Part 2. *C R C Critical Reviews in Environment Control*, *9*(1).
5. Choubisa, S. L., & Mishra, G. V. (2013). Fluoride toxicosis in bovine and flocks of desert environment. *International Journal of Pharmacy and Biological Sciences*, *7*(3), 35-40.
6. Choubisa, S. L. (2012). Status of fluorosis in animals. Proceeding of the National Academy of Sciences, Indian section B. *Biological Sciences*, 82(3), 331–39.
7. Jena, C. K., Gupta, A. R., & Patra, R. C. (2016). Protective effects of *Moringa oleifera* on hematological and biochemical parameters of cattle from industries fluoride polluted area. *Journal of Animal Research*, *6*(1), 91-97.
8. Choubisa, S. L. (2017). A brief and critical review on hydrofluorosis in diverse species of domestic animals in India. *Environmental Geochemistry and Health*, 1-16.
9. Narwariya, Y. S., & Saksena, D. N. (2012). Incidence of dental fluorosis in domestic animals of Shivpuri, Madhya Pradesh, India. *Journal of Environmental Research and Development*, *7*(1), 426-30.
10. Tiwari, I.C., & Kaur, P. (2008). Dental fluorosis in domestic animals. *Current Science*, *95*(12), 1674-75.
11. World Health Organization. (1993). Guidelines for drinking water quality. Vol.1, Recommendations 2nd Ed. Geneva.
12. Meeenakshi, & Maheshwari, R. C. (2006). Fluoride in drinking water and its removal. *Journal of Hazardous Materials*, *137*(1), 456-63.
13. Jain, A. K., Shekhar. R., Chandra, R., Shrivastava, K., & Sharma, V. (2010) Ground water quality in shallow aquifers of India. Central ministry of ground water quality in Faridabad. Government of India, 1-117.
14. Hobbs, C. S., Moorman, Jr. R. P., Griffith, J. M., West, J. L., Merriman, G. M., Hansard, S. L., & Chamberlain, C. C. (1954). Fluorosis in cattle and sheep. *University of Tennessee Agriculture Experiment Station*, Bull no. 235.
15. Shupe, J. L. (1980). Clinicopathological features of fluoride toxicosis in cattle. *Journal of Animal Sciences*, *51*(3), 746-58.
16. Kumar, M., Yadav, M., & Choudhary, A. (2015). Effect of fluoride concentration on cattle of Nagaur district (Rajasthan). *International Journal of Scientific Research Publications*, *5*(9), 1-2.
17. Phillips, P. H., & Suttie, J. W. (1960). The significance of time in intoxication of domestic animals by fluoride. *Archives of Industrial Health*, *21*, 343-45.
18. Modasiya, V., Bohra, D. L., Daiya, G. S., & Bahura, C.K. (2014). Observations of fluorosis in domestic animals of the Indian Thar desert, Rajasthan, India. *International Journal of Advance Research*, *2*(4), 1137-43.
19. Sheikh, Z. (2011). Prevention of fluorosis in domestic animals. Current Science, *101*(9), 1124-25.
20. Trangadia, B. J., Joshi, D. V., Patel, B. J., Kaul, L., & Kaul, P. L. (2011) Spontaneous fluorosis in Indian buffaloes. *Journal of Advanced Veterinary Research*, (1), 57-60.
21. Choubisa, S. L. (1999). Some observations on endemic fluorosis in domestic animals in southern Rajasthan (India). *Veterinary Research Communications*, *23*(7), 457–65.
22. Choubisa, S. L., Mishra, G. V., Sheikh, Z., Bhardwaj, B., Mali, P., & Jaroli, V. J. (2011). Food, fluoride and fluorosis in domestic ruminants in the Dungarpur district of Rajasthan, India. *Fluoride*, *44*(2), 70-76.
23. Choubisa, S. L. (2015). Industrial fluorosis in domestic goats (*Capra hircus*), Rajasthan, India. *Fluoride*, *48*(2), 105-112.
24. Ruckebusch, Y., Toutian, P. L., & Koritz, G. D. (2012). Veterinary Pharmacology and Toxicology. Springer Science & Business Media. 682-83.
25. Sahoo, N., & Ray, S. K. (2004). Fluorosis in goats near an aluminium smelter plant in Orissa. *Indian Journal of Animal Sciences*, *74*(1), 48-5