Prevalence of Dental Fluorosis in Goats (Cropa hircus) in some villages of Karera block in Shivpuri district, Madhya Pradesh

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ABSTRACT

Chronic fluoride toxicity in the form of dental fluorosis was observed in goats (Cropa hircus) in Dumduma, Bangama, Hazinagar, Silarpur, Sirsod, Nichroli, Zuzai, Toda Karera, Toda Rampur and Kalipahad villages of Karera block of Shivpuri district of Madhya Pradesh. The dental fluorosis in goats was characterized by light to deep yellowish teeth with dark coloration starting at the base. The mean fluoride concentration in drinking water varied from 1.65±0.0047 mg/L to 3.91±0.0072 mg/L. The prevalence of dental fluorosis in calves (<6 month) was greater than in adult goats, viz., 36.8 % and 14.2 % respectively. There is direct correction between the prevalence of dental fluorosis and fluoride content of ground water. Fluoride intake through the consumption of ground water and infested vegetation contributed to the development of fluorosis in goats. Possible factors causing variation in fluorosis in the goats in villages with identical fluoride concentration have been discussed in the present investigation.

Key words: Fluoride content in water, dental fluorosis, goats, Karera block.

Introduction

Fluoride is mainly derived due to solvent action of water on the rocks and the soil of the earth’s crust. Excessive intake of fluoride leads to serious effects on the teeth during tooth formation and abnormal hardening of bones, leading to a condition known as fluorosis, and is exacerbated by poor diet deficient in calcium and vitamins C. Many of the problems of pollution emanating from livestock system have mostly remained confined to the developed nations. In severely contaminated areas, it has been observed that livestock can survive only for 2-3 years, thereby limiting the reproduction and reducing drastically the success of animal husbandry (Wang et al., 1992; Wang et al., 1994; Chaubisa, 2001; Swarup and Dwivedi, 2002). Intake or ingestion of high amount of fluoride by humans and animals over a prolonged period is known to cause dental and skeletal fluorosis (WHO, 1970). Chronic fluoride toxicity in the form of dental, skeletal and non-skeletal fluorosis has been studied in cattle - Bos taurus, buffaloes - Bubalus bubalis (Chaubisa, 2008). A meliorative salt, aluminium sulphate -(Al₂SO₄) has been found to be useful in restoring hematological values except clotting time produced due to sub acute exposure of sodium fluoride in goats (Vinaykant, 2009). In the present study, an investigation was undertaken to determine the prevalence and severity dental fluorosis in goats due to fluoride contamination in ground water in some villages of Karera block of Shivpuri district, Madhya Pradesh.

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Materials and Methods

For the present study, a survey was conducted in ten villages viz., Dumduma, Bangama, Hazinagar, Silarpur, Sirsod, Nichroli, Zuzai, Toda Karera, Toda Rampur and Kalipahad situated in Karera block of Shivpuri district, for the fluoride contents in ground water sources and prevalence of fluorosis in goats. Fluoride ion concentration was measured in the water of hands pumps and well with Orion Fluoride Meter (model 720 A), manufactured by Orion Research, Inc., USA by using Ion selected Electrode method.

Examination of dental fluorosis in goats

The present investigation was undertaken to observe different stage of enamel mottling in mature and immature goats consuming water containing higher fluoride level. House to house surveys were conducted in the early morning and late evening when the animals generally remain available and in herds during daytime for a period during November, 2007 to December, 2009.

Results and Discussion

It is observed in all ten villages of Karera block drinking water sources like hand pumps and wells had a contribution of fluoride ranging from 1.65±0.0047 mg/L \(^{-1}\) in Hazinagar village to 3.91±0.0072 mg/l \(^{-1}\) in Dumduma village. The fluoride content is hand pumps and wells have been reported elsewhere (Narwaria and Saksena, 2012a; 2012b). Among mature goat 36.8% and in immature goats 14.2% were found (Table 1) affected with dental fluorosis. Dental fluorosis in cattle exhibited by light to deep yellow, colored teeth striated horizontal lines starting from the base of teeth (Figure 1.a,b,c and d). However, in mature animals, dental fluorosis appeared with deep yellow color on enamel of the anterior teeth. It has been that 20% mature goats and were found to be afflicted with dental fluorosis in Dungarpur district of Rajasthan (Chaubisa, 2010). Out of 1117 cattle, 18.09% have shown the signs of dental fluorosis.

In affected villages, the prevalence of dental fluorosis in calves (< 1 year age) was greater than adults (Maiti et al., 2003). Prevalence and severity of fluorosis in these animals obviously involves several other determinants besides exposure and frequency of fluoride intake (Chaubisa, 1999; Wang et al., 2002). Goats are basically plant-eaters and consume almost all edible parts of arid and humid-zone plants, viz., fresh leaves, berries pods, fruits etc. The most common trees and shrubs found in this area are Babool (A cacia nilotica), Ber (Ziziphus jujuba), Jambul/jarber (Ziziphus nummularia), Imali (Terminalia indica), Amla (Emblica officinalis) and Indian Cherry (Cordia dichotoma) (Figure 2.a,b,c and d). The fresh leaves, berries pods, fruits etc. are very rich in calcium and vitamin C. These two nutrients (calcium and vitamin C) are known to counteract fluorosis (WHO, 1970; Chinoy et al., 1994; Swarup and Dwivedi, 2002).

It has been reported for the first that ruminant species including cattle (Bos taurus), buffaloes (Bubalus bubalis), camels (Camelus dromedarius), sheep (Ovis aries) and goats (Coppa hircus)) are almost equally susceptible to fluoride toxicity even at low fluoride concentration in drinking water as in the case of human beings. The susceptibility however, is greatly influenced by the availability or presence of calcium and vitamin C in their food and food chains besides the amount, duration of exposure and frequency of fluoride intake, and other determinants (Chaubisa, 2010; Chaubisa et al., 2011). Recently, it has also been suggested that the awareness and education programme regarding the use of leaves, fruits and berries of V ilayati babool (Prosopis juliflora), Imali (Temarindus indica), Banyan (Ficus bengalensis) and Amla (Emblica officinalis) can be beneficial in amelioration of fluorosis (Sheikh, 2011). The remedial measure such as rainwater harvesting, supply of drinking water and food supplements for the places where fluoride is present, are needed.

Prevalence of dental fluorosis in immature goats

![Graph showing prevalence of dental fluorosis in immature goats](image)

Table 1 Prevalence of dental fluorosis in goats (Coppa hircus) fluoride endemic area of Shivpuri district

<table>
<thead>
<tr>
<th>G oats (Coppa hircus)</th>
<th>N.o. of Animals examined</th>
<th>D.ental fluorosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mature goats</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(&gt;1year)</td>
<td>57</td>
<td>21 (36.8%)</td>
</tr>
<tr>
<td>Immature goats</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(&lt;1year)</td>
<td>14</td>
<td>02 (14.2%)</td>
</tr>
<tr>
<td>Total</td>
<td>71</td>
<td>23 (45%)</td>
</tr>
</tbody>
</table>
Table 2 Calcium and vitamin - C content (mg/100 dry wt) in edible parts* of common plants in the study area

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Name of Plant</th>
<th>Common Name</th>
<th>Calcium (%dry wt)</th>
<th>Vitamin C (mg/100g)</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Acacia nilotica</td>
<td>Babool</td>
<td>F-0.64% L-2.53%</td>
<td>-</td>
<td>Carter, 1980</td>
</tr>
<tr>
<td>2</td>
<td>Zizphus jujuba</td>
<td>Ber</td>
<td>F-106.3-117.5 L-3612.7-4961.3%</td>
<td>F-309.3-364</td>
<td>San et al., 2009</td>
</tr>
<tr>
<td>3</td>
<td>Zizphus nummularia</td>
<td>Jungli / Jar ber</td>
<td>-</td>
<td>F-85</td>
<td>Goyal &amp; Sharma, 2009</td>
</tr>
<tr>
<td>4</td>
<td>Temarindus indica</td>
<td>Imali</td>
<td>S-248.56 Pu-35-17 F1-35.5</td>
<td>Pu-0.7-3.0 F1-13.8 L-3.0</td>
<td>Pugalenthi et al., 2004</td>
</tr>
<tr>
<td>5</td>
<td>Emblica officinalis</td>
<td>Amala</td>
<td>F-0.05%</td>
<td>F-6000</td>
<td>Khan, 2009</td>
</tr>
<tr>
<td>6</td>
<td>Cordia dichotoma</td>
<td>Indian Cherry</td>
<td>F-55</td>
<td>-</td>
<td>Rathor, 2009</td>
</tr>
<tr>
<td>7</td>
<td>Ficus bengalensis</td>
<td>Bargad</td>
<td>F-1.8</td>
<td>-</td>
<td>Roby, 2000</td>
</tr>
</tbody>
</table>

Prevalence of dental fluorosis in immature goats

* L = Leaves, Pu = Pulp, Fl = Flower, F = Fruits, S = Seeds

Figure 1: Different grades of dental fluorosis in Goat (a,b) immature and (c,d) mature Goat
Environmental awareness programme for the health implications due to fluoride should be emphasized through public education and rural community participation. Rural people and cattle owners need to make aware of the plants that are easily available in the surrounding and rich in calcium and vitamin C. It should be emphasized that these plants can be cultivated easily without any large investment, and their water demand is also less. These plants and their leaves, fruit and flower are available to the goats all round the year. Lists of calcium and vitamin C rich plants available in this area have been given in table 2.

Figure 2 a. Ficus bengalensis – Close view (Bargad) b. Emblica officinalis - Close view (Amala) c. Zizphus jujuba (Ber) d. Tamrindus indica - Close view (Imali)
A cknowledgements

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R eferences


