

## Impact of Environmental Fluoride on Animal Health: Key Findings and Prevention

Dr Ravindra Pal Mandar and Dr Amita

<sup>1</sup>Assistant Professor, Department of Veterinary Pharmacology and Toxicology, Mahatma Jyotiba Fule College of Veterinary and Animal Science, Chomu, Jaipur-303702 (Rajasthan), India

<sup>2</sup>PhD Scholar, Department of Veterinary Public Health and Epidemiology, College of Veterinary and Animal Science, Bikaner-334001 (Rajasthan), India

DOI: 10.5281/Vettoday.13889870

### Introduction

Fluoride toxicity occurs when there is an excessive amount of fluoride ions in the body. Fluoride originates from fluorine, a naturally occurring and widespread element. Adding fluoride to drinking water helps lower the rate of tooth decay by promoting demineralization and remineralization of teeth. However, an excess of fluoride can cause dental fluorosis or skeletal fluorosis, potentially harming bones and joints.

### Sources of Fluoride Toxicity

- Drinking water: The main source of fluoride exposure for domestic animals is drinking water with high fluoride levels.
- Agricultural feed: In regions where groundwater is polluted with fluoride, it is often used for agricultural irrigation, which can contaminate the feed consumed by domestic animals.
- Industrial sources: Fluoride toxicity can also result from waste produced during the manufacture of fertilizers, mineral supplements, and metal ores from steel and aluminium processing.
- Bone meals: These can be a major source of fluoride for livestock.
- Rock phosphates and limestone: Naturally contain fluoride compounds.
- Soil: Soil formed from rocks and surface water leaching through rocks may have toxic levels of fluoride.

### Toxic Effects

The most commonly affected species by fluoride toxicity is cattle.

**Skeletal abnormalities:** Fluoride can lead to increased bone resorption and remodelling,

resulting in lameness, stiffness, and irregular hoof growth.

**Dental problems:** It can cause dental pain, mottled enamel, and uneven tooth wear.

**Reproductive issues:** Fluoride affects the reproductive systems of both male and female animals.

- In males, it can reduce sperm count and motility, cause testicular damage, and lead to oxidative stress. In females, it may cause ovarian dysfunction.

**Kidney damage:** Long-term exposure to high levels of fluoride in drinking water can result in renal diseases.

### Clinical Findings for Fluoride Poisoning in Animals

#### Acute fluoride poisoning (fluorosis)

- such as from ingesting large amounts of acaricides (sodium fluoride), rodenticides (sodium fluorosilicate), or dental products meant for human use, can cause symptoms of illness within 2 hours.
- Common clinical signs include severe gastroenteritis, excessive salivation, restlessness, sweating, loss of appetite, muscle weakness, stiffness, difficulty breathing, rapid heartbeat (ventricular tachycardia), and clonic convulsions, which may be followed by depression and death.

#### Chronic fluorosis

- Marked by signs of malnutrition and skeletal and dental abnormalities. Reduced feed and water intake, along with weight loss and poor milk production (such as in dairy cows), are often due to dental lesions and difficulty chewing.

- Common dental issues include mottled, chalky, pitted, and stained enamel, as well as uneven and excessive tooth wear.
- Dental pain may be indicated by the animal lapping drinking water.
- Skeletal problems, resulting from increased bone resorption and remodelling, can cause severe lameness, stiffness, abnormal hoof growth, and the formation of bony growths (exostoses).
- In advanced stages, cattle severely affected by joint involvement may be forced to move on their knees.
- Periosteal hyperostosis often impacts the ribs, and the metabolically active, growing bones of young animals are more severely affected.

#### **Diagnosis of Fluoride Poisoning in Animals**

- A history of exposure, environmental factors considered.
- Tentative diagnosis based on history, clinical evaluation and postmortem examination if fatal.
- Analysis of tissue, water and food samples to measure fluoride concentration provides valuable confirmatory evidence.
- A diagnosis of acute fluoride poisoning should be made on the basis of a history of exposure and typical clinical and histopathologic findings.
- The measurement of serum calcium and magnesium concentrations may provide supportive evidence.
- In chronic fluorosis, detection of fluoride in tissues must be considered in association with history, clinical signs of disease, and, where relevant, necropsy findings.

#### **Treatment and Control of Fluoride Poisoning in Animals**

- The prognosis and response to treatment in chronic fluorosis cases are generally poor due to the irreversible damage that has already occurred.
- For animals with acute toxicosis, administering calcium gluconate and magnesium hydroxide, or milk orally, may help reduce fluoride absorption, although the outlook remains poor if large amounts of fluoride have been ingested.
- Supplementing with calcium carbonate, aluminium salts, magnesium metasilicate, or boron can help reduce fluoride absorption or promote its excretion.
- Once chronic fluorosis symptoms appear, treatment is usually ineffective, so the main focus should be on prevention.