

Fluorosis in Cattle

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Fluorosis is a chronic disease caused by the continued ingestion of small but toxic amounts of fluorine in the diet or drinking water over a long duration leading the cumulative effect, while acute poisoning occurs due to inhalation of fluorine containing gases by smoke, vapours, dust from industries of aluminum, copper, glass, enamel, iron, steel and super phosphate. Dust from volcanic eruptions also contain large amount of fluorine. Accidental administration of large amount of fluorine leads to fluorosis.

Etiology

The toxic effects of fluorine depend on the amount ingested into the body, the solubility and bio-availability of it. When level exceeds 100 ppm of fluorine in ration utilizing the source of fluorine as rock phosphate or cryolite likely to cause diseases in cattle. Calcium fluoride or sodium fluorosilicate is relatively non-toxic and an intake of 400 mg to 2 gm/kg of body weight is necessary to have fatal effects. Sodium fluoride is nearly twice toxic and general level of 50 ppm of dry ration should not be exceeded, otherwise induces fluorosis. Mottling of tooth enamel occurs at 27 ppm, moderate effects at 49 ppm level. Where as bony light lesions are observed at 27 ppm, moderate at 49 ppm level and marked at 93 ppm. Milk production in dairy cows is not affected at 50 ppm of fluorine in the diet up to fourth lactation. Fluorine in excess of 2 ppm in water is toxic to animals.

Minor teeth lesion occurs at 5 ppm, while when the level exceeds of 10 ppm the excessive wear and tear of tooth occurs. More systemic effects occur when the water contains 30 PPM of fluorine. Chronic intoxication occurs when bore water contains 12 – 19 ppm fluorine.

When daily intake of fluorine is 0.5 to 1.7 mg/kg body wt. in the form of sodium fluoride produces dental lesions in growing animals without affecting general health, whereas the adult animals can tolerate double the dose of the above intake i.e. 1 to 3.5 mg/kg. body weight per day is sufficient to cause severe dental fluorosis without affecting growth rate or reproductive function. An intake of 1 mg/kg body weight is the maximum safe limit for ruminants. An intake of 2 mg/kg

body weight produces clinical signs after continued ingestion.

In case of pregnant cows the fluorine content of bones of new born calves depends on the dam's intake of fluorine in the last 3-4 months of pregnancy.

Epidemiology

The common causes are drinking water from deep wells, artesian bores, industrial contamination of pasture and the feeding of fluorine from phosphatic rock supplements / limestone usually occurs in animals suffering from phosphorus deficiency. Death losses are rare and restricted largely to acute poisoning. But the major losses are due to the unthriftiness caused by chronic fluorosis.

Pathogenesis & Necropsy Findings

Normal cattle have blood levels of up to 0.2 mg fluorine per deciliter of blood and 2-6 ppm in urine. The detoxification process takes place if intake is very high in the form of deposition of fluorine in association with phosphate before irruption of teeth. The deposition is greatest in long bones on periosteal surfaces and exostosis occurs due to excessive mobilization of calcium and phosphorus at any age in life. The bone lesions like osteomalacia, osteoporosis, osteofluorosis, hip lameness and stiffness of limbs, painful gait, un-thriftiness are the characteristic clinical symptoms. Palpably and visibly enlarged bones particularly the mandible, sternum, metacarpal, metatarsal and phalanges become short, thicker, broader, porous, brittle, hence are prone to fracture. Periosteal hyperostosis or exostosis at joint or at places of attachment of ligaments and tendons cause shifting pain and lameness. Degenerative changes are seen kidney, liver, adrenal glands, heart muscle, adrenal glands and central nervous system, bone marrow and aplastic anemia. Fluorine does not pass placental barrier hence new borns are not affected until they begins to drink water.

Clinical findings

In case of acute intoxication there is ruminal stasis, constipation or gastroenteritis occurs due to

irritation of stomach with the formation of hydrofluoric acid. Nervous signs are characteristic and include muscle tremor, weakness, pupillary dilatation, hyperesthesia and constant chewing. Tetany and collapse follow and death usually occurs within few hours.

In dental form, deciduous as well as permanent teeth that have grown prior to poisoning are free from lesions. In cattle lateral incisors show most pronounced changes. The earliest and mildest sign is mottling of tooth enamel, erosion of teeth, with the appearance of pigmented spots, opaque chalk like areas, very light yellow, green, brown or black colored spots having linear pigmented streaks and pits or bands arranged horizontally across the teeth. Presence of multiple carries is a constant feature of this poisoning. If the period of intoxication exposure is for a limited period then there is bi-lateral affection of teeth. Improper mastication, reduced appetite, poor growth in young ones and acetonemia in adults. In chronic poisoning anemia is observed due to suppression of hemopoietic activity of the bone marrow and interference with mineralization process. Reduced milk yield is observed when fluorine intake level is ranged between 150 – 200 ppm.

Adverse effect on reproduction, significant increase in post calving anestrus, decline in fertility is observed in cows receiving a diet containing 8-12 ppm fluorine for a year.

Diagnosis

In normal animal fluorine level up to 1200 ppm is observed, but it can be increased up to 3000 ppm in animals which are exposed to fluorine. Final diagnosis depends upon fluorine assay (Bio-chemical examination) of food and drinking water, blood, urine in living

animals, while in bones and teeth at necropsy.

Control and Prevention

1. Removal of source of fluorine intoxication.
2. Acute cases require gastro intestinal sedatives and demulcents.
3. To neutralize residual fluorine in the alimentary tract calcium salts are given intravenously.
4. Feed mineral supplements should not be incorporated more than 2% of the grain ration. An intake of 1-1.5 mg/kg body weight fluorine is the maximum safe limit advisable without causing major deleterious effects on health in ruminants.
5. Bone meal is a rich source of fluorine, hence must be used cautiously in the feed. Water from deep wells and artesian bores should be checked for fluorine content before use and allow to settle for at least 6 hrs before use.
6. Aluminum sulfate @ 30 gms or in higher doses should be given daily for prevention of chronic fluorosis.

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