



Lecture title: Nitrate and Nitrite Toxicosis

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Summary:

*The toxic element as it occurs in growing plants is always nitrate and ruminal microbes reduce nitrate to nitrite.

* the consumption of an excessive amount of nitrate or nitrite from grazing crops, hay, silage, weeds, drinking water, lubricating oil, fertilizer

*Cattle: The minimum lethal dose of nitrite is 88 to 110 mg/kg BW or about 0.6 g of potassium nitrate per 1 kg BW.

*Sheep: The lethal dose of nitrite is 40 to 50 mg/ kg BW.

*Horses: The estimated oral lethal dose of nitrate in horses is 61 to 152 g/animal..

Epidemiology

***Common sources** of nitrate for farm animals include the following:

- 1- Cereal crops used as pasture
- 2- green feeds, for example, Sudan grass, corn, Oat hay
- 3- Water from deep wells contaminated with fertilizer
- 4-Brassica spp., for example, B. napus: rape, turnips, and others; Brassica napus:
- 5-Some species of algae are nitrate producers

***Risk Factors**

* Large applications of nitrogen fertilizer or manure increase soil nitrate and plant.

•pigs being most susceptible, followed by cattle, sheep, and horses.

• susceptibility of cattle relative to sheep is attributable either to their greater ability of sheep to convert nitrite to ammonia.

• Hay made from nitrate-rich material



Pathogenesis

- Under normal circumstances, ingested nitrate is reduced in the rumen to nitrite and further converted to ammonia.
- When this system is overwhelmed by a large or sudden ingestion of nitrates, nitrites are rapidly absorbed into the blood.
- Nitrates have a direct caustic action on alimentary mucosa, and large quantities is associated with gastroenteritis.
- * Nitrate is converted to nitrite faster than nitrite is converted to ammonia. Consequently, when higher than normal amounts of nitrate are consumed, an accumulation of nitrite may occur in the rumen.
- The nitrite anion oxidizes heme iron from the ferrous (Fe^{+2}) to the ferric (Fe^{+3}) state, resulting in methemoglobinemia and hypoxia. (Methemoglobin is hemoglobin that has been oxidized from the ferrous (Fe^{++}) to the ferric (Fe^{+++}) state, thus unable to bind oxygen.).
- Nitrites are also vasodilators, which may contribute to the development of tissue hypoxia by causing peripheral circulatory failure.
- * when an animal dies from nitrate poisoning, it is due to a lack of oxygen.
- Signs of toxicity @10-20% MetHb □ Death at 75-80% Met Hb.

Clinical findings

* Clinical signs of nitrate poisoning are related to the lack of oxygen in the blood. Acute poisoning usually occurs from a half hour to four hours after consuming toxic levels of nitrate. Onset of symptoms are rapid and include:

Acute toxicosis include

1-weakness, depression, respiratory distress.

2-cyanotic mucous membranes (bluish/chocolate brown mucous membranes)



3- terminal convulsions. 4-Abortions.

5- The eye, the tongue, and lips, have a blue-brown discoloration

6- bloat 7-coma, death

Chronic exposure : anoxia, stillbirths and abortions, and abnormalities.

Clinical pathology

- Chocolate-brown discoloration of the blood
- blood levels of methemoglobin.
- Methemoglobinemia may be detected by examination of the blood in a reversion spectrometer,

Necropsy Findings

- The gastrointestinal mucosa is congested and hemorrhagic; the blood is dark red to coffee brown in color and clots poorly.

Diagnosis

- clinical signs and the possibility of exposure to toxic plants or water.
- Laboratory analysis can of dead cattle.
- Field Test for Nitrates : Diphenylamine test: 3 drops reagent mixed with suspect fluid (urine, blood, macerated plant tissue) Blue color indicates nitrate reaction.

Differential diagnosis list:

- | | |
|-------------------------|---------------------|
| 1-Carbohydrate overload | 2-Cyanide toxicosis |
| 3-Hypomagnesemia | 4-Urea toxicosis |

Treatment

- Methylene blue is the specific antidote. The standard dose rate is traditionally 1 to 2 mg/kg BW, injected IV as a 1% or 2% solution, but a variety of doses up to 10 mg/kg BW have been used.

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CONTROL : Receive adequate carbohydrates in their diet, and traveling or hungry animals should not be allowed access to dangerous plants.