

Copper Poisoning in Small Ruminants

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Copper is a metallic mineral that is an essential nutrient required in very minute amounts for all species of farm animals. Although it is an essential nutrient, copper can also be **poisonous** if ingested in amounts that exceed the animal's requirement. There is a tremendous variation in the amount of copper needed by different species of farm animals. Similarly, there is tremendous variation in the susceptibility to copper poisoning among the farm animal species. What makes this problem confusing is that extra copper may need to be added to the diets of certain livestock species (pigs, poultry) to optimize health and performance, while the same feed can be lethal to other livestock species.

Sheep are by far the most susceptible farm animal species to copper poisoning, with goats being less susceptible than sheep and cattle being less susceptible than either sheep or goats. Pigs are the least susceptible to copper poisoning, their rations often contain added copper (125-250ppm) in amounts that, if consumed by sheep, can cause acute copper poisoning. Many cases of poisoning occur when sheep or goats ingest small amounts of copper over a prolonged time period. Copper that is ingested is stored in the animal's liver, and repeated ingestion of small amounts of copper above the animal's requirement may cause accumulation of what eventually becomes a toxic amount of copper for the animal.

Sources of copper that can cause copper poisoning in sheep and goats

- Trace mineral-supplemented salt that is formulated for cattle or horses
- Vitamin and mineral supplements intended for horses, cattle, swine, or poultry
- Complete feeds for swine, horses, poultry, or cattle
- Pasture that has been fertilized with swine manure
- Pasture that has been fertilized with poultry litter
- Copper-containing disinfectant foot baths for cattle

In addition to the consumption of feeds containing high concentrations of copper that cause poisoning in sheep, copper poisoning can occur when liver disease is present. Referred to as secondary copper poisoning, liver disease causes normally stored copper in the liver to be released into the blood stream where it causes destruction of the red blood cells (hemolysis). Certain plants (for example, *Senecio* species) that contain toxic alkaloids when eaten by sheep over a period of weeks can cause sufficient liver damage to precipitate a sudden release of stored copper from the liver to cause copper poisoning.



Yellow discoloration of the eye (jaundice) in a sheep suffering from copper poisoning.

Once copper has accumulated to a toxic amount in the liver, the sheep or goat can develop sudden and severe signs of disease.

The signs of copper poisoning in sheep and goats include:

- Weakness, panting, and dull attitude
- Pale mucous membranes
- Yellow discoloration (jaundice) of the mucous membranes of the eyes, gums and genitalia
- Dark brown or red colored urine
- Abortion in pregnant ewes and does
- Death

Treatment of copper poisoning is very challenging, and severely affected animals often die despite treatment. Medications are administered to affected animals to increase the rate of excretion of copper from the liver. Oxygen administration and other supportive care may be required. When it is known that sheep have ingested feeds with toxic concentrations of copper (i.e. pig rations), feeding ammonium molybdate and sodium sulfate will help reduce the absorption of copper.

Diagnosis of copper poisoning can generally be made on the basis of the clinical signs, the observation of swollen, 'gunmetal-colored' kidneys, port-wine-colored urine, and an enlarged spleen on post mortem examination, and the detection of elevated concentrations of copper in the blood and liver. Blood copper concentrations above 2 micrograms/ml and liver copper concentrations above 150ppm (wet weight) are highly suggestive of copper toxicity.

Prevention of copper poisoning is simple. Owners of sheep and goats must remain aware that premixed complete feeds, salts, and nutritional supplements designed for other species may contain concentrations of copper that are dangerous to sheep and goats. Because poultry manure (litter) and swine manure contain potentially dangerous concentrations of copper, sheep and goats should not be allowed to graze pastures where these have been applied as fertilizer. Check with your veterinarian before adding any supplemental mixtures of vitamins or minerals to the diet of your sheep or goat.