

Copper Toxicity in Sheep

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Recently, I visited a sheep farm where copper (Cu) toxicity was suspected. Several lambs appeared lethargic and anemic. The producer had purchased feeder lambs from a farm that had been feeding poultry litter (manure).

Sheep are unique in that they accumulate copper in the liver more readily than other farm animals. As a result, they are very susceptible to Cu toxicity (poisoning). Mature ewes of British breed origin appear to be the most vulnerable and there is evidence to suggest that Finn Sheep and Texels also have a tendency to accumulate more Cu in the liver than other breeds.

Copper is essential for life. It is required for normal iron metabolism, synthesis of elastin and collagen, melanin production and integrity of the central nervous system. It is essential in keratin (wool) production. More recently, it has been shown that copper is one of the key trace minerals required for an effective immune response. Signs of deficiency include anemia, brittle or fragile bones, loss of hair or wool pigmentation and poor wool growth. In sheep, stringy wool and "swayback" are commonly reported.

Generally, sheep require about 5 ppm (parts per million or mg/kg) of Cu in their total diet. Toxicity can occur at levels above 25 ppm. However, dietary molybdenum (Mo) levels also affect copper requirements, as Mo forms an insoluble complex with Cu to prevent copper absorption. If molybdenum levels are low (less than 1 ppm), sheep are more susceptible to Cu toxicity. If Mo intakes exceed 10 ppm, Cu deficiency may occur on diets that would normally be adequate. Sulfur (S) further complicates the Cu:Mo relationship by binding with the Mo.

Copper toxicity in sheep usually results from the accumulation of excess Cu in the liver over a period of a few weeks to more than a year with no clinical signs, followed by a sudden release of liver Cu stores to cause toxicity (rapid breakdown of red blood cells). In these situations, chronic Cu poisoning may result from excessive Cu intakes or from low intakes of Mo, S, zinc,

calcium or following liver damage. Stresses, such as weather, environment, poor nutrition, transportation and handling, can also cause the liver cells to die and release the stored copper into the bloodstream.

Affected sheep are lethargic and anemic. They may grind their teeth incessantly and experience extreme thirst. Membranes are very pale and may appear yellow, as jaundice sets in. Urine is a bloody color. Death usually occurs 1 to 2 days after the onset of clinical symptoms. At post-mortem, tissues are pale to dark yellow and the kidneys are a very dark color.



Sheep should be fed mineral mixes that have been specifically formulated for sheep.

In contrast, cattle require about 10 ppm of Cu in their diet and can tolerate Cu levels ten times higher than sheep. Non-ruminants, such as pigs and chickens, tolerate even higher levels of Cu. Growing pigs are often fed 100 to 250 ppm to improve performance. According to the Salt Institute, the toxic level of Cu in the diet of chickens ranges from 250 to 800 ppm.

Thus, due to species differences, it is necessary to purchase grain rations or mineral premixes which have been specifically formulated for sheep. It is recommended that sheep NOT be fed poultry litter or other waste products which contain high levels of copper. In addition, there have been instances where high levels of Cu have been traced to the fertilization of pasture with pig manure.

If and when copper toxicity is suspected, the diagnosis needs to be confirmed by a veterinarian or diagnostic laboratory. Sources of copper need to be promptly identified. It is important to know the Cu and Mo status of all feeds and forages being fed. Grains are lower in copper than forages. Most forages will contain copper at levels equal to or above the NRC requirement for ruminants; however, as plants mature, the bio-availability of the copper decreases. Errors in feed mixing should also be considered as a possible source of excess copper. Water should not be overlooked as a source.

Although prevention is much preferred, there are times when treatment is warranted to prevent further losses. The most common treatment is to give a drench daily containing 50 to 100 mg of ammonium molybdate and 0.5 to 1.0g of sodium sulfate.

Though more data is needed, observations suggest that goats are more tolerant of copper than

sheep. In copper load studies conducted in Germany, goats consumed more copper and retained 6 to 9 times less in their livers than their trial lamb mates, indicating differences in utilization and resistance to toxicity between the species. "Dairy Goat Information of the Serious Kind," an excellent Internet source (www.saanendoah.com/goatss.html) recommends that goats NOT be fed minerals labeled for sheep or sheep AND goats, without some other form of copper supplementation. Minerals formulated for cattle or horses usually contain adequate levels of copper and can be fed to goats. Copper boluses can be used (resized for goats) when goats, and/or cattle share the same pasture or pen with sheep.

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