Vitamin A Deficiency in Beef Calves

Background

Unlike many vitamins that are produced by ruminal bacteria, vitamin A is a requirement in the diet of cattle. Cattle convert carotene from leaves of plants to vitamin A in the wall of the small intestine. Vitamin A is necessary for vision, maintenance of epithelial tissue and mucous membranes, bone development, and immune function. Since vitamin A is a fat soluble vitamin, cattle can store it in their liver when their daily intake is 3 to 5 times greater than their requirements. Mature cows can store up to 4 months of vitamin A in their livers under plentiful conditions. Therefore under ideal conditions cattle fed good quality hay during the winter will have adequate vitamin A levels from carotene in hay and accumulated liver stores.

However, under less than ideal situations vitamin A supplementation may be required to maintain proper health and reproductive performance of the cow and normal development and health of calves. Drought conditions will decrease the amount of carotene in plants limiting the ability for cows to accumulate liver stores during grazing. Additionally, harvested forage during a drought will have extremely low carotene levels, decreasing the ability of cows to consume their requirements during winter feeding. Another complicating factor is that many drought stressed forages have elevated nitrate levels. High nitrate levels are thought to lead to destruction of carotene and Vitamin A in the digestive tract and increasing requirements for Vitamin A by depressing thyroid function.

Clinical Signs

Common signs of vitamin A deficiency in cattle include reduced feed intake and growth, rough hair coat, night blindness, edema, diarrhea, seizures, increased susceptibility to infection, abnormal sperm, abnormal bone growth, low conception rates, abortion, stillbirths, and weak calves. Specifically for fetal and neonatal calves adequate vitamin A is critical. Low vitamin A can lead to calf loss from abortions and still born calves in pregnant cows. Calves that are born alive from a cow with low vitamin A levels may be blind from microphthalmia (Figure 1) or constriction of the optic nerve, have deformed bone development or weak uncoordinated muscles leading to inability to nurse. If neonatal calves cannot acquire adequate Vitamin A, seizures or other neurologic signs are possible from increased cerebrospinal fluid pressure. Continued low vitamin A can lead to severe diarrhea that is often fatal. Additionally, these calves may be at risk for increased infectious diseases because of poor immune function.

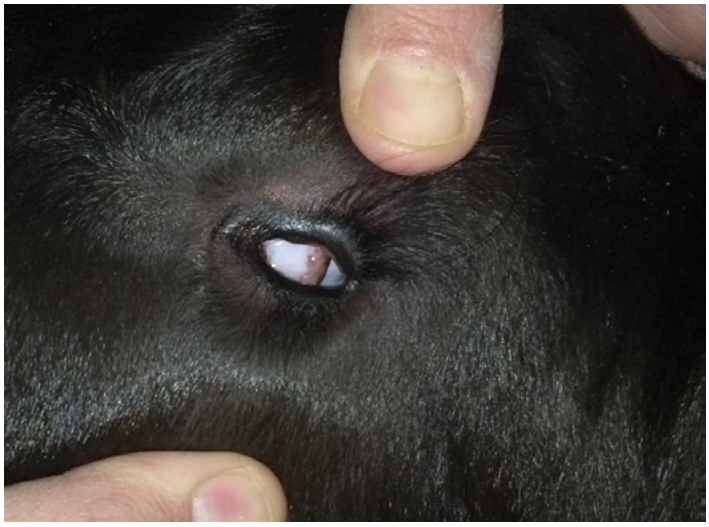

Figure 1, Calf born with microphthalmia.
Photo courtesy of Dr. Terry Engelken.

Supplementation of Vitamin A

Late pregnant cows that are at risk of low vitamin A (following drought conditions, fed poor quality forage (corn stalks, stemmy or weather damaged hay) or cows with minimal green grass intake during the year) should be supplemented with vitamin A. Supplemental vitamin A can be fed to cows in liquid supplements, mixed with feed or added to salt. Vitamin A will degrade over time, so prolonged storage of mineral mixes will have decreased vitamin A availability. Cows should intake

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30,000 to 45,000 IU per head per day depending on stage of pregnancy or lactation. Vitamin A can also be administered via injection of a vitamin A product. Injection of vitamin A is a very efficient way to increase liver stores compared to oral supplementation. Cows can be injected with 1 to 1.5 million IU of vitamin A. However, for vitamin A deficient cows a single injection may not be sufficient. Cows that are already deficient in vitamin A have a reduced ability to store vitamin A in the liver. Therefore it may be necessary to repeat the injection monthly until adequate stores are achieved or sufficient oral supplementation can be attained.

Calves that are born with signs of vitamin A deficiency due to abnormal development will probably not benefit from supplemental vitamin A. Abnormal bone development that constricts the optic nerve leading to blindness or muscle incoordination from spine abnormalities will probably not respond to vitamin A. Other calves that are not severely affected will benefit from an injection of supplemental vitamin A at birth (500,000 IU). Normal calves will be born with adequate levels of vitamin A but require additional vitamin A from consumption of milk that has satisfactory levels of vitamin A. Therefore it may be necessary to repeat the injection of vitamin A in 2-3 weeks for calves nursing cows that are deficient in vitamin A.

It is also important to remember that cows and calves that are deficient in vitamin A are probably deficient in other vitamins and minerals such as vitamin E, copper, manganese, selenium and zinc. Thorough evaluation of vitamin and mineral status should be done routinely. Liver biopsies can be performed on cows in mid to late gestation to assess and correct vitamin and mineral status prior to calving. Calves that die either from abortion, still birth or from other causes after birth should have a complete diagnostic work up including liver mineral and vitamin levels (especially vitamins A and E). Cattle producers can then cost effectively supplement the necessary vitamins and minerals to help ensure a healthy beef cow and calf.

Suggested References

McDowell LR. 2000. Vitamin A. In Vitamins in Animal and Human Nutrition. Pp. 15-90. Ames: Iowa State University Press.

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