

THIAMIN DEFICIENCY IN FEEDLOT CATTLE: A CASE STUDY

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B vitamins are abundant in milk and many feeds. Ruminant tissues require most B vitamins, and synthesis of B vitamins by ruminal microorganisms normally can supply the need. Thus, B vitamin deficiencies usually are limited to situations where a vitamin antagonist is present or ruminal synthesis is limited. A feedlot disorder, polioencephalomalacia (PEM), which occurs in grain-fed cattle and sheep can be cured by thiamin injection and has been attributed to either breakdown of thiamin in the rumen or production of a thiamin antagonist. This paper presents the case history of one research animal, a 700 pound black baldy steer, and its encounter with PEM.

This steer, a native-bred animal, was purchased in the spring of 1986 at the Oklahoma City Stockyards. Prior to purchase, the steer had grazed wheat pasture with 3 to 4 pounds of a corn-oat supplement daily. One week after arrival in Stillwater, he received IBR, PI₃, Lepto, Homophilus and BVD vaccinations, a vitamin A and D injection and Ivermectin for deworming. Approximately one month later, this animal was surgically equipped under anesthesia by veterinary surgeons with a 4-inch rumen cannula. This steer was used in experiments starting one month later. The steer was maintained on a prairie hay diet and received about 2 pounds of a 40% protein supplement for this two-month period. During experiments, the steer was fed a high-grain ration (Table 1) and was in a 3 x 3 m pen with free access to water.

One month was used to adapt the steer to the high-grain diet. Once adapted, the animal received steam flaked corn, rolled wheat, rolled corn, and steam flaked wheat diets for 10-day periods. The diet was 82% grain, 12% cottonseed hulls, 2% molasses, 1.3% limestone, 1% urea, .6% KCl, .5% salt, .5% sodium sulfate, vitamin A, monensin at 30 g/ton and Tylan. Feed intake was 1.5% body weight on a dry matter basis.

On the eighth day on the steam flaked wheat ration, day 38 on trial, the steer began to refuse feed. Sampling was cancelled, and rolled corn was substituted into the diet in place of the wheat to reduce ruminal fermentation rate and speed recovery. However, feed refusals continued and increased. To aid rumen function, three gallons of rumen fluid from another steer consuming the rolled corn ration was transferred into the rumen of the steer via cannula. Two days later, 5 days after initial feed rejection, the steer developed diarrhea. Rectal temperature was normal. One-half gallon of kapectin was dosed into his rumen, and 20 ml of Albon was administered into the jugular vein. Three gallons of rumen fluid from a second donor steer on the rolled corn diet and 3 gallons from a third steer fed the steam flaked wheat diet also were transferred to the sick steer.

When trying to halter and treat the steer the next morning, 6 days after initial feed rejection, the steer fell on his side with his legs in an extended position. Veterinary examination revealed a normal temperature, rigidity of the limbs, diarrhea and loss of vision. Blood was drawn via the jugular for analysis, and drug therapy was given. Six ml of thiamin hydrochloride (3 ml IV, 3 ml IM) and 40 ml of penicillin (IM) were administered. Thirty minutes later, the steer went into shock rolling his head over his back, rotating his eyes and

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twitching his ears. Thiamin concentration in the blood was checked by Hoffman LaRoche Co., Nutley, NJ two months later. Blood thiamin was below .5 ppm, the lower detection limit of the analytical procedure.

The symptoms persisted for the next 24 hours. Suspected diagnoses included lead poisoning, rabies, *Homophilus* and thiamin deficiency. Blood levels of lead were normal (4 ppm). Feces were checked for coccidiosis and revealed very few eggs. For the next three days, 7 ml thiamin hydrochloride (IM), 3 sulfa pills and 40 ml penicillin (IM) were given daily. Thiamin injections produced reactions thought to be due to a burning sensation.

The pathology of PEM includes a characteristic softening and degeneration of the brain gray matter which leads to circling, muscular incoordination, opisthotonus (drawing the head back over the shoulder) and head pressing, progressing to blindness, convulsions and death. Only a few animals develop the condition, and if treated early, they respond to large intravenous doses of thiamin. If treatment is delayed, survivors may be permanently blind or may suffer permanent central nervous system impairment. This steer regained his coordination and appetite but remains visually impaired. He has been placed on high grain diets but subsequent to this condition, diets for all steers on trial have been supplemented daily with 200 mg thiamin hydrochloride.

Precise thiamin requirements are unknown for ruminants. Extrapolation of requirements for monogastrics would predict that the thiamin present in common feedstuffs should exceed the need by 3 to 4 times. Hence, ruminal thiamin synthesis should not be needed. Some research suggests that specific antagonists may be synthesized in the rumen. Elevated sulfate from gypsum, dynamite or other sources appear to increase ruminal thiamin destruction. Those studies have used .72% sulfate, well above the .34% sulfate in this ration.

B vitamin nutrition of ruminants warrant further investigation. Thiamin deficiency noted in feedlots is presumably the result of some

Table 1. Composition of finishing ration (dry matter basis).

Ingredient	%
Grain ^a	77.22
Cottonseed hulls	12.00
Molasses	2.00
Chromic oxide	.30
Pelleted supplement	8.48
Calcium carbonate	1.29
Dicalcium phosphate	.24
Vitamin A-30	.01
Potassium chloride	.61
Trace mineral salt	.50
Sodium sulfate (Na ₂ SO ₄)	.50
Urea	1.00
Rumensin 60	.02
Tylan 40	.04
Number 2 dent corn	4.27

^aThe grain fed each period was altered so that steam flaked corn, rolled wheat, rolled corn, and steam flaked wheat were consumed.

unknown combination of factors including genetic background of the animal, type and processing of the ration, feed additives and physiological status of the steer. Whether thiamin supplementation on a regular basis would prevent this problem or cause other problems and what levels might be useful (200 mg thiamin HCl costs 1.7 cents) remains to be determined.