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RESEARCH FACTS
RESEARCH & TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY

Rumen pH Levels

Project Title:

Determining the Incidence, Prevalence and Severity of Subacute Ruminal Acidosis in Feedlot Cattle

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Background

Grain-based finishing diets contribute to rapid, efficient and economical growth in feedlot cattle. However, some researchers and animal welfare advocates are concerned that this may pose a risk to animal welfare. The concern is that grain-based diets increase the risk of rumen acidosis, the lowering of the pH level in the rumen due to microbial fermentation of dietary starch. Acute rumen acidosis (grain overload) is a well-known risk when cattle that are not adapted to grain consume too much grain, too quickly. This causes the rumen to become too acidic very quickly and can result in severe health problems. To prevent this from happening, feedlots use step-up programs to carefully adapt forage-fed feeder cattle to grain-based finishing diets. Subacute rumen acidosis, a phenomenon in which rumen pH doesn't drop as drastically, but tends to remain relatively low all the time, is still a potential risk even after cattle have been adapted to grain-based finishing diets.

The frequency and consequences of chronic subacute rumen acidosis have not been studied extensively, because measuring rumen pH has traditionally required rumen fistulated animals and very intensive measurements.

Objectives

To develop an understanding of the numerous animal, dietary and feeding management factors that may influence the risk of sub-acute ruminal acidosis in feedlot cattle.

What they did

A total of 998 crossbred yearling heifers and 907 steers were fed separately in 8 pens averaging 249 heifers or 227 steers per pen. In each pen, four cattle were given a bolus to continuously measure and record rumen pH. Cattle were initially fed a backgrounding diet for 66 days (46.5% corn and alfalfa silage, 38% barley grain, 15%DDGS, limestone, and mineral and vitamin premix), then stepped up over 40 days and 5 transition diets to a finishing diet (9.5% corn silage, 80% wheat grain, 10% DDGS, and mineral and vitamin premix). Cattle were fed three to four times per day, such that bunks were “slick” (completely empty) at the end of the day. On days when the diet changed, the new diet was introduced at the second feeding of the day. Straw bales were added to the pen once when staff felt that cattle were experiencing digestive upsets. The boluses and pH data were recovered when the cattle were slaughtered at the end of the feeding period.

What they learned

As expected, increasing the level of wheat grain in the diet had the expected effects on rumen pH. In all cattle, pH dropped, became more variable, and pH spent more time below 5.6 as the cattle moved through the transition diets. On the first transition diet, pH averaged 6.4, cattle averaged 10 minutes per day at a pH below 5.6, and fewer than 10% of cattle experienced between one and three bouts of acidosis (i.e. episodes where they spent 180 consecutive minutes below pH 5.6). On the finishing diet, pH averaged 6.1 and cattle spent an average of 157 minutes per day at a pH below 5.6. Over 40% of cattle experienced one to three bouts of acidosis, and less than 10% experienced seven to ten bouts of acidosis. Some cattle had bouts of acidosis on more than one diet; when added across the whole trial, 57% of cattle had experienced one to three bouts, 20% had experienced four to 6 bouts, 3% had experienced seven to 10 bouts, and 3% had experienced more than 10 bouts of acidosis.

What it means

This research showed that cattle can be successfully transitioned to a wheat-based finishing diet with pH effects of a relatively mild severity, provided it’s done carefully and slowly. By comparison, an earlier trial (J. Anim. Sci. 92:3053) adjusted cattle (35 head per pen) from 42% to 81% barley grain using four transition diets over 19 days with similar results; on the final diet, pH averaged 6.0, with cattle spending up to 195 minutes per day at pH below 5.6.

Another study where cattle were penned and fed individually as they were transitioned from 35% to 85% barley grain in five steps over 15 days reported an average pH of 5.8 with cattle spending more than 9 hours per day at pH below 5.6 (J. Anim. Sci. 83:1116). This confirms that rumen pH measurements collected from individually fed cattle do not represent those experienced by cattle in pen feeding situations.

Cattle evidently vary considerably in their ability to cope with high grain diets. Although 26% of cattle in this study experienced four or more bouts of acidosis during this trial, 57% experienced only one to three bouts, and 17% experienced no acidosis at all. More research would be needed to determine whether these differences stem from their place in the pecking order, genetic differences, differences in the bacteria, protozoa and fungi in their rumen (i.e. the “rumen microbiome”), previous nutritional and health history, or some combination of all these things.

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