EFFECTS OF SPEED OF RATION STEP-UP AND MONENSIN ON RUMINAL PH, LACTATE, AND PROTOZOAL POPULATION IN FEEDLOT CATTLE

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Summary

Fluctuations in ruminal pH, lactate concentration, and ciliated protozoal population were monitored in 40 individually fed crossbred heifers that were stepped up to an 85% concentrate diet either slowly (12 d) or rapidly (3 d), with or without monensin (30 ppm). Speed of step-up affected ruminal pH, lactate concentration and protozoal population initially (up to 28 d), but thereafter no differences occurred between the groups, suggesting adaptation to ruminal conditions. Monensin had no effect on ruminal pH, lactate concentration, or protozoal population.

(Key words: Ruminal Microorganisms, Step-up Monensin, Feedlot Cattle.)

Introduction

When cattle are switched from a high-forage to a high-grain diet, the ruminal microbial population undergoes a dramatic shift. How quickly cattle are stepped to a high grain diet could have a major influence on microbes, particularly protozoa. Previous studies have followed microbial changes for short periods and with restricted feed intakes. Therefore, our objectives were to determine the influence of speed of step-up on ruminal pH, lactate concentration, and protozoal population from the beginning of the finishing period until slaughter, in cattle fed ad libitum.

Experimental Procedures

Forty Hereford-Angus heifers (average weight, 680 lb), previously fed a sorghum silage diet, were randomly allotted to one of four treatments in a 2 × 2 factorial arrangement. The main treatments were speed of step-up (slow or rapid) and monensin (without or with 30 ppm). Cattle in the slow step-up program were fed 25, 40, 55 and 70% corn diets in successive increments (3 d for each increment) before being placed on the final diet. Cattle in the rapid step-up program were fed a 70% concentrate diet for 3 d before receiving the final diet. The final diet consisted of 85% cracked corn, 10% roughage (dehydrated alfalfa and sorghum silage), and 5% supplement. The cattle were individually fed once daily in amounts sufficient to allow ad libitum intake.

Ruminal contents were collected by stomach tube from all 40 animals on the day before feeding grain (d 0), after the rapid step-up (d 5), after the slow step-up group reached full feed (d 14), and at 14-d intervals thereafter until slaughter (d 119). Ruminal contents were analyzed for pH, lactate, and protozoal counts.

Results and Discussion

Ruminal pH was highest before beginning the grain feeding (7.17 on d 0) and lowest on d 56 (5.29). Statistical analysis on only the first four sampling dates revealed that average ruminal pH was higher ($P < 0.01$) in heifers stepped up slowly (6.45) than in heifers stepped up rapidly (6.22). However, ruminal pH thereafter fluctuated similarly in both groups of cattle. Following adaptation to full feed, ruminal pH progressively increased and eventually stabilized (except on d 56, Figure 1). In both groups, ruminal lactate concentration peaked when the animals reached full feed (50 mM on d 5 in cattle stepped-up rapidly and 29 mM on d 14 in cattle stepped-up slowly) and then declined to extremely low levels. The speed of step-up had no effect on ruminal lactate concentration.

Protozoa1 numbers decreased from d 0 to d 5 in the rapid step-up program but increased in the slow step-up program. After d 5, protozoal counts in both groups followed similar fluctuations (Figure 2). Average protozoal. numbers peaked on d 5, progressively declined until d 56 (P<.05), and then increased (P<.05), suggesting an adaptation of protozoa1 population to ruminal conditions. At the beginning of the study, the cattle possessed various concentrations of 11 protozoa1 genera, but after d 28, only three genera survived. The number of cattle devoid of protozoa (defaunated) ranged from 1 on d 14 to 11 on d 42 and d 56 and then dropped to 2 on d 119; the speed of step-up did not affect (P>.10) the number of defaunated animals at any sampling time. Although cattle were individually penned, isolation was not absolute, and cattle could have been exogenously reinoculated from a faunated neighbor. Alternatively, refaunation may have been endogenous, with the protozoa either surviving in the rumen at undetectable levels or emigrating from the omasum and then rapidly proliferating as ruminal conditions improved. Regardless of the source of inoculum, defaunation in feedlot cattle is apparently transitory.

Generally, monensin had no effect on ruminal pH, lactate concentration, or protozoal population. However, monensin-fed heifers tended to have higher ruminal pH (6.40) than those receiving no monensin (6.28). The beneficial effect of monensin tended to be more pronounced in cattle stepped up rapidly (ruminal pH 6.34 vs 6.11 for monensin fed and control heifers, respectively) than in cattle stepped up slowly (6.46 vs 6.44).

We concluded that the effect of speed of step-up on ruminal conditions was confined to the initial 28 d of the feeding period. Defaunation is apparently transitory, and cattle harbor a dynamic protozoa1 population that fluctuates in response to changing ruminal conditions.

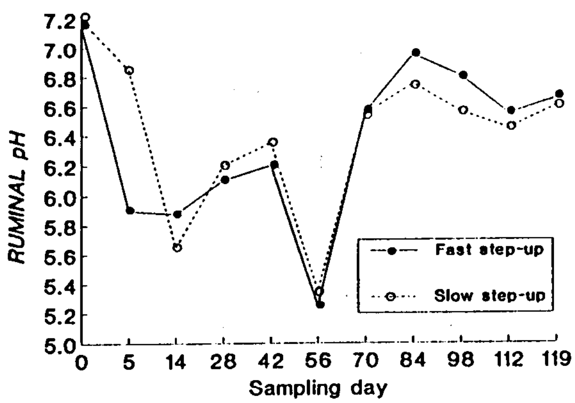

Figure 1. Influence of Speed of Ration Step-up on Ruminal pH in Feedlot Cattle. Each Value Represents Mean of 20 Cattle

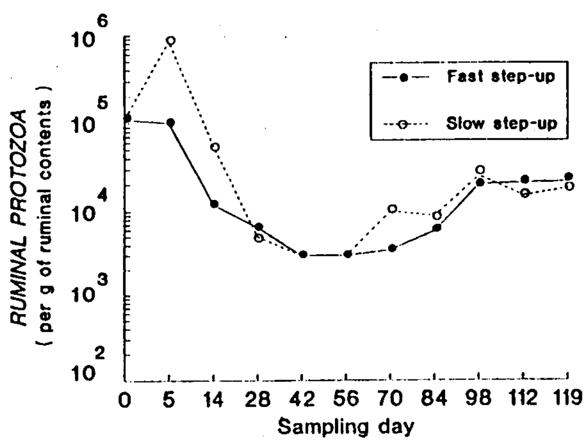

Figure 2. Influence of Speed of Ration Step-up on Ruminal Ciliated Protozoa Each Value Represents Mean of 20 Cattle