

Effects of plane of nutrition and as-fed milk replacer temperature on abomasal dynamics in Holstein calves

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Introduction

Fluctuations in as-fed milk replacer have been implicated as a potential cause of abomasal diseases, including abomasitis and bloat. As feeding preweaned calves a higher plane of fluid milk nutrition becomes increasingly common, understanding how specific feeding management factors affect the abomasal compartment will aid in optimizing milk ration development and implementation. The objectives were to determine the effects of plane of nutrition (PON) and as-fed milk replacer temperature (AFMRT) on the functionality and environment of the abomasum in healthy Holstein calves.

Materials and Methods

Fourteen bull calves (2 ± 1 d of age) with adequate passive transfer of immunity (serum total protein >5.2 g/dL) were randomly assigned to 1 of 4 treatments in a 2x2 factorial design; factors being: MR PON (low [LOW], high [HI]) and AFMRT (consistent [CON], variable [VAR]). The low PON MR diet consisted of 450 g/d of 22% CP – 20% fat MR (10.7% solids); calves fed the high PON MR diet were allocated 1100 g/d of 26% CP – 20% fat MR (15.5% solids). The AFMRT in the CON treatment groups consistently ranged between 100 – 105°F (37.8 – 40.6°C); the VAR treatment groups AFMRT randomly fluctuated for 10 consecutive feedings among 5 temperature ranges: 80 – 84.9°F (26.7 – 29.4°C), 84.9 – 89.9°F (29.4 – 32.2°C), 89.9 – 95°F (32.2 – 35.0°C), 95 – 100°F (35.0 – 37.8°C), 100 – 105°F (37.8 – 40.6°C). Each calf had an abomasal cannula surgically placed on d 5. From d 1 through d 8, all calves were fed the LOW-CON diet; assigned MR diets began on d 9 and were fed at a CON temperature. Beginning on d 14, AFMRT varied according to treatment.

On d 19, acetaminophen was added into each MR aliquot to indirectly assess abomasal emptying rate (AER). Peripheral blood samples were collected at 0, 1, 2, 3, 4, 6, and 8 h following MR administration for plasma acetaminophen analysis. Postprandial abomasal fluid samples were collected at 0, 1, 2, 4, 6, and 8 h to assess gastric pH and ex-vivo bacterial growth potential of *Clostridium perfringens* Type A (CPA) and *Salmonella typhimurium* (ST). Repeated measures data were analyzed using PROC MIXED.

Results

Postprandial pH was greater in HI calves ($P=0.01$) but tended to be lower in VAR calves ($P=0.061$). The VAR AFMRT resulted in a faster AER relative to a CON AFMRT ($P=0.04$). There were PON x time effects for CPA ($P=0.003$), with HI calves having greater counts. CPA counts were greater in calves fed the CON AFMRT ($P=0.01$).

Significance

HI elevates postprandial abomasal pH, thereby facilitating increased CPA counts in luminal abomasal fluid. Fluctuating AFMRT increases AER. Chronic fluctuations in AFMRT may increase the rate of partially digested nutrient delivery to the proximal small intestine, which may increase the risk of gastrointestinal diseases. Further research needs to be performed to evaluate additional feeding management factors that affect the abomasum in preweaned calves.