URINE pH: POTENTIAL DIAGNOSTIC CRITERION FOR SUBACUTE RUMINAL ACIDOSIS (SARA) IN LACTATING DAIRY COWS
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TAKE HOME MESSAGES

- Rumen fluid pH and rumen pH6-hrs, a measure of acidosis, were related to urine pH, even when diets were fed that did not cause SARA.

- Once the relationships between SARA and urine pH are established using SARA-inducing diets, it should be possible to use urine pH as a diagnostic criterion for SARA.

INTRODUCTION

Subacute ruminal acidosis is characterized by episodes of low rumen pH in dairy cows. Clinical signs of SARA are variable; therefore, it is often difficult to identify animals suffering from this metabolic disorder. Affected animals may exhibit anorexia or inconsistent feed consumption, develop intermittent diarrhea, become dehydrated, have unexplained abscesses, and develop laminitis. It has been proposed that a pH of 5.5, based on fluid collected by rumenocentesis (aspiration by needle) from the caudoventral rumen be used as a diagnostic criterion for identification of groups of dairy cows that are likely to have SARA. A cross-sectional field study of 15 Holstein herds in Wisconsin detected ruminal pH values <5.5 in 19% of cows between 2 and 30 days in milk and 26% of cows that were 90 to 120 days in milk. In one-third of these herds, >40% of the lactating cows tested had ruminal pH values <5.5. It seems likely that SARA is present in a large number of dairy herds, and that costs associated with health and production problems related to it are considerable. Previous research demonstrated that dietary cation-anion difference affected the urine pH of lactating cows and suggested that a relationship may exist between ruminal acidosis and urine pH. The goal of this study was to examine the potential use of urine pH as a diagnostic criterion for identification of dairy cows likely to have SARA.

MATERIALS AND METHODS

Six lactating Holstein cows with ruminal cannulas were fed totally mixed diets with corn silage, ground corn, DDGS, soybean meal, whole cottonseed, and wheat straw. The six treatment diets varied only in their contents of NaHCO₃ or K₂CO₃ and were fed for two-week periods in a Latin-square design. A seventh (spare) cow was assigned to the control diet during the first three periods and one cow had mastitis in the fifth period and was dropped from the experiment. In the last week of each period, the pH of urine (if obtainable) and composite rumen fluid samples were measured to provide data representing two-hour intervals throughout a 24-hour period. These data were used to calculate mean rumen fluid and urine pH. Rumen pH6-hrs, the total area below pH 6, was also computed as a measure of acidosis.
RESULTS AND DISCUSSION

Figure 1 shows mean rumen fluid pH throughout the day across diets. The shaded area in the figure corresponds to pH6-hrs. Ruminal pH fell for 8 to 10 hours after the cows were fed at 1030 h daily and gradually returned to the pre-feeding value.

Mean rumen fluid pH for each cow in each period was related to the corresponding mean urine pH (Figure 2, $P < 0.02$); however, only 15% of the total variation was explained. In contrast, 64% of the variation was explained by the relationship between rumen pH6-hrs and mean rumen fluid pH for each cow in each period (Figure 3, $P < 0.001$). Rumen pH6-hrs was also related to mean urine pH for each cow in each period (Figure 3, $P < 0.001$) and 28% of the total variation was explained.

These data indicate that rumen fluid pH and rumen pH6-hrs, a measure of acidosis, are related to urine pH, even when diets are fed which do not cause SARA. It should be possible, then, to use urine pH as a diagnostic criterion for SARA once the relationships between them are established using SARA-inducing diets. The number of cows required to be sampled in a herd to determine whether or not SARA is present can also be determined when data from future research becomes available. Use of urine pH instead of rumenocentesis to diagnosis SARA will be less invasive, and reduce health risks and cost.

![Figure 1](image_url)

**Figure 1.** Mean rumen fluid pH throughout the day across diets. The area corresponding to a measure of acidosis, pH6-hrs, is shaded. Cows were fed at 1030 h daily.
Figure 2. Mean rumen fluid pH versus mean urine pH for each cow in each period.

Figure 3. Rumen pH₆-hrs, a variable related to acidosis, versus rumen fluid pH for each cow in each period.
Figure 4. Rumen pH₆-hrs, a variable related to acidosis, versus urine pH for each cow in each period.