

Effect of apple cider vinegar on the urine pH of lambs

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Introduction

Urolithiasis is a common disease in growing lambs. Acidification of the urine is both a treatment and prevention for struvite urolithiasis. Ammonium chloride has been shown to produce acidic urine within 24-72 hours, depending on dose. The challenges with increasing ammonium chloride level in feed is the unpalatability of the salt and daily individual dosing has issues with client compliance. Apple cider vinegar has been used by producers as both a treatment and prevention of urolithiasis by both addition to water and by direct drenching. There is currently a lack of evidence to support use of apple cider vinegar in the peer-reviewed literature. The objectives of this study were to investigate the effect of apple cider vinegar on the urine pH of sheep when drenched by mouth and compare the effects on urine pH to ammonium chloride.

Materials and methods

Weaned male lambs in a privately owned sheep operation, approximately 4 months old, were randomly allocated to 1 of 3 groups: apple cider vinegar (ACV), ammonium chloride (AC) and control (C). Lambs were housed in 2 pens that were managed identically. They had free-choice water and were fed free-choice custom mix 16% protein sweet feed that was provided twice a day approximately 2 lbs/hd/day, along with a 1/2 lb/hd/day of alfalfa hay. Lambs were fed at 7 am and 4 pm. A collection cup system was used. Urine was collected 3 times a day (8 am, 2 pm and 8 pm) for 14 days. Urine was collected the day before the study commenced, corresponding to day 0 urine pH and the lambs were individually weighed.

Lambs were drenched with either 200 mg/kg ammonium chloride with added water to make a 60 mL volume drench (AC group); 60 mL of commercially available apple cider vinegar (ACV group) or 60 mL fresh water (C group). Lambs were drenched twice daily for 10 days.

Urine pH was measured immediately after collection using urine paper pH strips. Treatment administration, urine collection and pH measurement were performed by 1 of 4 investigators over the course of the study.

Linear mixed models using the “xtmixed” command in Stata 14.2 were used to test the effect of treatment on urine pH. Fixed effects included treatment group (apple cider vinegar, ammonium chloride, control), time of day (8 am, 12 pm, 8 pm), day (day 0 to 14 of study), and a 2-way interaction between treatment and day. Random intercepts for day, time of day and sheep were included in the model unless estimates were negligible. Contrasts within day were adjusted using the Bonferroni adjustment for multiple comparisons. Statistical significance was set at $P \leq 0.05$.

Results

Five animals were allocated to each of the ACV and AC groups, and 3 to the control group. Urine pH mean for all animals was 6.9 with a range of 5.5-8 at 8 am on day 1 of the study (before any animals were treated). The ACV group had significantly higher pH than the control group on Day 1 (mean pH across all 3 urine collections), but the ACV group was not significantly different than the control group at any other time points. The ammonium chloride group had significantly lower pH compared to the control group on Day 2 through Day 7, and on Day 12. Urine pH decreased below pH 7 for both control and ACV groups after day 7. Lambs appeared to tolerate drenching with both apple cider vinegar and ammonium chloride well.

Significance

Sixty milliliters of apple cider vinegar drenched to sheep on a diet typical to that of show lambs did not result in production of urine with a pH below 6.5 when compared to sheep drenched with ammonium chloride. Therefore, we recommend that ammonium chloride is the preferred oral solution to be administered to dissolve struvite stones in sheep.

