Measurement of urine pH and net acid excretion and their association with urine calcium excretion in periparturient dairy cows

ABSTRACT

Urine pH (UpH) and net acid excretion (NAE) are used to monitor the degree of systemic acidification and predict the magnitude of resultant hypercalciuria when feeding an acidogenic ration to control periparturient hypocalcemia in dairy cattle. The objectives of this study were to evaluate the diagnostic performance of urine dipstick and pH paper for measuring UpH, and to characterize the UpH–NAE relationship and the association of urine Ca concentration ([Ca]) with UpH and NAE. Urine samples (n = 1,116) were collected daily from 106 periparturient Holstein-Friesian cows fed an acidogenic ration during late gestation. Net acid excretion was measured by titration, and UpH was measured by a glass-electrode pH meter (reference method), Multistix-SG urine dipsticks (Siemens Medical Solutions Inc., Ann Arbor, MI), and Hydrion pH paper (Micro Essential Laboratory Inc., Brooklyn, NY). Diagnostic performance was evaluated using Spearman correlation coefficient (rs), Bland–Altman plots, and logistic regression. Urine pH measured by urine dipstick (rs = 0.94) and pH paper (rs = 0.96) were strongly associated with UpH. Method-comparison studies indicated that the urine dipstick measured an average of 0.28 pH units higher, and pH paper 0.10 pH units lower, than UpH. Urine [Ca] was more strongly associated with UpH (rs = −0.65) than NAE (rs = 0.52). Goals for controlling periparturient hypocalcemia under the study conditions were UpH <6.22 and <6.11, based on achieving urine [Ca] ≥5 mmol/L and estimated urinary Ca excretion ≥4 g/d, respectively. Urine pH was as accurate at predicting urine [Ca] as NAE when UpH >6.11. We conclude that pH paper is an accurate, practical, and low-cost cow-side test for measuring UpH and provides a clinically useful estimate of urine [Ca].

Keyword: Urine dipstick; pH papernet acid excretion; Acidogenic diet; Hypercalciuria