

## Steers that excrete less creatinine when fed protein-limiting diets are more feed efficient

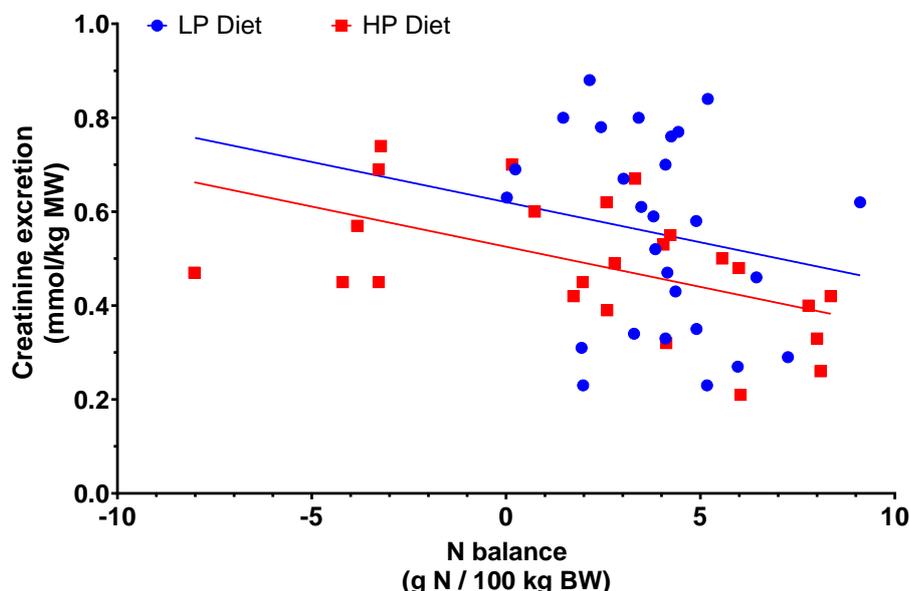
E. Parker<sup>A</sup>, B. Fraser<sup>A</sup>, D. F. A. Costa<sup>B</sup>, and L. F. P. Silva<sup>B,C</sup>

<sup>A</sup>School of Veterinary Sciences, The University of Queensland, Gatton, QLD, 4343, Australia.

<sup>B</sup>Queensland Alliance for Agriculture and Food Innovation, The University of Queensland, St Lucia, QLD, 4072, Australia.

<sup>C</sup>Email: l.pradaesilva@uq.edu.au

For cattle grazing in the seasonally dry tropics of Australia, feed efficiency (FE) should be highly regarded considering that the amount and quality of feed can be a constraint for extended periods of the year. This work investigates how urinary creatinine excretion (UCE) is related to FE in cattle, given the association between creatinine excretion and muscle metabolism. The use of UCE is here proposed for the evaluation of FE because, theoretically, the more efficient cattle would have lower muscle turnover, which can be important when nitrogen (N) is a limiting nutrient. To validate the hypothesis that more efficient cattle would have lower UCE and that it was positively correlated to FE, three groups of 10 *Bos indicus* steers ( $398 \pm 4.3$  kg body weight) received two diets, one supplying 70% of the rumen degradable protein requirements [*i.e.* low protein (LP) diet], and the other supplying 100% [*i.e.* high-protein (HP) diet] for 70 days each. Feed efficiency was calculated as the residual gain, estimated as the individual difference of the actual average daily gain (ADG) and the expected ADG [*i.e.* derived from the linear regression of ADG over all weighing periods and dry matter intake (DMI)]. During the last seven days, the steers were held in metabolism crates for daily measurements of total faecal and urine outputs and calculations of nutrient digestibility. Blood samples were collected at four time points to evaluate plasma urea nitrogen (PUN). The concentration of creatinine in the urine was performed according to the method of George et al. (2006) with a Prodigy 250 x 46 mm, 5  $\mu$ m, ODS C18 reverse phase column (Phenomenex; Torrance, CA, USA). Steers in a negative N balance had increased UCE compared to animals in positive N balance ( $P=0.02$ , Figure 1). This was the result of increased creatinine concentration in the urine ( $P=0.08$ ) instead of increased volume of urine produced ( $P=0.36$ ). Feed efficiency had a tendency to be associated with increased UCE ( $P=0.09$ ) and the latter was found to be positively correlated with PUN in the LP diet ( $P=0.04$ ). The greater creatinine values for the LP diet demonstrate a likely greater muscle degradation, which helps when dietary N is deficient (more circulating N from muscle, more N-recycling back to the rumen). There was a large variation in N use efficiency (NUE) among the steers, with retention of N varying from -91 to 70 % of digested N. Steers with greater NUE excreted less urinary creatinine ( $P<0.05$ ). These results indicate that more efficient cattle in a protein-limiting diet excrete lower concentrations of creatinine in their urine, likely reflecting lower muscle protein turnover.



**Figure 1. Relationship between total creatinine excretion and nitrogen balance in steers fed diets with either low (LP) or high (HP) protein content.**

### References

George SK, Dipu MT, Mehra UR, Singh P, Verma AK, Ramgaokar JS (2006). *Journal of Chromatography B: Improved HPLC method for the simultaneous determination of allantoin, uric acid and creatinine in cattle urine* **832**, 134-137

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