

This manuscript presents a careful and thorough analysis of the relationship between feed efficiency as measured through two different metrics (feed conversion efficiency and residual feed intake) and two biomarkers, namely 1) the difference in <sup>15</sup>N abundance in animal tissues (plasma in all but one study in which muscle was sampled) and feed, and 2) plasma urea concentration. The analysis is a nice follow up of recent research conducted by this group and others.

The manuscript is well written although the writing may be improved in some specific passages indicated under Specific comments. The methods are sound and the results interesting. The Discussion following the presentation of results is thoughtful and the research is novel and has important implications to ruminant productivity and sustainability.

I have the following comments for the authors to consider:

Major:

- 1) Would it make sense to weight by the experiment duration normalized to unity?
- 2) Statistical analyses: it may be easier for readers to follow if the statistical models as equations were presented earlier in the text before providing further details on, for example, R commands or model selection through AIC and BIC.
- 3) If the type of animal (i.e. bulls, heifers or steers) was introduced into the model, both as a main effects and as an interaction with the biomarkers, would it be significant?
- 4) Line 189 and throughout (e.g. right panel in Figure 1). I assume that by “dietary” or “diet” the authors mean the dietary treatment in each study? It might be less ambiguous to say “treatment”
- 5) ADG was at the end of the day the best predictor. I agree with the authors that the use of the biomarkers and especially <sup>15</sup>N abundance can certainly improve the prediction of FCE based on ADG, but I think a very important point to highlight in the Abstract and Conclusions is that ADG was still the best single predictor.
- 6) A comment without request for modification: Could there be any use of analyzing and studying delta <sup>15</sup>N(animal – feed) measured in hair? Thoughts for future research

Abstract

Line 38. Specify which percentage does “extreme animals” refer to

Introduction

Line 70. Suggest “ranking individual animals”

Line 77. I think there is a leap in the explanation regarding feed sorting. Consider expanding with one or two sentence to clarify the point

Materials and Methods

Lines 119-120. Did the authors try running the analyses both with and without Study #8, as <sup>15</sup>N abundance was not measured in plasma urea but in muscle?

Lines 124-125. “Table 1”

Lines 136-141. Perhaps it would be useful to readers to include the equation showing how DMI is calculated by regressing against CG, ADG and mBW<sup>0.75</sup>, with RFI equating the residuals in the regression

Lines 143 and 146. "analyses"

Line 150. Please inset space between number and units

Line 163. Subscript in N<sub>2</sub>

Line 167. "measured"

Lines 219-229. I recommend adding the equation for the statistical model

#### Discussion

Lines 334-335. This is valid when animals are fed TMRs, as in the present analysis, but differences between DMI and N intake may occur in grazing systems

Line 340. "VandeHaar"

Line 372. "with growing heifers"

Line 373. Please insert space i.e. 20% CP

Lines 387-389. Not sure that I understand the intention correctly. Does it mean that only 11 or 6% of the animals within a CG would differ by 0.06 or 0.08 kg/kg and would thus be estimated to have significantly different FCE using <sup>15</sup>N abundance or urea N, respectively?

Line 392. Insert comma after Moriasi et al. (2007)

Line 448. Which currency is this? Is it US dollars?

Line 454. Insert comma after "Interestingly"

Line 455. Is simple or mixed models meant by "both approaches"? I would mention both approaches to be explicit

Lines 454-461. I agree with the reasoning with the following caveat: to me the relationship goes beyond only a high correlation but also represents a response of a similar magnitude. It seems to me that a high correlation between both variables does not necessarily require a similar slope in their respective relationships with delta <sup>15</sup>N<sub>(animal-diet)</sub>.

Line 486. Suggest using "Rather," instead of "On the other hand,"

#### Conclusions

Line 502. "contrasting"

Table 1, second column heading. Perhaps "type of animal" would be a better description than "sex", as other aspects are also considered

Figure 1. If possible, using different colors would allow for better distinction of the different types of animals