

## Using piecewise regression models to evaluate beef cow responses to nutritional challenges

A. Aliakbari<sup>1</sup>, J. Pires<sup>1</sup>, L. Barreto-Mendes<sup>1</sup>, F. Blanc<sup>1</sup>, I. Cassar-Malek<sup>1</sup>, I. Ortigues-Marty<sup>1</sup> and A. De La Torre<sup>1</sup>

<sup>1</sup>Université Clermont Auvergne, INRAE, VetAgro Sup, UMR Herbivores, F-63122 Saint-Genès-Champanelle, France; [amir.aliakbari@inrae.fr](mailto:amir.aliakbari@inrae.fr)

Productive and metabolic adaptive responses to nutritional challenges are key components to study resilience and robustness regarding the challenges facing livestock production systems. Different methods have been proposed to evaluate responses to perturbations, however, there is no agreement on a reference method that accounts for the complex adaptive response of animals to FR. The objective of the present study was to assess the potential of piecewise models to quantify the responses of beef cows to nutritional challenges and describe between-cow variability. In total, 22 suckling Charolais cows were exposed to 4 nutritional challenges, each consisting of 4 days of feed restriction (FR1, FR2, FR3, and FR4; covered 50 % of net energy requirements), followed by 3 days of ad libitum forage intake. Cows were allowed 14 days of ad libitum forage intake between the first challenge and the other three successive challenges. Data of daily milk yield (MY, kg/d) and plasma non-esterified fatty acid concentrations (NEFA, mM) were analysed using continuous piecewise regression models. The estimated individual regression coefficients for MY and NEFA from the models were used as indicators of adaptive responses. The coefficients were then grouped and compared using hierarchical clustering. The MY decreased in average -0.28, -0.58, -0.95, and -1.08 kg during FR1, FR2, FR3, and FR4, respectively, compared to the preceding ad libitum period. In contrast, NEFA increased 0.19, 0.16, 0.23, and 0.33 mM in FR1 to FR4, respectively, compared to the previous ad libitum period. Clusters of animals with greater MY change during FR presented smaller changes in plasma NEFA, compared to clusters of animals with smaller MY changes. These results showed that piecewise regression models are relevant to highlight differences between cows in the prioritisation of milk production underpinned by the use of body reserves. The continuous piecewise linear models allowed to reduce the complexity of beef cow responses to FR in the form of individual regression coefficients, which can be useful to define suitable proxies for resilience and robustness.