



**HAL**  
open science

## **A candidate proteomic signature from the plasma of Charolais bulls to phenotype feed efficiency**

Isabelle Cassar-Malek, Gonzalo Cantalapiedra-Hijar, Arnaud Delavaud,  
Muriel Bonnet

### ► **To cite this version:**

Isabelle Cassar-Malek, Gonzalo Cantalapiedra-Hijar, Arnaud Delavaud, Muriel Bonnet. A candidate proteomic signature from the plasma of Charolais bulls to phenotype feed efficiency. 10. International Symposium on the Nutrition of Herbivores (ISNH10), Sep 2018, Clermont-Ferrand, France. Cambridge University Press, *Advances in Animal Biosciences*, 9 (3), 2018, 10th. International Symposium on the Nutrition of Herbivores (ISNH10). hal-02734335

**HAL Id: hal-02734335**

**<https://hal.inrae.fr/hal-02734335v1>**

Submitted on 2 Jun 2020

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

## A candidate proteomic signature from the plasma of Charolais bulls to phenotype feed efficiency

Isabelle Cassar-Malek, Gonzalo Cantalapiedra-Hijar, Arnaud Delavaud, Muriel Bonnet

Université Clermont Auvergne, INRA, VetAgro Sup, UMR Herbivores, F-63122 Saint-Genès-Champanelle, France

E-mail: [isabelle.cassar-malek@inra.fr](mailto:isabelle.cassar-malek@inra.fr)

**Take home message** We have identified a set of candidate biomarkers for feed efficiency in the plasma proteome of young Charolais bulls underlying the contribution of non-productive functions such as immunity.

**Introduction** The measurement of the feed efficiency (FE) requires an individual and strict control of the ingestion and performances of animals at least over a period of 70 days. We aimed at developing biomarkers from low invasive samples the combination of which will predict FE individual variations.

**Material & methods** We examined the plasma proteome of two groups of Charolais young bulls according to their residual feed intake (RFI) and feed conversion efficiency (FCE) metrics (Meale *et al.*, 2017). The study included 17 extremes animals: n=9 positive RFI vs n= 8 low RFI negative (0.69 vs -0.75 kg/j). Prior to nano LC-MS/MS analysis, the plasma samples were depleted of high-abundance proteins using the Proteominer technology (Cassar-Malek *et al.*, 2015). Statistical analysis of data included ANOVA, Principal Components Analysis (PCA) and correlation analysis (Pearson). Lists of proteins were analysed using ProteINSIDE (<http://www.proteinside.org/>) to mine biological information. Gene Ontology (GO) enrichment tests (P value\_Benjamini Hochberg < 0.05) were done with human orthologs to take advantage of the most complete annotation available for molecular functions and biological processes. A similar workflow was applied to the same animals ranked according to their FCE (0.17 [low FCE] vs 0.23 [high FCE] kg/kg).

**Results & discussion** A PCA analysis of all data was applied to remove outliers (n=2/per RFI group) from further analysis. Then a differential abundance according to RFI was revealed for 51 proteins (P <0.1) including 4 uncharacterised proteins. A correlation between plasma abundance and RFI values was detected for 24 proteins out of the 51 proteins (-0.795 <r2 <+0.806). Nine of the 51 differential proteins- 5 of the proteins correlated to RFI- were detected in a repertoire of secreted proteins identified by computation of published RFI omic datasets (Cassar-Malek and Bonnet, this symposium). These proteins are candidate biomarkers for RFI. The top GO Molecular Functions of the differential proteins were: calcium ion binding, serine-type endopeptidase inhibitor activity, lipid binding, carbohydrate binding, growth factor activity, regulation of insulin-like growth factor receptor signaling pathway. GO Biological Processes were mainly related to immunity (immune response, innate immune response), inflammatory response, complement and coagulation cascades, protein modification (protein folding, proteolysis, negative regulation of endopeptidase activity) and lipid metabolism (lipid transport, triglyceride and cholesterol homeostasis). These findings agree with the recent report that non-productive functions including immunity may contribute to inter-individual variations in feed efficiency in pig (Gondret *et al.*, 2017) and cattle (Weber *et al.*, 2016; Alexandre *et al.*, 2015).

Examination of proteomic data according to the FCE index revealed 21 differentially abundant proteins and 7 correlated proteins (-0.599 < r2 < +0.637). Comparison of FCE and RFI datasets showed that 6 proteins out of the 9 identified above as candidate RFI biomarkers are specific for RFI while 3 of them are common to both RFI and FCE.

**Conclusion** This is the first study identifying candidate biomarkers for feed efficiency in the plasma of cattle. It opens perspectives for biomarkers validation and high-throughput evaluation of this trait in ruminants.

**Acknowledgements** The authors acknowledge APIS-GENE for funding the study.

### References

- Alexandre PA, Kogelman LJA, Santana MHA, Passarelli D, Pulz LH, Fantinato-Neto P, Silva PL, Leme PR, Strefezzi RF, Coutinho LL, Ferraz JB, Eler JP, Kadarmideen HN and Fukumasu H 2015. BMC Genomics 16, 1073
- Cassar-Malek I, Delavaud A, Barboiron C, Chambon C and Picard B 2015. In: ICAP 2015 (p. 211). 4th International Congress on Analytical Proteomics, Lisbon, PRT (2015-09-07 - 2015-09-09).
- Gondret F, Vincent A, Houée-Bigot M, Siegel A, Lagarrigue S, Causeur D, Gilbert H and Louveau I 2017 BMC Genomics 18, 244.
- Meale SJ, Morgavi DP, Cassar-Malek I, Andueza D, Ortigues-Marty I, Robins RJ, Schiphorst AM, Laverroux S, Graulet B, Boudra H, Cantalapiedra-Hijar G 2017. Journal of Agricultural and Food Chemistry 65, 9817-9827.
- Weber KL, Welly BT, Van Eenennaam AL, Young AE, Porto-Neto LR, Reverter A and Rincon G PLOS ONE. 01611(3):e0152274