News
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Team Biomarkers of performance, adaptation and qualities (Biomarkers)

HIGHLIGHT

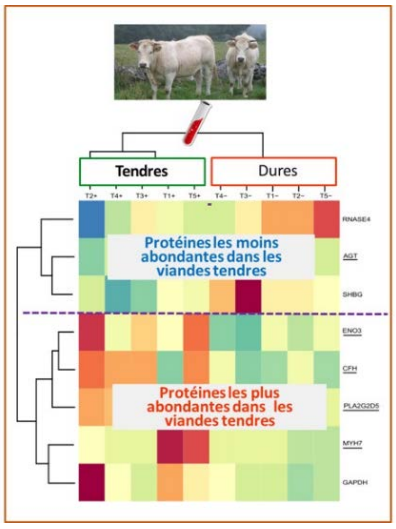
Plasma biomarkers for beef tenderness

Predicting meat tenderness in live animals is a challenge for the beef sector because it would make it possible to adapt husbandry practises according to the production objectives. To meet this challenge, we have been looking for biomarkers in bovine blood plasma. The analysis of the data available in the literature combined with the characterisation of plasma proteins enabled us to identify about a hundred candidate proteins to be minimally invasive biomarkers for tenderness. Once their predictive performance capacity has been evaluated and validated, the biomarkers will be integrated into tools for prediction of beef tenderness from a blood sample.

Tenderness is a complex phenotype, evaluated after the slaughter of cattle and the maturation of their meat, for which the beef industry is waiting for early detection tools. Omics technologies have made it possible to identify muscle biomarkers in the molecular signatures of tenderness (transcripts, proteins and genes). The discovery of generic biomarkers, which are minimally invasive in living animals, is a new challenge for animal selection, market segmentation and sectors of excellence, and proposition of husbandry practises. We searched for plasma biomarkers for tenderness, thanks to a combination of in silico study and proteomics unprecedented in livestock animals. Based on a systematic review of the literature, and on the construction of a database of 44 publications (Boudon and Cassar-Malek, 2019), we have generated an aggregated dataset.

It was analysed using the ProteINSIDE web service (Kaspric et al, 2015) to predict the muscle secretome and the proteins likely to be found in plasma. A repertoire of 75 candidates was established, based on their secretion, whether conventional, unconventional, or linked to micro or macro vesicles (Boudon et al, 2020a).

Shotgun proteomics of the *Longissimus* muscle (rib steak) of heifers from the Fleur d'Aubrac PGI revealed 71 proteins linked to the tenderness of this muscle, 38 of which newly identified for this quality. Proteomics of the plasma revealed, for the first time, 31 potential biomarkers of tenderness in this fluid (Boudon et al, 2020b).



Legend: *Identification of biomarkers for tenderness in the blood plasma of heifers from the Fleur d'Aubrac PGI, using shotgun proteomics.*

The study has generated a repertoire of about a hundred plasma proteins. The repertoire reflects the biological pathways known in the mechanisms of tenderness in the muscle. It comprises 32 proteins whose genes are present in regions of the genome closely associated with tenderness (Tenderness QTL) as well as 11 proteins with a genetic polymorphism (SNP).
This work has completed the list of biomarkers previously discovered cattle and the knowledge on tenderness mechanisms with the involvement of vesicular secretion pathways, micro-vesicles and exosomes. Once validated on larger numbers of cattle of various age- breed-sex, these biomarkers will be integrated into tools for the prediction of the tenderness of cattle based on protein detection from a blood sample.

Learn more:

S Boudon, J Henry-Berger, I Cassar-Malek. Aggregation of omic data and secretome prediction enable the discovery of candidate plasma biomarkers for beef tenderness. International Journal of Molecular Sciences, 21(2):1–33, 2020a. doi: 10.3390/ijms21020664.

S Boudon, D Ounaissi, D Viala, V Monteils, B Picard, I Cassar-Malek. Label free shotgun proteomics for the identification of protein biomarkers for beef tenderness in muscle and plasma of heifers. Journal of Proteomics, 217, 2020b. doi: 10.1016/j.jprot.2020.103685.

S Boudon and I Cassar-Malek. Dataset of proteins related to beef tenderness, 2019. https://doi.org/10.15454/7DKRQD, Portail Data INRAE, V2

Bibliographical references:

Kaspric N, Picard B, Reichstadt M, Tournayre J, and Bonnet M. 2015. ProteINSIDE to Easily Investigate Proteomics Data from Ruminants: Application to Mine Proteome of Adipose and Muscle Tissues in Bovine Foetuses. PLoS ONE 10(5): e0128086. doi:10.1371/journal.pone.0128086 -/- PubMed (PMID: 26000831)

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