Developing a phenotyping strategy for protein efficiency in fattening pigs

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Contact name: Claudia Kasper
Email: claudia.kasper@agroscope.admin.ch

Project description

To reduce the environmental footprint of pork production, improving the protein efficiency of fattening pigs is crucial. Differences in protein efficiency, i.e., the ability to incorporate dietary protein into the body, are heritable (Kasper *et al.*, 2019; Ewaoluwagbemiga *et al.*, 2023). Thus, protein efficiency can be increased through breeding. Phenotyping for this trait is difficult, and has previously been done by measuring the protein content of the carcass using chemical methods after slaughter. This approach is time consuming and costly, and therefore not suitable for genetic studies that require large sample sizes and therefore high-throughput phenotyping. Recently, we have developed a method that can estimate protein content in a cheaper and non-destructive way using X-rays with good accuracy (Kasper *et al.*, 2019). However, this is still labour intensive, especially when phenotyping live pigs, and therefore not yet practical for breeding. Feeding patterns, as automatically recorded for each individual by the feeding stations, could potentially provide information on protein efficiency, as these patterns have been associated with overall feed efficiency in pigs at both the phenotypic and genetic levels (Kavlak and Uimari, 2019), as well as with protein gain (Carcò *et al.*, 2018). However, while the accuracy of estimating energy efficiency and fat gain using automatically generated feed consumption data is satisfactory, the accuracy of estimating protein efficiency from aggregated feeding pattern data is low (Ewaoluwagbemiga *et al.*, 2021). The aim of the proposed work is therefore to combine a wealth of existing experimental data (nitrogen and phosphorus efficiency, feed composition and blood parameters, etc.) with routinely or automatically collected data such as feed consumption patterns, birth weight, growth performance, and others, to improve the prediction models for efficiency traits.

Prerequisites

This project requires at least a basic knowledge of R and some enthusiasm for using more sophisticated statistical techniques such as PLS or basic machine-learning applications (e.g., the *caret* package in R).

Literature

Carcò, G, Gallo, L, Dalla Bona, M, Latorre, MA, Fondevila, M & Schiavon, S, 2018, The influence of feeding behaviour on growth performance, carcass and meat characteristics of growing pigs. PLoS ONE, 13 (e0205572)

Ewaoluwagbemiga, EO, Bee, G & Kasper, C, 2021, Evaluation of feeding behaviour traits to predict efficiency traits in pigs using partial least square regression. *Animal* 15: 100351 ([PDF](#))

Ewaoluwagbemiga, EO, Bee, G & Kasper, C, 2023, Genetic analysis of protein efficiency and its association with performance and meat quality traits under a protein-restricted diet. *Genetics Selection Evolution* 55: 35 ([PDF](#))

Kasper, C, Ruiz-Ascacibar, I, Stoll, P & Bee, G, 2019, Investigating the potential for genetic improvement of nitrogen and phosphorus efficiency in a Swiss Large White pig population using chemical analysis. *Journal of Animal Breeding and Genetics* 137 (6): 545-558 ([PDF](#))

Kasper, C, Schlegel, P, Ruiz-Ascacibar, I, Stoll, P & Bee, G, 2020, Accuracy of predicting chemical body composition of growing pigs using dual-energy X-ray absorptiometry. Animal 15: 100307 ([PDF](#))

Kavlak, AT & Uimari, P, 2019, Estimation of heritability of feeding behaviour traits and their correlation with production traits in Finnish Yorkshire pigs. *Journal of Animal Breeding and Genetics* 136: 484-494

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