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Modelling feed efficiency in dairy cows for selection and management decisions

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Selective breeding and herd management practices are two important levers to improve feed efficiency in dairy cattle production. However, different approaches are used to model this trait and make decisions in both fields. The objective of this study was to compare two variables used for genetic evaluations (Residual feed intake, RFI) and the simulation of feed efficiency in the SimHerd software (FEsim). This comparison was carried out using a dataset collected at the Danish Cattle Research Centre. It comprised lactations 1-3 of Holstein cows for which weekly averages were available from 1-44 weeks in milk for dry matter intake (DMI), energy corrected milk yield (ECM) and body weight (BW). After cleaning, data were available for 1732 lactations recorded on 908 cows. The FEsim variable was computed by dividing expected by observed net energy intake. Expected energy intake was estimated using an equation with ECM, BW and BW change (BWc) as energy sinks and energy coefficients from nutritional studies. RFI was derived using a multivariate analysis of DMI, ECM and BW longitudinal records with random regression (RR) linear mixed models. Estimated variance components were used to calculate regression coefficients for the prediction of expected DMI based on ECM, BW and BWc. RFI was derived as the deviation between observed and expected DMI. Thus, efficient cows had higher FEsim and lower RFI values. RR mixed models were also run to estimate covariances between FEsim and RFI. Repeatability values were low for RFI (0.12-0.25) but consistent with previous estimates. Repeatability of FEsim was low until week 37 in milk (0.06-0.25) and moderate in weeks 37-44 (up to 0.43). Correlations between the cow effect of FEsim and ECM were moderately positive over most of the lactation, and moderately negative between FEsim, BW and DMI. Correlations between the cow effect of FEsim and RFI were moderately to strongly negative, i.e. favourable, over the whole lactation (-0.50 to -0.95). Hence, decisions made using RFI and FEsim will be rather consistent, but re-ranking of cows will occur especially at the start and end of lactation.

Encapsulation of bacteria and plant extracts for enhancing safety and health in fresh cheese

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This project focuses on developing a novel fresh cheese enriched with microcapsules (MC) containing microbial strains with bioactive/antimicrobial properties and plant extracts rich in functional compounds to enhance health benefits, safety and shelf-life. MC were formulated with co-emulsified microbial strains of Lactococcus lactis (LcL), Lacticaseibacillus paracasei (LbP) and Lb. rhamnosus (LbR) species and functional plant extracts (blackcurrant, black carrot, elderberry, Moringa, Alchemilla, grape stalk) using chitosan or whey protein coatings at different concentrations. 108 MC combinations were analyzed over 30 days of storage at 4°C, assessing encapsulation efficiency (EE%), microbial viability, and polyphenol retention. The highest EE% was observed for LcL and LbP together with blackcurrant and moringa coated with chitosan, and LbP with elderberry and whey proteins coating. After 30 days at 4°C, viability losses were around 1.9 log CFU/g, and LbP with moringa and blackcurrant in whey protein exhibited the best performance in terms of EE%. Grape stalk and blackcurrant extracts showed the highest polyphenol retention. Based on these results, further work will focus on Alchemilla, elderberry, and moringa for LcL and Alchemilla, elderberry, and blackcurrant for LbP/LbR using whey protein as coatings. These MC will be used for model-cheeses production that will be analysed by Nuclear Magnetic Resonance for the delineation of their characteristic profile. Alongside a consumer survey for 1,000 participants will assess acceptance of novel dairy products toward innovation, risk-benefit perception and willingness to adopt sustainable food technologies. This study was carried out within the ONFoods2 and received funding from the European Union Next-GenerationEU (PNRR-MISSIONE 4 COMPONENTE 2, INVESTIMENTO 1.3–D.D. 1550 11/10/2022, PE00000003).