

Inferring individual cow effects, dairy system and feeding on latent variables underlying milk yield and quality, protein composition and cheese-making traits in dairy cattle

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Shortened title: **Latent structure of cheese-making traits**

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Summary

This study aimed to examine the latent structure of 26 cheese related phenotypes in dairy cattle. Traits related to milk yield and quality (8 traits), milk protein fractions (8 traits), coagulation and curd firmness (CF, 5 traits) indicators, and cheese-making phenotypes [cheese yields (%CY,) and nutrient recoveries in the curd (REC), 5 traits] were analyzed through multivariate factor analysis (MFA) using a *varimax* rotation. All phenotypes were measured in 1,264 Brown Swiss cows. Ten, mutual orthogonal, latent variables (factors; Fs) were obtained explaining 74% of the original variability. Those Fs captured basic concepts of the *cheese-making* process. More precisely, the first 4 Fs, sorted by variance explained, were able to capture the underlying structure of the CY percentage (F1: %CY), the CF process with time (F2: CF_t), the milk and solids yield (F3: Yield) and the presence of nitrogen (N) into the cheese (F4: Cheese N). Moreover, 4 Fs (F5: α ₁- β -CN, F7: κ - β -CN, F8: α ₂-CN and F9: α ₁-CN-Ph) were related to the basic milk caseins and 1 factor was associated with the α -LA whey protein (F10: α -LA). A factor describing the udder health status of a cow (F6: Udder health), mainly loaded on lactose, other nitrogen compounds in the milk and SCS, was also obtained. Further, we inferred the effects of some potential sources of variation (e.g. stage of lactation and parity) including feeding and management systems. Stage of lactation had a significant effect for 7 of the 10 Fs, followed by parity of the cow (3 Fs), dairy system and feeding (3 Fs). Our work demonstrates the usefulness of MFA in reducing a large number of variables to few latent factors with biological meaning and representing groups of traits that describe a complex process like the cheese-making. This characteristic might be of great benefit for the dairy cattle industry.