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Introduction

Fine milk composition:

- Fatty acids (FA) profile → importance in human health
- Proteins (PR) profile → relevant to the dairy industry for cheese making process

The PhénoFinlait project has been carried out to explore milk composition in FA and PR of French dairy ruminants

The aim of this study was to evaluate:

Feasibility of genetic selection to improve sheep milk quality → genetic parameters for major fatty acids and proteins

Materials and methods

Population: 2 breeds

- 11.747 Lacaune (LAC) ewes in 1st lactation → 40.204 test-day records
- 8.159 Manech red faced (MRF) in 1st and 2nd lactation → 26.809 test-day records

Analysed traits:

- Milk yield, total fat content (FC)
- Milk composition profiles estimated by mid-infrared spectrometry and expressed in g/100g of milk fat or protein:
 - SFA: saturated FA, MUFA: mono-unsaturated FA, PUFA: poly-unsaturated FA
 - CN: total caseins, WP: whey proteins, caseins: κ-CN, α_{S2}-CN, α_{S1}-CN, β-CN

Genetic parameters:

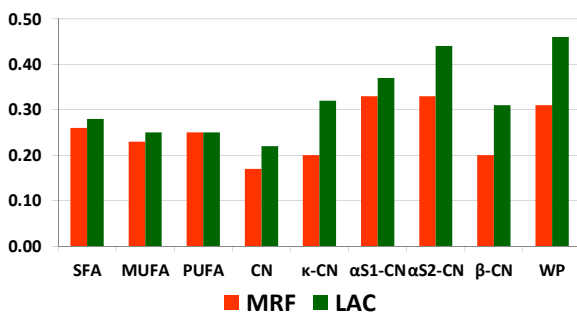
Performed by REML with WOMBAT software Using a multiple-trait (FA or PR) animal model with for each trait:

$$y = X\beta + Za + Wp + e$$

where y : vector of observations,
 β : vector of fixed effects: herds X day, parity, stage at lactation, age at lambing within parity, litter size;
 a : vector of random genetic effect $N(0, A\sigma_a^2)$;
 p : vector of random permanent environment effect $N(0, I\sigma_p^2)$;
 e : vector of random residual $N(0, I\sigma_e^2)$;
 X, Z and W : incidence matrices.

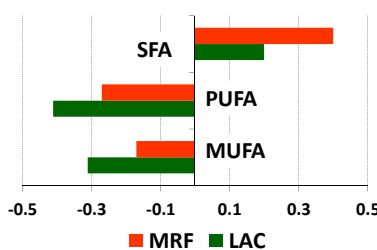
Results

Heritability estimates:



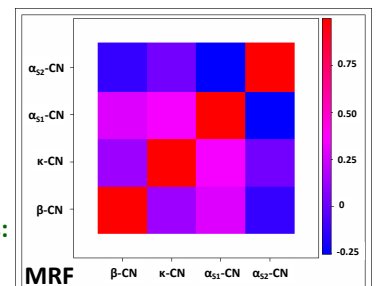
FA not genetically correlated with milk yield

Genetic correlations between FA and FC:



Genetic correlations between caseins:

α_{S2}-CN: null or negative correlations



Conclusion

- Heritability estimates: moderate for FA, and moderate to high for PR (with larger differences between breeds)
- FC positively correlated with SFA and negatively with MUFA and PUFA
- Positive genetic correlations between caseins except α_{S2}-CN

- ▶ Current selection on FC should increase SFA in milk fat
- ▶ Direct selection on major FA and PR profiles is now possible in French dairy sheep



PhénoFinlait
A French dairy industry R&D program on fine milk composition