



# Genetic correlations between methane production & milk fatty acid contents of Walloon Holstein cattle throughout the lactation

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## Background

- Enteric methane (CH<sub>4</sub>) emissions of cows
  - ✓ Common bio-chemical pathways with acetate & butyrate
- Milk fatty acids (FA) from acetate & butyrate
  - ✓ Potential predictors of CH<sub>4</sub>
- Association between CH<sub>4</sub> emissions & milk FA changes through the lactation
  - ✓ Still unclear

## Material & Methods

### Data

- Prediction of CH<sub>4</sub> emissions (g/d) & groups of milk FA contents (g/dL of milk) from milk mid-infrared (MIR) spectra
  - ≥ 5 records/cow
  - ≥ 20 cows/herd
- 243,260 MIR spectra collected between January 2007 and January 2014
- From 5 to 305 days in milk (DIM)
- 33,850 first-parity Walloon Holstein cows from 630 herds
- Pedigree file: 109,975 animals

### Model

- Bivariate random regression test-day models
  - MIR CH<sub>4</sub> & 1 group of FA
  - Resolved using REMLF90 (Misztal, 2012)

$$y = Xb + Q (Wh + Zp + Za) + e$$

where  $y$  = Vector of observations

$b$  = Vector of fixed effects

→ Herd x test-day

→ Classes of lactation stage

→ Gestation stage x lactation stage

→ Lactation stage x age at calving x season of calving

$h$  = Vector of herd x year of calving random effects

$p$  = Vector of permanent environmental random effects

$a$  = Vector of additive genetic random effects

$Q$  = Covariate matrix for 2<sup>nd</sup> order Legendre polynomials

$X$ ,  $W$  &  $Z$  = Incidence matrices

$e$  = Error

## Objective: Estimation of genetic correlations between CH<sub>4</sub> emissions & FA contents in milk throughout the lactation

### Conclusions

- Genetic correlations between CH<sub>4</sub> production & milk FA vary according to lactation stage of the cow
- Need to take into account this fact when predicting CH<sub>4</sub> emissions from milk FA contents

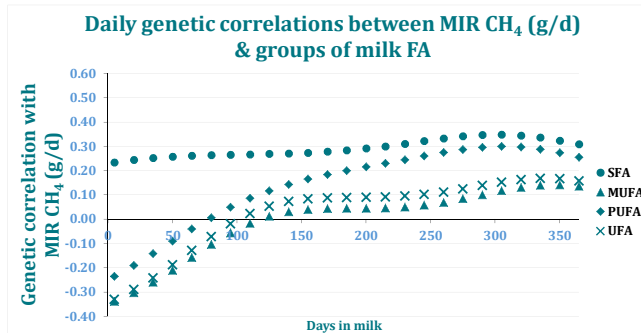
### Results

- Heritabilities of studied traits & genetic correlations of FA with CH<sub>4</sub>

Trait	h <sup>2</sup>	Averaged daily genetic correlation with CH <sub>4</sub>
MIR CH <sub>4</sub> (g/d)	0.24	/
SFA (g/dL of milk)	0.40	0.29
MUFA (g/dL of milk)	0.19	0.00
PUFA (g/dL of milk)	0.29	0.12
UFA (g/dL of milk)	0.20	0.04
SCFA (g/dL of milk)	0.39	0.29
MCFA (g/dL of milk)	0.41	0.25
LCFA (g/dL of milk)	0.17	0.15

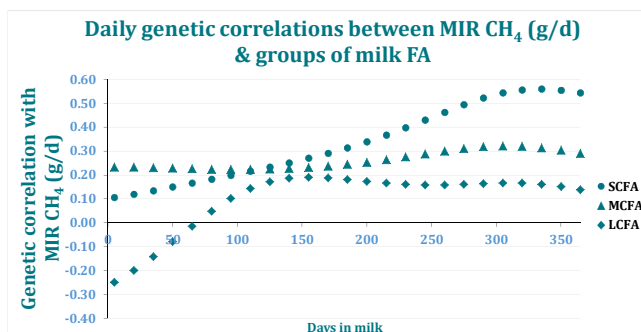
h<sup>2</sup> = heritability; SFA = Saturated FA; MUFA = Monounsaturated FA; PUFA = Polyunsaturated FA; UFA = Unsaturated FA; SCFA = Short-chain FA; MCFA = Medium-chain FA; LCFA = Long-chain FA

- Evolution of genetic correlations between MIR CH<sub>4</sub> and groups of FA



Positive correlations between CH<sub>4</sub> and SFA, SCFA & MCFA

Low correlations in early lactation and high after for SCFA & correlations more stable across DIM for SFA & MCFA



Negative correlations between CH<sub>4</sub> and UFA & LCFA in early lactation & increasing afterward to become positive