UNIWERSYTET ROLNICZY
im. Hugona Kołłątaja w Krakowie

30 lat PFCBDF

Z Hodowcami w przyszłość

PennState

Relationship between the content of ketone bodies and fatty acids in cow's milk

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Why that kind of research?

- Searching for possibilities to improve diagnostic models for ketosis
- Fatty acids (FA) composition as early sign of sublinical ketosis (SK)

Animal welfare

Farmer welfare

Why preventing ketosis is so important?

Costs

Ketosis costs

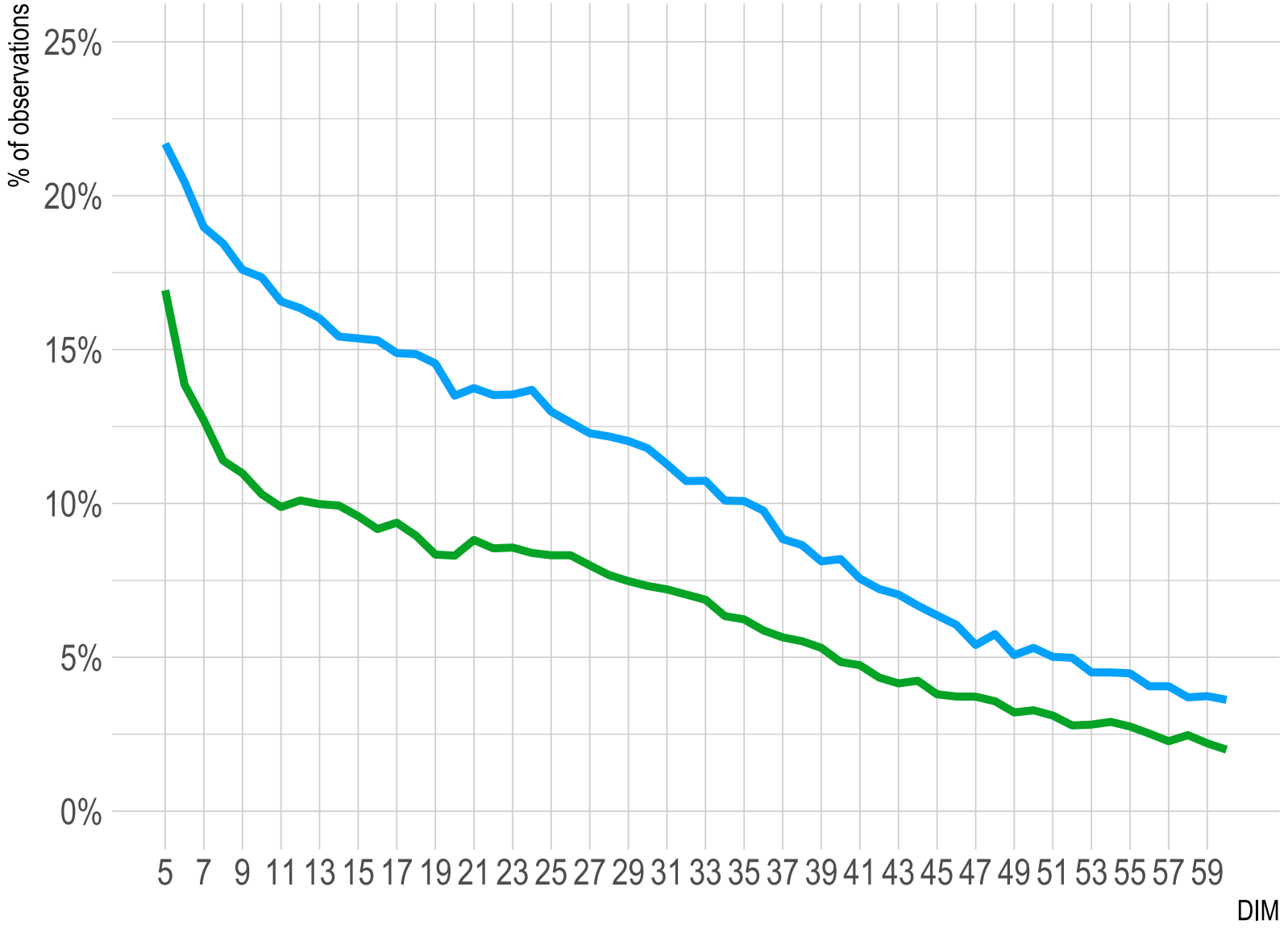
- 77$,180$ (primiparous, multiparous)

Liang et al., 2017

- $375, $256 (primiparous, multiparous)

McArt et al., 2015

Ketosis prevalence, milk recorded population



2014
2022

10.8%
in 2014

6.9%
in 2022

Kwaśniewska et al., 2024

Current diagnostic model used in Poland by PFCBDF

- three independent variables: milk acetone (mACE) and BHB (mBHB), fat to protein ratio
- 0.6 sensitivity
- 0.9 specificity

Hypothesis and aims

- content of selected FA in milk may be a good indicator for the early prediction of SK in dairy cows
- examination of the relationship between the content of selected FA in milk and the content of basic milk components and ketone bodies

Materials and methods

- > 3 milion milk samples from around 1 milion cows collected within 2017-2019
- Holstein-Friesian cows
- Cows in 6 to 60 days in milk (DIM)

Materials and methods

- Milk analysed with FTIR method
- Milk parameters: fat, protein, casein, lactose, urea, SCC, mACE, mBHB
- Spearman’s correlation coefficients

Types of ketosis

- Type I (peak of lactation)
- Type II (transition period)

Lei et al., 2021

New approach

Types of hiperketolaktia (HYKL) – based on dominant metabolite: mACE and/or mBHB

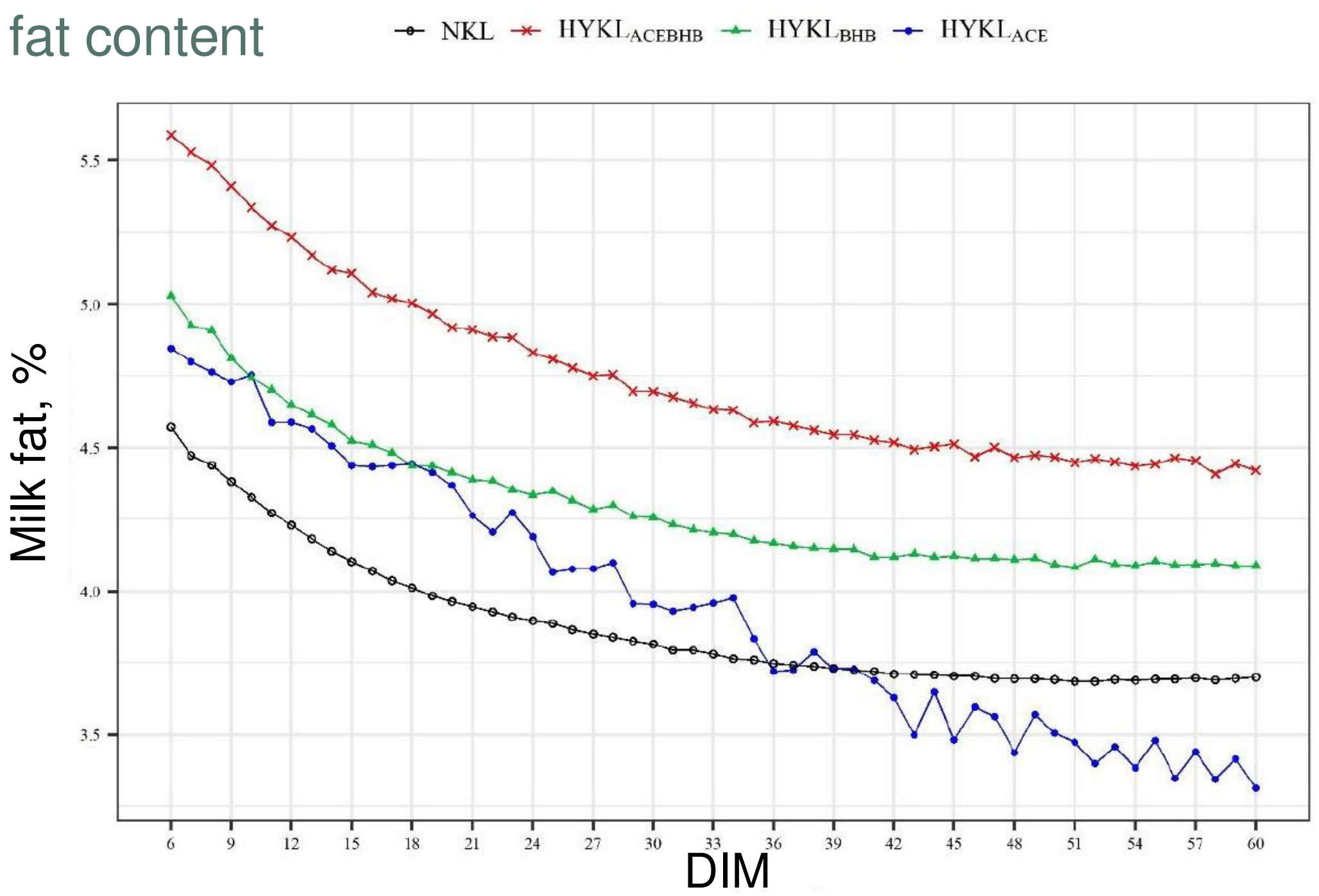
Kowalski et al., 2023

- Normoketolactia (NKL): mACE <0.15 mmol/L and mBHB <0.10 mmol/L
- Hyperketolactia (HYKL): mACE ≥0.15 mmol/L or mBHB ≥0.10 mmol/L
- Hiperketolactia BHB (HYKLBHB): mACE <0.15 mmol/L and mBHB ≥0.10 mmol/L
- Hiperketolactia ACE (HYKLACE): mACE ≥0.15 mmol/L and mBHB <0.10 mmol/L
- Hiperketolaktia ACE & BHB (HYKLACEBHB): mACE ≥0.15 mmol/L and mBHB ≥0.10 mmol/L

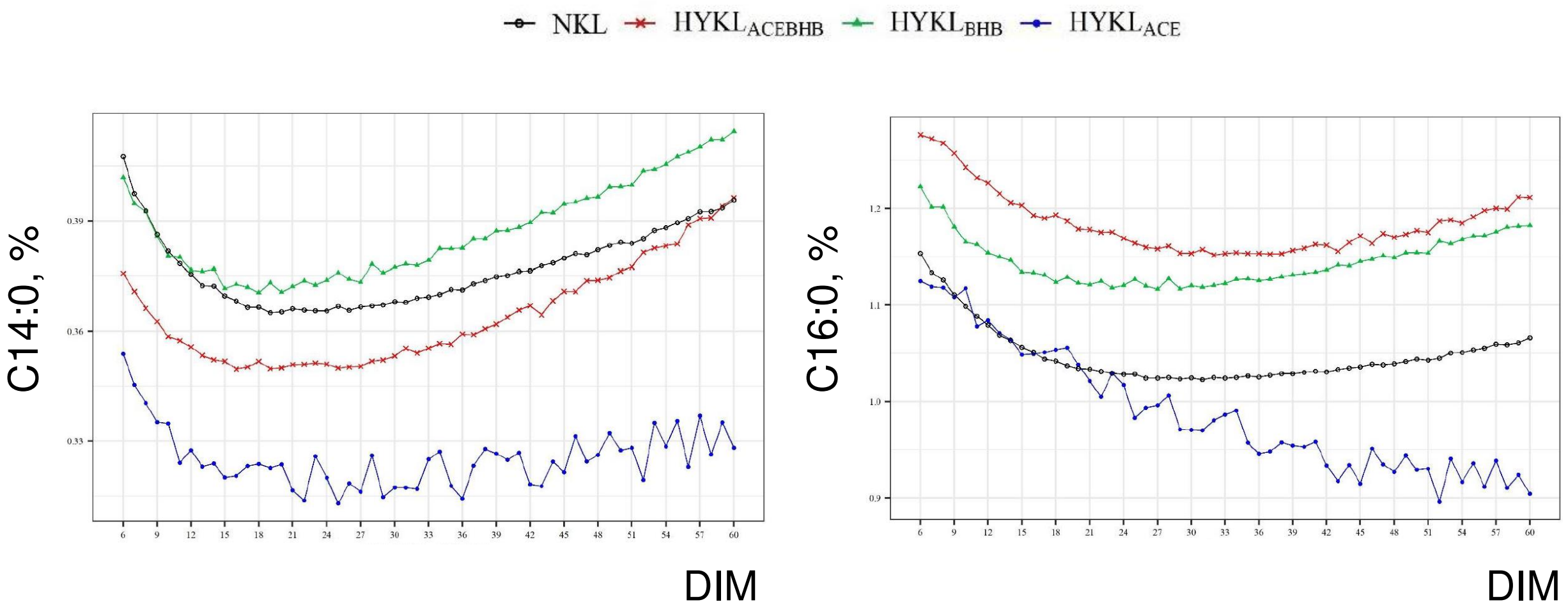
- C14:0 - myristic acid
- C16:0 - palmitic acid
- C18:0 - stearic acid
- C18:1 - oleic acid

- TUFA - Unsaturated fatty acids
- SFA - Saturated fatty acids
- PUFA - Polyunsaturated fatty acids
- MUFA - Monounsaturated fatty acids
- LCFA – long chain fatty acids
- SCFA – short chain fatty acids

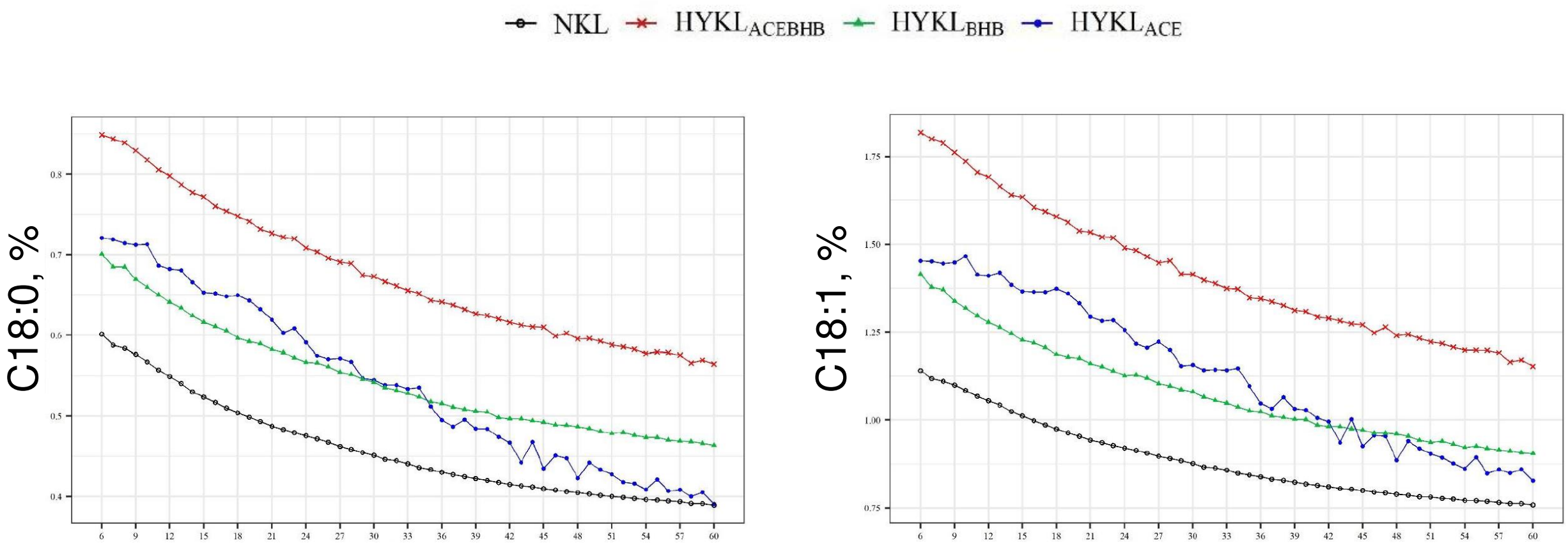
Milk fat content



C14:0 and C16:0 contents



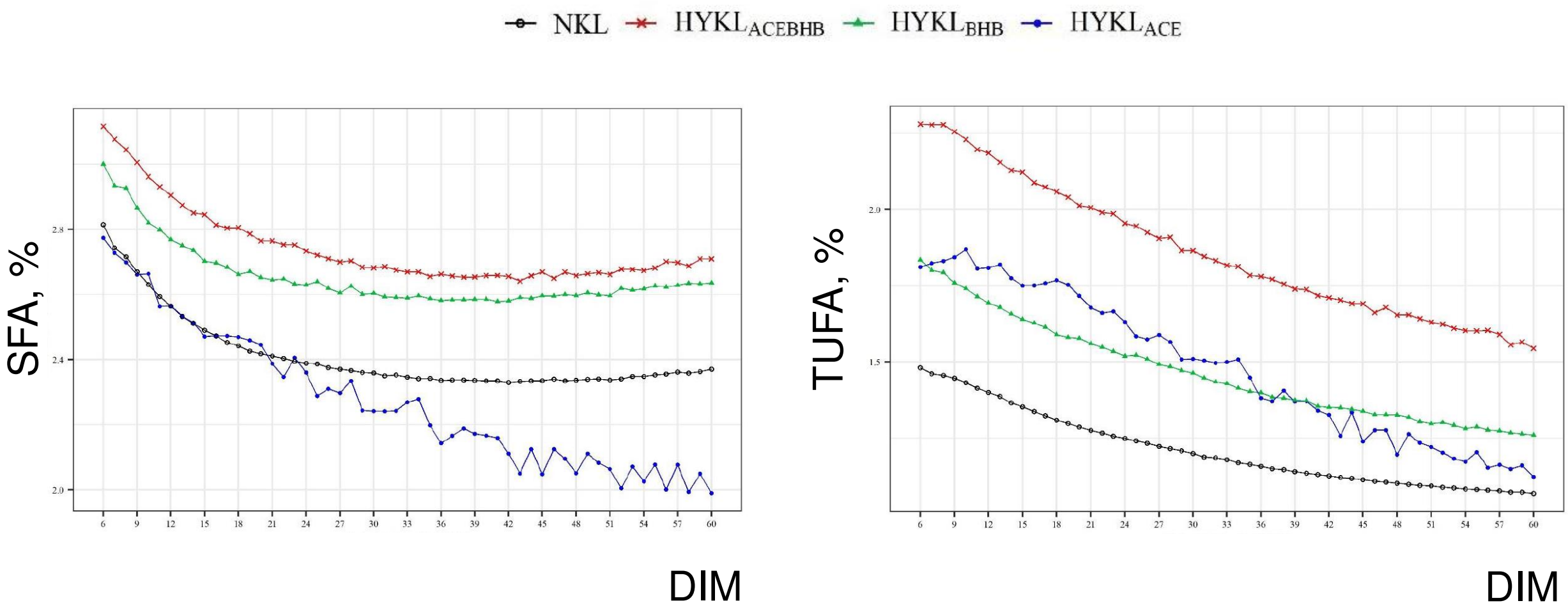
C18:0 and C18:1 contents



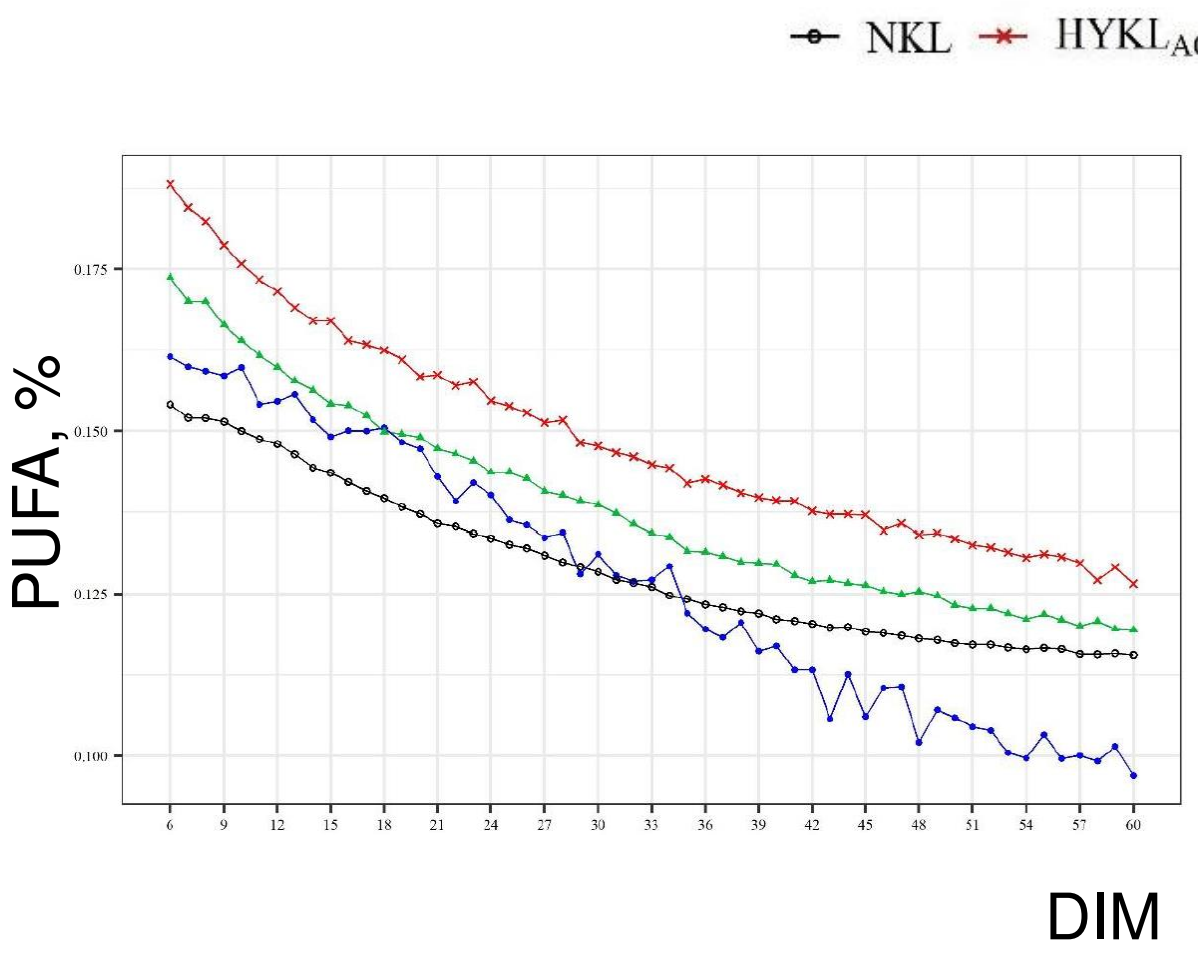
increase of C18:1 FA content in the milk of cows with subclinical ketosis two weeks before its diagnosis

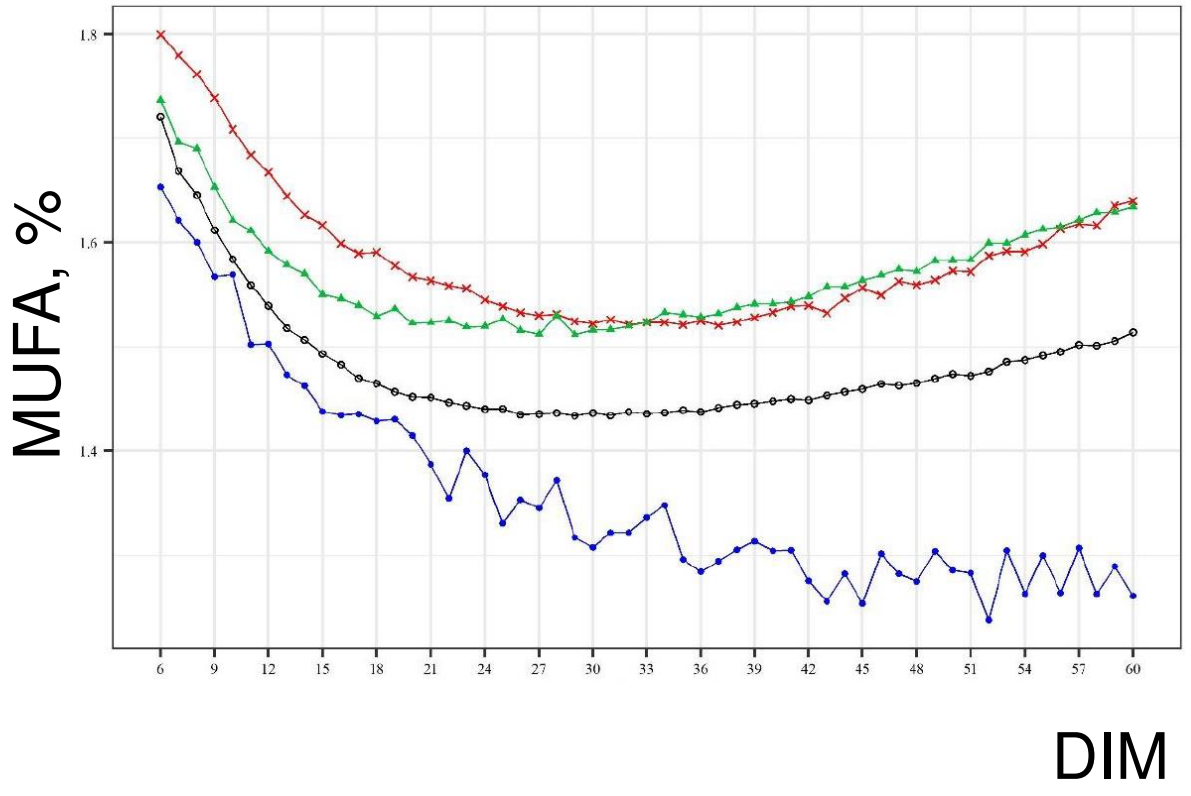
Van Haelst et al., 2008

SFA and TUFA contents

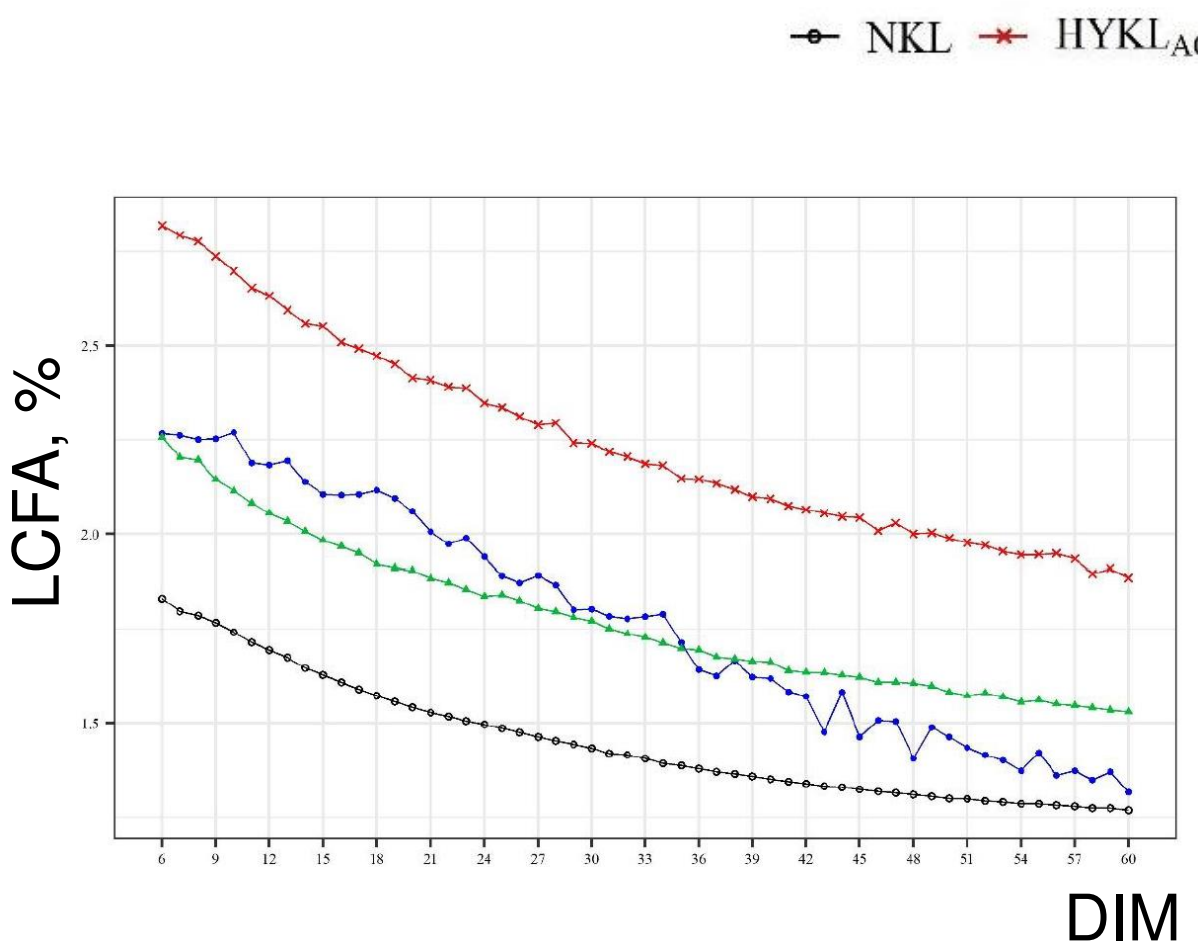


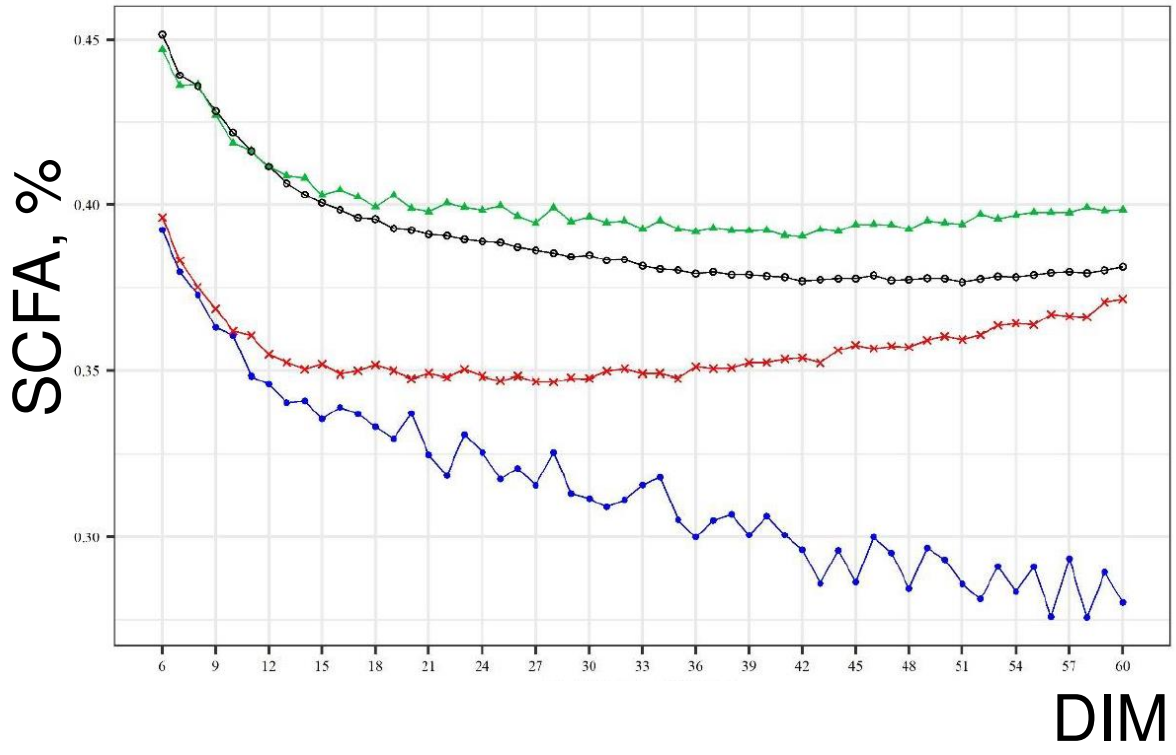
PUFA and MUFA contents



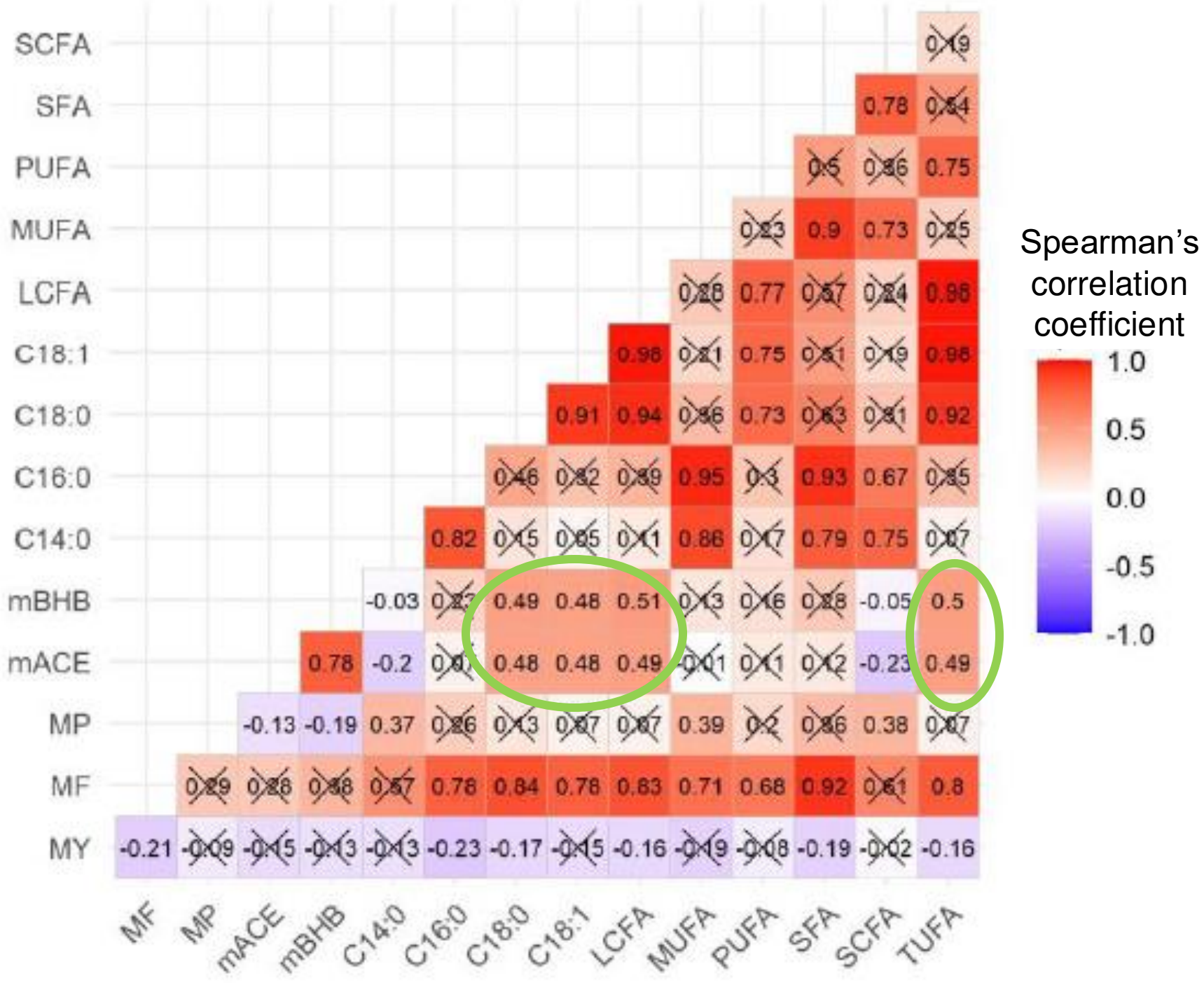


LCFA and SCFA contents

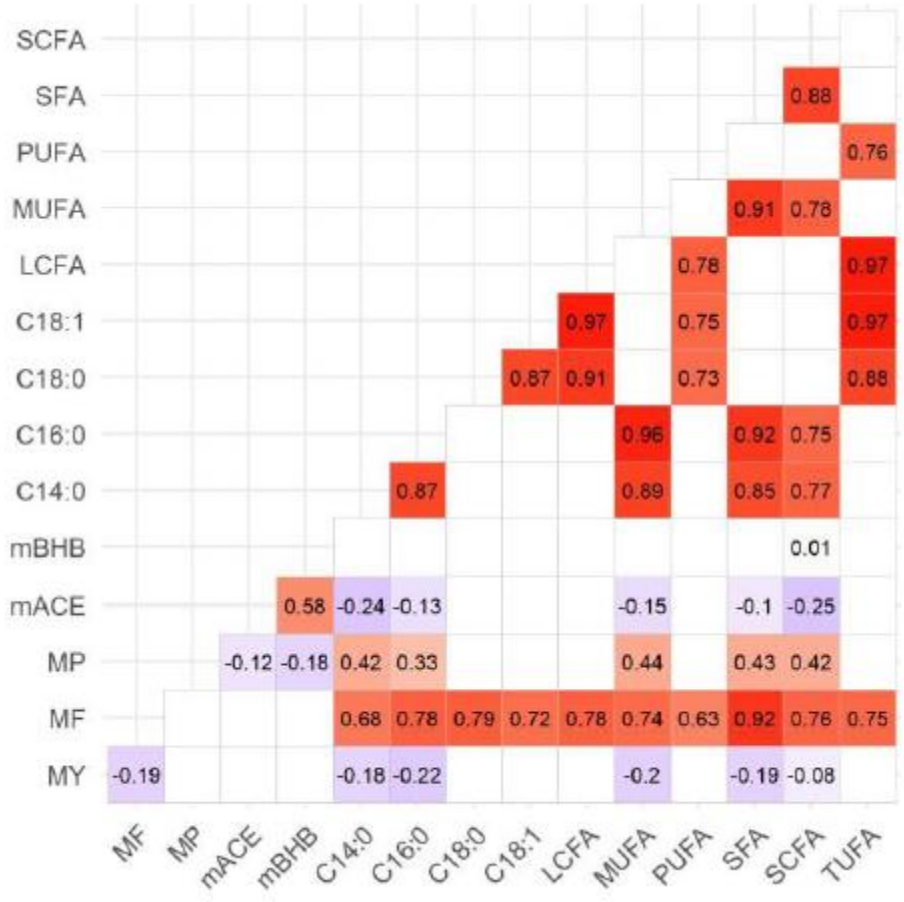




Correlations between the contents of selected chemical components in All milk samples

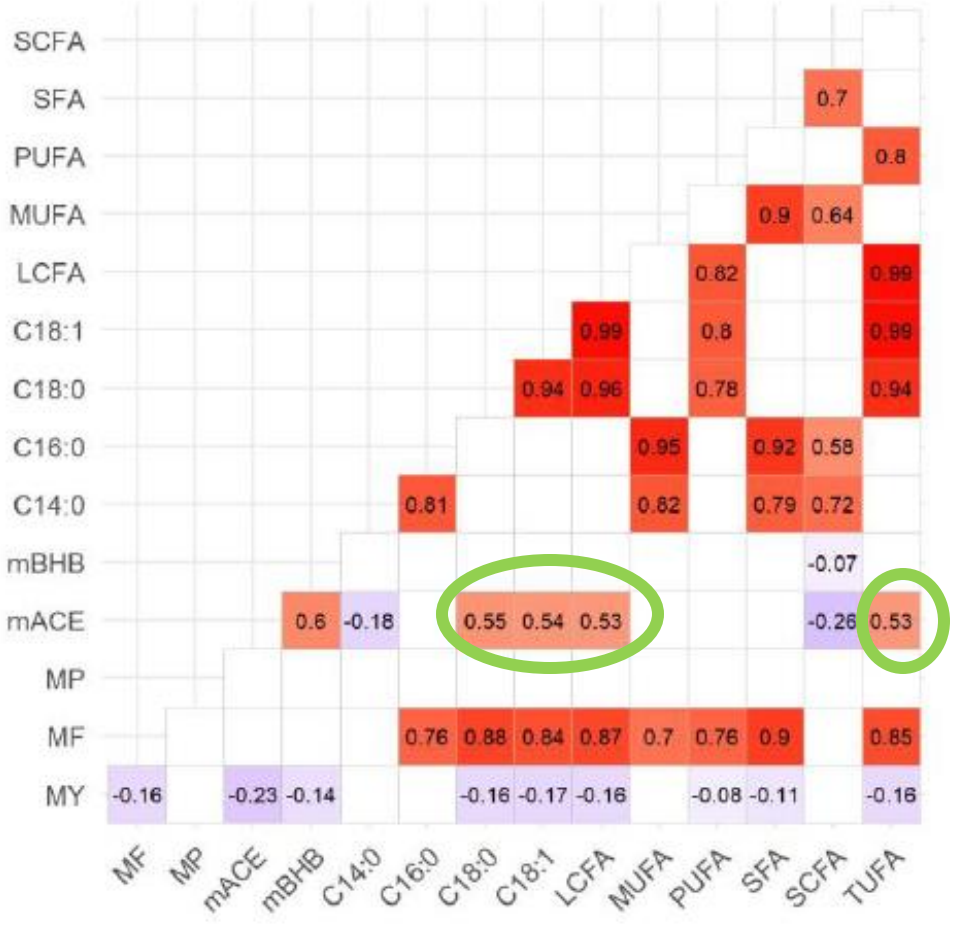


Correlations in NKL milk samples



Spearman's correlation coefficient

Correlations in HYKL milk samples



Conclusions

- Statistically significant relationships have been shown between the content of ketone bodies and FA and their groups in milk (highests **for LCFA, TUFA, C18:1** and **C18:0**)

- The variability of the milk FA content depending on DIM and ketolactia status creates the potential to improve the quality of diagnostic models of SK, including the model used by PFCBDF

Thank you

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