

Detailed milk fatty acid profiling of the Danish dairy cattle population

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Background

Since 2015, milk samples from all Danish dairy cows under yield control have been analyzed using mid infrared spectroscopy. The FOSS Application Note 64 has subsequently been used to predict content of seven FA groups (SCFA, MCFA, LCFA, SFA, MUFA, PUFA, and trans FA) together with four individual FA (C14:0, C16:0, C18:0, C18:1 (Table 1). This study is carried out as a part of the project “Specialized Organic Breeding Goals and Breeding Schemes for Dairy Cattle – SOBcows”.

Fatty acid group	Characteristics	Abbreviation
short chain fatty acids	C4-C10, saturated	SCFA
medium chain fatty acids	C12-C16, mostly saturated	MCFA
long chain fatty acids	C18, both saturated and unsaturated	LCFA
saturated fatty acids	C4-C20	SFA
mono unsaturated fatty acids	C18:1 (C16:1, C14:1)	MUFA
poly unsaturated fatty acids	C18:2 n6, C18:3 n3, CLA	PUFA
trans fatty acid	C18:1tr, CLA	TFA
Individual fatty acids		
C14:0 - myristic acid		C14:0
C16:0 - palmitic acid		C16:0
C18:0 - stearic acid		C18:0
C18:1 - oleic acid		C18:1

Table 1. Groups of fatty acids and individual fatty acids predicted using Foss Application Note 64.

Objectives

- More than 3.5 million milk samples from three Danish dairy breeds (Holstein, Jersey, Red) and crossbred cows have been analyzed from May 2015 to October 2016.
- Initially, comparison of 132,732 first-parity DH cows and 21,966 first-parity DJ cows has been studied in relation to management and season.
- In near future, FA milk profiles collected from the daughters of bulls with extreme SFA% breeding values will be investigated from seven organic farms to explore response of seasonal effects depending on SFA% breeding values.

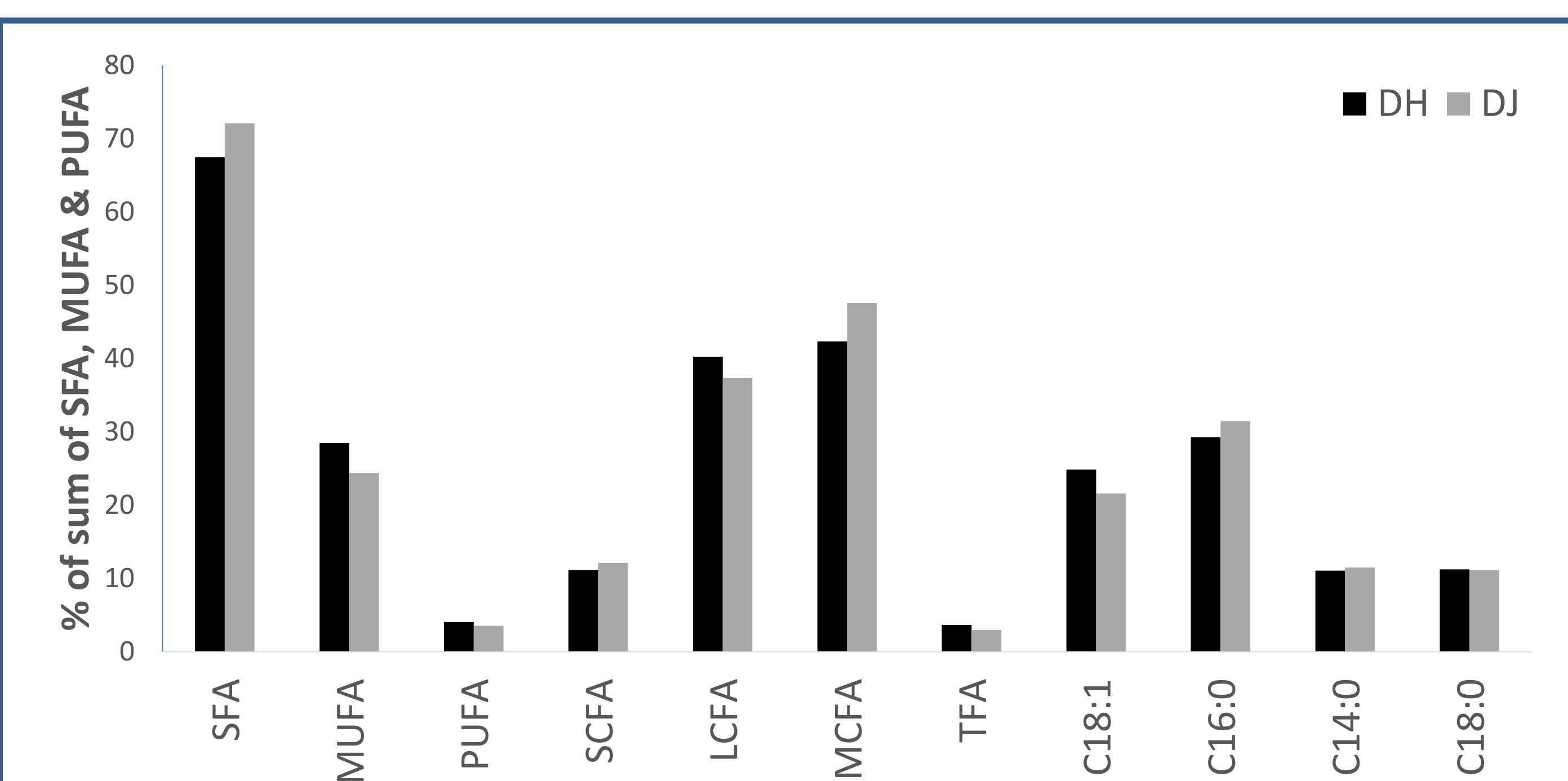


Figure 1. Effect of breed on fatty acid composition of bovine milk. DH: Danish Holstein; DJ: Danish Jersey.

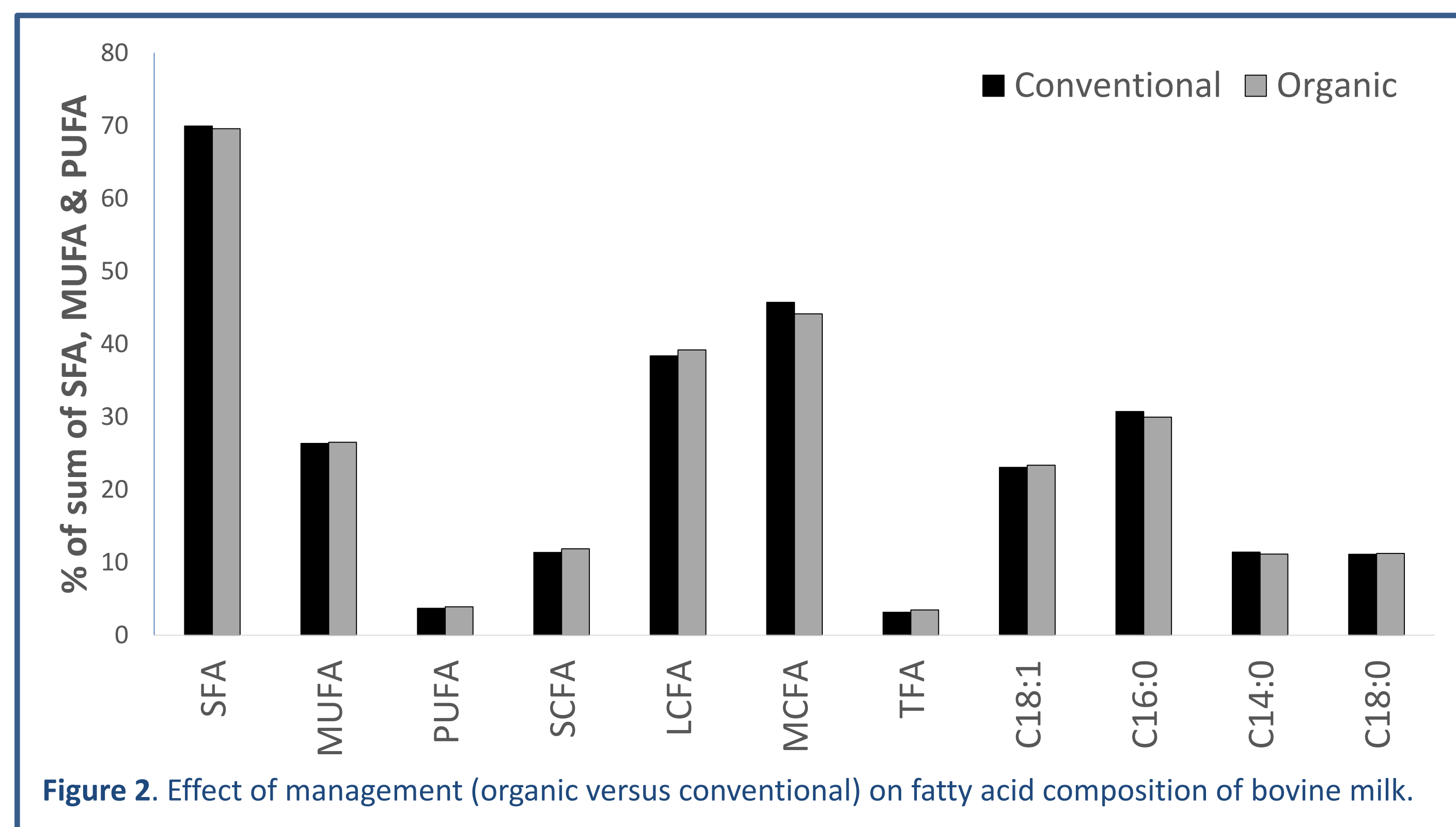


Figure 2. Effect of management (organic versus conventional) on fatty acid composition of bovine milk.

Primary study findings

- The proportion of SFA, SCFA, MCFA, C16:0 and C14:0 were higher for Danish Jersey compared to Danish Holstein (Fig. 1).
- Organic cows had higher levels of PUFA, SCFA, LCFA, TFA, C18:0 and C18:1 compared to conventional cows (Fig. 2).
- Milk SFA% in daughters from ten bulls from organic farms documents large variation between bulls. Further, SFA% was lower in summer during grazing than during indoor feeding (Fig 3).

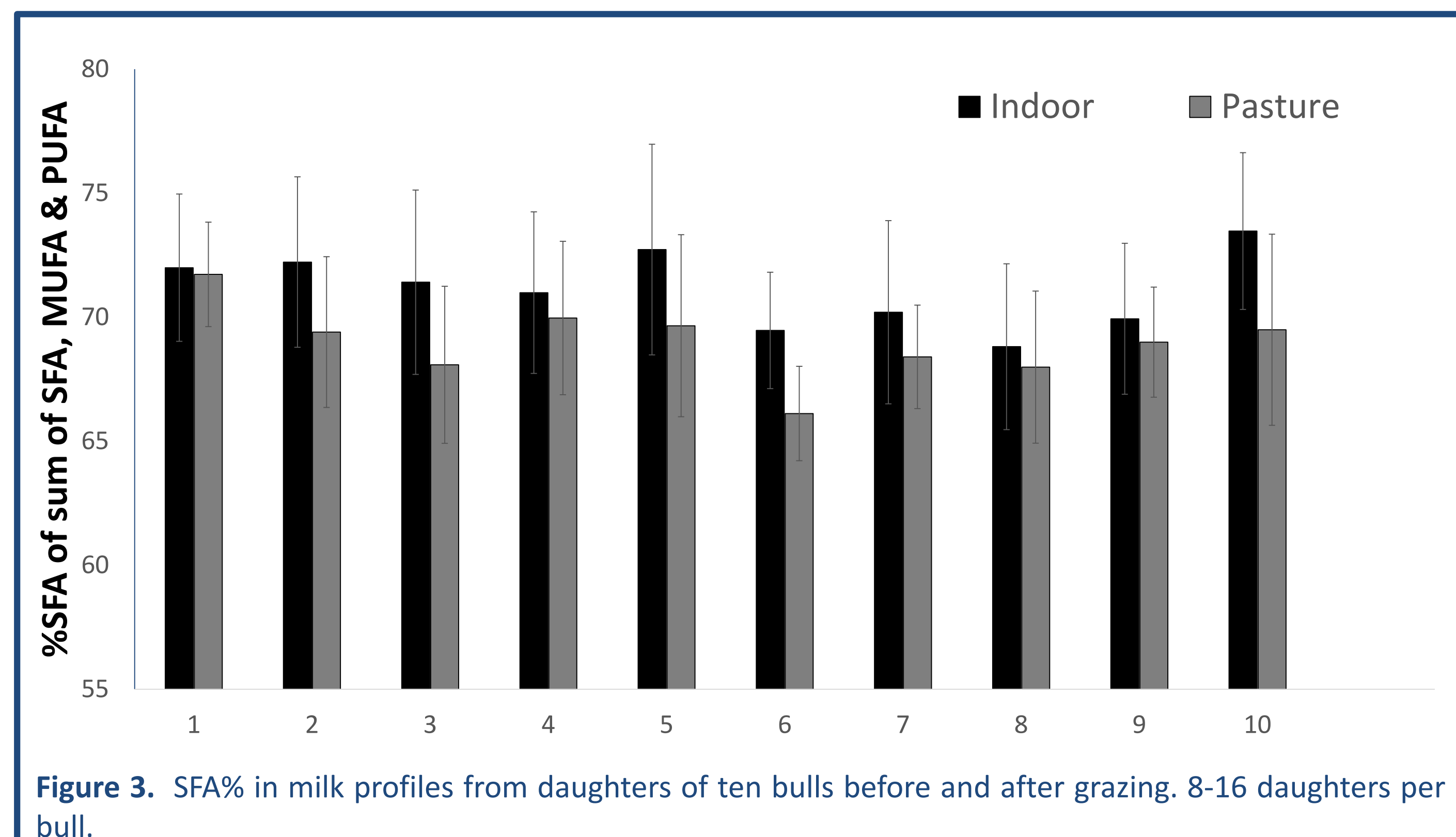


Figure 3. SFA% in milk profiles from daughters of ten bulls before and after grazing. 8-16 daughters per bull.

Perspective

- The study confirms that FA composition of bovine milk is not only affected by breed, but also by management system, parity (not shown) and lactation stage (not shown).
- The data can be used to exploit the possibilities for genetic selection and feeding strategies to change the fatty acid profile in milk into a desired direction.
- New healthy dairy products exploiting variations related to e.g. breed and management will be developed in close collaboration with the Danish dairies.