Keeping up with a healthy milk fatty acid profile require selection

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Alterations of FAs in raw milk

Butterfat in milk can be altered by…

- Feed
- **Genetics**
- Environment

FA profiles have multiple implications…

- Indicators for health traits
- Indicators for fertility
- Influence human health
  - Niche products
  - Milk price

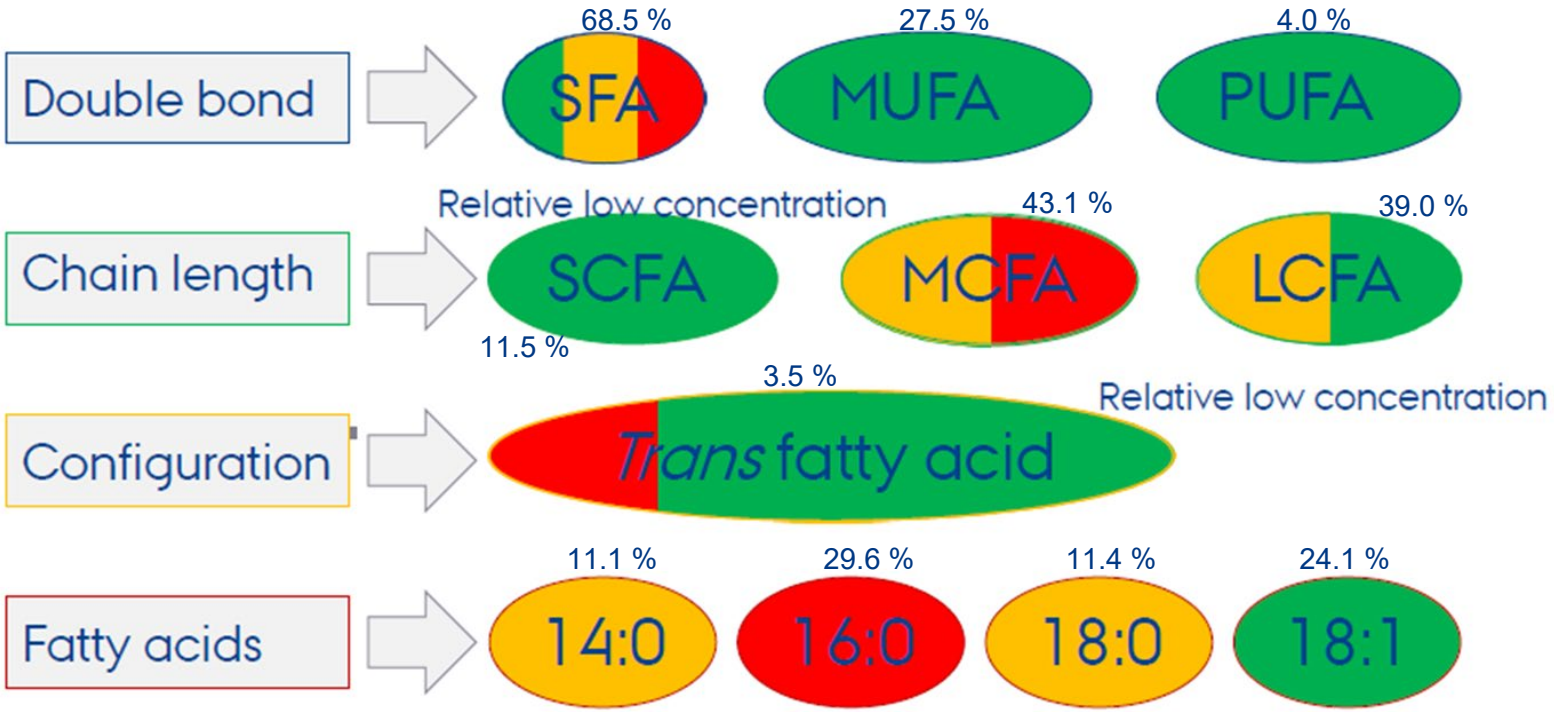
Danish fatty acid data

- 15+ million milk samples May 2015 – Dec 17
- Via routine recording scheme
- Analysed using MIR spectroscopy
- Fatty acid predicted using Foss Application Note 64
- 11 categories (7 groups and 4 individual fatty acids)

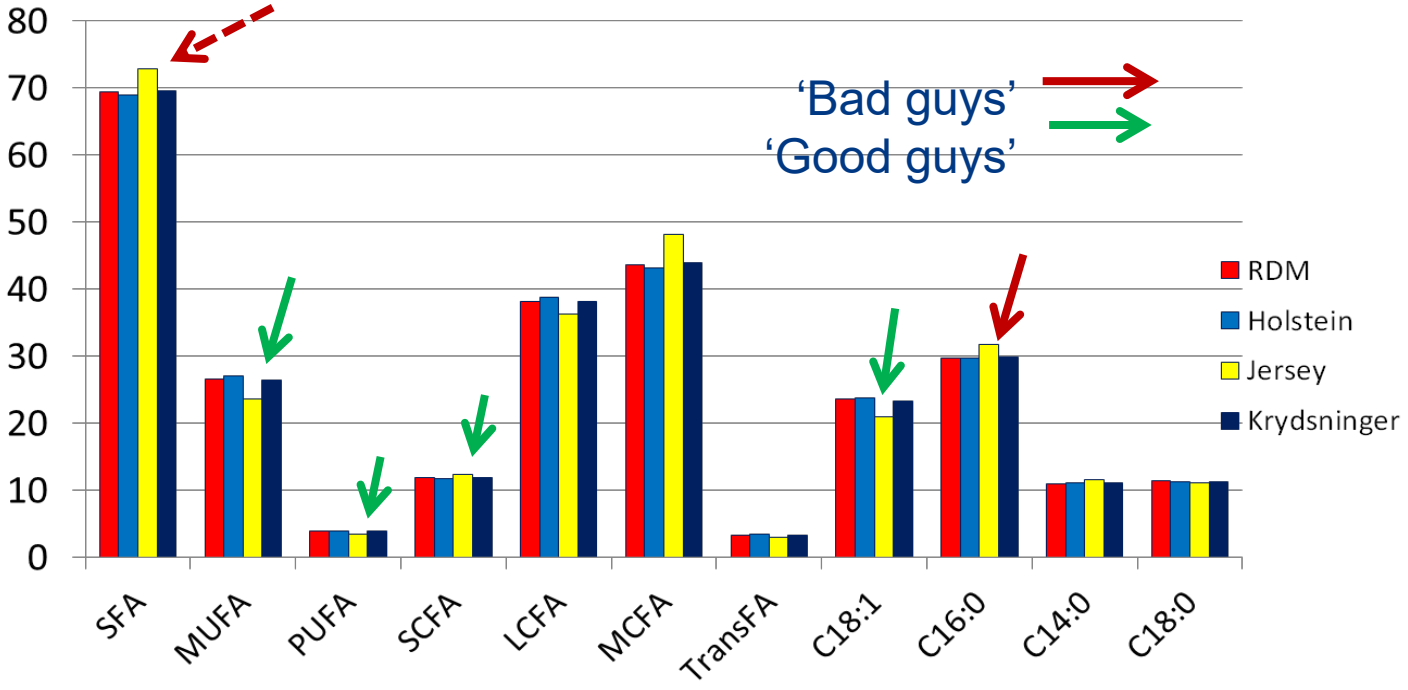
FOSS Application 64

Fatty acid group	Name	
SFA	Saturated fatty acids	C4 – C20
MUFA	Monounsaturated fatty acids	C18:1 (C16:1, C14:1)
PUFA	Polyunsaturated fatty acids	LA. ALA, CLA
SCFA	Short-chain fatty acids	C4-C10
MCFA	Medium-chain fatty acids	C12-C16
LCFA	Long-chain fatty acids	C18 -
TransFA	Trans fatty acids	C18:1tr, CLA
C14:0	Myristic acid	
C16:0	Palmitic acid	
C18:0	Stearic acid	
C18:1	Oleic acid	

Fatty acids and human health



Differences between the different breeds in FA compositions



Heritabilities - Holstein

Fatty acid group	% of total	Amount, gram
SFA	0.15	0.19
MUFA	0.15	0.11
PUFA	0.08	0.09
SCFA	0.16	0.19
MCFA	0.12	0.20
LCFA	0.11	0.11
TransFA	0.07	0.06
C14:0	0.09	0.17
C16:0	0.14	0.20
C18:0	0.11	0.12
C18:1	0.13	0.11

Genetic correlations

		% of total fat				
		MUFA	PUFA	SCFA	C16:0	Total fat
Holstein	MUFA	-				
	PUFA	0.61	-			
	SCFA	-0.69	-0.05	-		
	C16:0	-0.64	-0.65	0.04	-	
	Total fat	-0.33	-0.26	0.33	0.17	-
Jersey	MUFA	-				
	PUFA	0.50	-			
	SCFA	-0.33	0.52	-		
	C16:0	-0.73	-0.77	-0.29	-	
	Total fat	-0.26	-0.11	0.14	0.10	-

Breeding values for FA's

Using the following univariate repeatability linear animal model:

$$y = \mathbf{X}b + \mathbf{Q}h + \mathbf{Z}a + \mathbf{W}pe + e$$

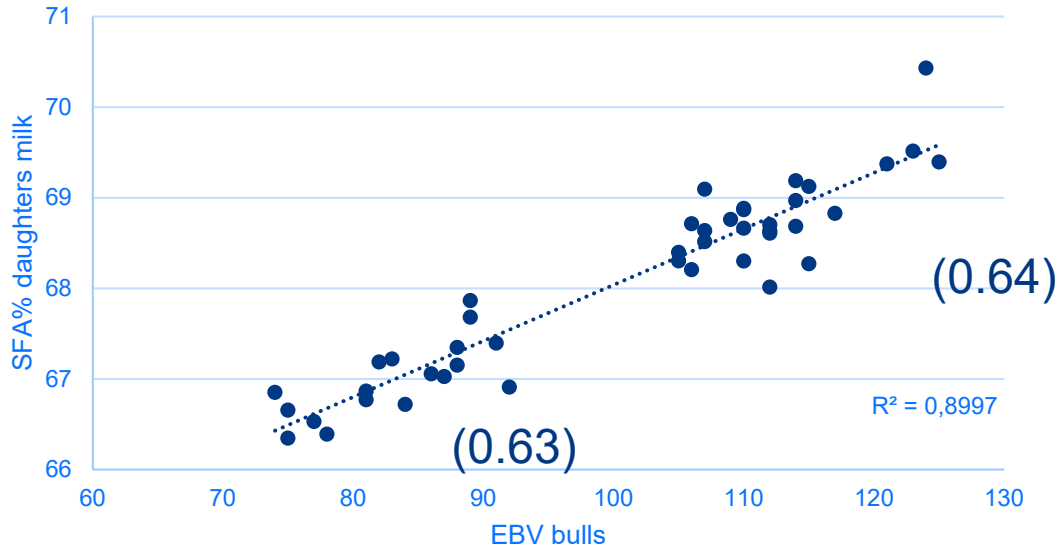
Fixed effects:

- month×year of recording
- DIM according to the Wilmink (1987)

Do these EBV's work?

- Bull with low and high EBV's for SFA% were selected
  - Low EBV(SFA% of total fat) : Average EBV: 81
  - High EBV(SFA% of total fat) : Average EBV: 114

Do these EBV's work?



Do these EBV's work?

- In seven Organic herds
  - 81 daughters of low EBV(SFA%) were selected
  - 113 daughters of high EBV(SFA%) were selected
- Milk from these were GC tested
- LS mean differences between these groups:
  - GC SFA% of total fat: 1.98 (72.2)

Breeding value correlations

Holsteins

NTM trait	MUFA,%	PUFA, %	SCFA, %	C16:0, %
Growth	-	0.10	0.09	-0.14
Fertility	-0.09	-	0.08	-
Mastitis	-0.12	-	0.12	-
Health	-0.11	0.05	0.13	-
Udder	-	-	-0.12	0.13

How to include FA's in the dairy BG

- Re estimate ew for all BG traits
- Keep overall ew for yield and re estimate ew within the yield traits
- Keep the overall ew for fat and:

F-index= v_1*MUFA+ v_2* PUFA + v_3*SCFA + v_4*C16

Or

F-index= v_1*MUFA+ v_2* PUFA + v_3*SCFA + v_4*C16 + v_5*Kg fat

Conclusion

Thanks for listening, and all participants in this project…

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STØTTET AF
promilleafgiftsfonden for landbrug

Undersøgelsen er en del af Organic RDD 2-projektet SOBcows