Variability of Major Fatty Acid Contents in Luxembourg Dairy Cattle

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**Presenter*

1. Introduction and Objective

Common human health concerns and imminent needs for more **sustainable nutrition patterns** require from dairy industry and farmers a. o. **a closer look at milk fatty acid (FA) profile**.

The aim of this study was to **estimate the variability of the major FA** from data collected during the official milk recording in Luxembourg and generated by the **mid-infrared spectrometry (MIR)**.

2. Materials and Methods

Animal Population

148,296 milk samples were collected from October 2007 to January 2009 on 36,522 cows in 718 herds. Five breeds were represented.

All milk samples were analyzed by MIR spectrometry using a FOSS MilkoScan FT6000. The generated spectra were recorded.

Prediction of FA contents

Saturated (SAT), monounsaturated (MONO), omega-9 (n-9), short chain (SCFA), medium chain (MCFA) and long chain (LCFA) fatty acid were studied.

FA were estimated by applying MIR calibration equations obtained on Belgian data (first results: Soyeurt et al. in JDS 2006) to the recorded MIR spectra. The predictions were in g/dl of milk and were converted in g/100 g fat by using the content of fat obtained from MIR spectrometry.

Variability Study

Multi-trait test-day random regression models :

Fixed effects : herd*date of test; class of days in milk * lactation number; age * lactation number.

Random effects : herd * calving year, animal additive, permanent environment (PE) within and across lactations, and residuals.

3. Results and Discussion

Table 1. Descriptive statistics of data.

Unit	Trait	N	Mean	SD	Min.	Max.
g/100g of fat	SAT	148206	68.86	4.36	54.23	77.00
	MONO	148206	27.97	3.78	20.00	40.85
	n-9	148206	19.33	3.49	12.01	32.00
	SCFA	148206	9.23	0.89	5.00	11.00
	MCFA	148206	53.14	4.91	36.01	61.00
	LCFA	148206	39.48	5.37	30.00	58.98
g/dl of milk	SAT	148206	3.02	0.61	1.18	6.08
	MONO	148206	1.22	0.27	0.45	3.08
	n-9	148206	0.85	0.22	0.26	2.52
	SCFA	148206	0.40	0.09	0.13	0.87
	MCFA	148206	2.33	0.48	0.80	4.60
	LCFA	148206	1.73	0.39	0.63	4.52

*Table 2. Variability related to herd management estimated from herd*date of test.*

Unit	Trait	Mean	SD	Min.	Max	Range	Benefit (in %)[1]
g/100g of fat	SAT	-0.86	1.50	-7.07	2.57	9.63	13.99
	MONO	0.70	1.28	-2.51	6.92	9.43	**33.72**
	n-9	0.71	1.07	-1.92	6.03	7.95	**41.16**
	SCFA	-0.06	0.35	-1.64	1.39	3.03	**32.87**
	MCFA	-1.76	1.65	-9.61	2.11	11.72	22.06
	LCFA	1.75	1.88	-2.64	10.98	13.62	**34.51**
g/dl of milk	SAT	0.06	0.20	-0.74	0.80	1.54	**51.12**
	MONO	0.08	0.08	-0.19	0.79	0.98	**79.90**
	n-9	0.06	0.07	-0.14	0.61	0.75	**88.25**
	SCFA	0.01	0.03	-0.11	0.13	0.24	**59.05**
	MCFA	-0.01	0.15	-0.59	0.56	1.15	**49.32**
	LCFA	0.13	0.13	-0.28	1.13	1.41	**81.79**

[1] Benefit = 100*(range divided by the general mean of the considered trait).

Variability of herd management ranged between **13.99 to 88.25%.**

Table 3. Genetic variability.

		Random effects					Breeding value					
Unit	Trait	Heritability	Herd*calving year	PE within lactation	PE across lactations	Residual	Mean	SD	Min.	Max.	Range	Benefit (in %)[1]
g/100g of fat	SAT	**0.16**	0.08	0.13	0.12	0.51	1.70	0.70	-1.88	4.62	6.50	9.43
	MONO	0.13	0.08	0.15	0.09	0.55	0.65	0.56	-1.56	3.59	5.15	**18.40**
	n-9	0.11	0.08	0.14	0.09	0.59	0.55	0.44	-1.29	2.82	4.11	**21.27**
	SCFA	0.14	0.05	0.12	0.11	0.58	0.78	0.15	-0.06	1.44	1.50	**16.26**
	MCFA	0.11	0.07	0.17	0.05	0.61	7.32	0.50	4.57	9.69	5.12	9.64
	LCFA	0.10	0.08	0.16	0.05	0.61	5.71	0.57	2.68	8.93	6.25	**15.83**
g/dl of milk	SAT	**0.28**	0.04	0.05	0.17	0.46	0.46	0.17	-0.30	1.30	1.59	**52.77**
	MONO	0.12	0.05	0.09	0.08	0.66	0.14	0.04	-0.04	0.36	0.40	**33.11**
	n-9	0.10	0.06	0.10	0.06	0.69	0.02	0.03	-0.12	0.18	0.30	**35.35**
	SCFA	**0.27**	0.04	0.05	0.17	0.47	0.05	0.02	-0.06	0.16	0.22	**54.45**
	MCFA	**0.29**	0.05	0.07	0.15	0.44	0.38	0.12	-0.21	1.00	1.21	**51.86**
	LCFA	0.13	0.05	0.07	0.09	0.67	0.26	0.07	-0.02	0.62	0.64	**36.99**

[1] Benefit = 100*(range divided by the general mean of the considered trait).

Heritabilities ranged between **0.10 to 0.29. Genetic benefit** was the most important for **%MONO, %n-9, %SCFA, %LCFA**, **all traits expressed in milk**.

Results of model showed also that tlactation and breed influence the contents of fatty acids in milk and milk fat.

4. Conclusion

The results of this study showed the influences of genetics and herd management on FA. Currently, these two methods to improve milk fat are mostly studied and used separately. However, most efficient would be to combine both and to study suspected interactions between management practices and genetics.

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