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MILK FATTY ACIDS IN RELATION TO PRODUCTION CONDITIONS

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INTRODUCTION

Milk fat is created predominantly by triglycerides of fatty acids (FA), fatty acids representing 95 % of the amount of pure fat. Acids with saturated chain with even number of carbons from C4 to C18, and unsaturated chain C16:1, C18:1, C18:2, C18:3 and C20:4 are the main acids that occur in triglycerides of fat in cow's milk. Short-chain fatty acids SCFA up to C10 originate in biosynthesis in mammary gland, long chain saturated fatty acids LCFA starting with C18 come mainly from blood plasma, into which they came mainly from body fat of dairy cow after calving. Fatty acids from C12 to C16 MCFA can be of both origins. Mono unsaturated fatty acids C16:1 and C18:1 MUFA can come from resorption of feed's fat, however, poly unsaturated fatty acids PUFA come from own synthesis by means of dehydrogenating enzymatic system, while unsaturated fatty acids from lipids of feeds are hydrogenated in rumen.

Lower fatty acids, mainly butyric acid (C4:0), gives characteristic delicious flavour and scent to milk fat, important organoleptic characteristics that other fats in foods do not have. Unsaturated fatty acids with conjugated double bond system, linoleic, linolenic and arachidonic are essential for the mammals and man and they are called factor F (vitamin F). They participate in creation of prostaglandines and other substances with important regulatory effects. Lack of vitamin F presents itself by retardation of the growth, dermatitis, kidneys disorder. Dairy products are the main source of conjugated linoleic acid, a functional food component with health benefits.

The aim of the paper was to extend the knowledge about current FA profile of cow milk fat at herds of cows held in mountain dairy farms in regions of Liptov and Orava in Slovakia.

EXPERIMENTAL PROCEDURES

The fatty acids (FAs) composition of individual milk was determined by GC-MS.

The milk samples were taken from 181 cows in total of Pinzgau, Holstein, Slovak pied, Holstein x Pinzgau, and Holstein x Pinzgau x Red breeds at summer pasture period and from the same cows at winter feeding with grass haylage and maize silage ratio.

On the chromatogram 54 FAs were identified and expressed relatively in %. There were detected the spectrum of saturated, unsaturated, short and long chain positional and geometric isomers of FAs and evaluated in groups in according to their structure:

– saturated fatty acids (SAFA), C4:0 – C24:0,
– monounsaturated fatty acids (MUFA) C10:1 – C20:1,
– polyunsaturated fatty acids (PUFA) C16:2 – C22:5.

Special attention is given to essential fatty acids:

– linoleic acid (LA, C18:2n6cis,cis),
– conjugated linoleic acid, (CLA, C18:2n9cis trans),
– α-linolenic acid (ALA, C18:3n3cis)
– eicosatetraenoic – arachidonic acid (ETA, C20:4n6cis).

RESULTS

Results of FAs estimation in pasture period are in table 1, and in winter feeding period in table 2.

The content of SAFA ranged from 59 to 70 %, the lowest value was in winter period in milk of Slovak pied cows.

In the content of MUFA was no statistically significant difference between breeds and between seasons either. The highest value was as an opposite of SAFA in winter period in milk of Slovak pied cows – 28,18%.

The total content of PUFA showed the highest value in milk of Pinzgau and Slovak pied cows. Statistically significant (P<0,01) was the highest value at Pinzgau cows at pasture – 4,06%.

The most interesting is the conjugated linoleic acid (CLA), which has been shown to possess a number of health benefits based on biomedical studies across a variety of animal models, showed the significant difference between breeds. The highest value was at Pinzgau – 0,82%, lower (P=0,015) at Slovak pied – 0,62%, and significantly (P<0,001) lower at Holstein – 0,44%, and cross-breed Holstein x Pinzgau – 0,45%, and Holstein x Pinzgau x Red – 0,43% in summer period. In Winter period was similarly the highest content of CLA at Pinzgau herd – 0,74%, lower (P=0,015)at Slovak pied – 0,60% and significantly (P<0,001) lower at Holstein – 0,46%, and cross-breed Holstein x Pinzgau – 0,44%, and Holstein x Pinzgau x Red – 0,35% (Fig. 1). The different content of CLA in milk of groups of Pinzgau cows in according to their fathers shows the genetical influence (Fig. 2).

Table 1: Basic groups of milk fatty acids in estimated farms (g/100g of estimated acids) at pasture of milking cows.

Breed of milking cows		SAFA	MUFA	PUFA	LA	CLA	ALA	ETA
Pinzgau (n=30)	x average	**65.12**	**28.08**	**4.06**	**2,09**	**0.82**	**0,60**	**0,15**
	x min	55.66	21.41	2.63	1,55	0.38	0,36	0,06
	x max	73.37	35.66	5.71	2,67	1.79	0,93	0,26
	Sx	5.47	4.34	0.99	0,40	0.4	0,19	0,05
Slovak pied (n=34)	x average	**68.44**	**25.46**	**3.71**	**1,87**	**0.62**	**0,76**	**0,12**
	x min	62.48	21.22	2.95	1,57	0.39	0,56	0,06
	x max	73.44	30.26	4.76	2,30	0.93	0,96	0,43
	Sx	2.83	2.34	0.54	0,21	0.15	0,11	0,07
Holstein (n=24)	x average	**70.09**	**24.83**	**2.8**	**1,71**	**0.44**	**0,33**	**0,10**
	x min	57.85	19.73	2.21	1,23	0.3	0,23	0,00
	x max	76	35.53	3.87	2,35	0.77	0,53	0,16
	Sx	3.85	3.25	0.43	0,25	0.13	0,08	0,04
Holstein x Pinzgau (n=30)	x average	**70.35**	**24.32**	**3.01**	**1,72**	**0.45**	**0,44**	**0,12**
	x min	60.56	17.8	2.48	1,33	0.31	0,23	0,06
	x max	76.83	33.32	3.65	2,20	0.78	0,73	0,19
	Sx	3.97	3.63	0.35	0,22	0.11	0,10	0,04
Holstein x Pinzgau x Red (n=30)	x average	**68.1**	**26.33**	**2.89**	**1,71**	**0.43**	**0,33**	**0,15**
	x min	57.63	22.34	2.45	1,41	0.33	0,27	0,09
	x max	72.37	36.45	3.52	2,10	0.55	0,41	0,21
	Sx	3.43	3.19	0.27	0,17	0.06	0,04	0,03

Table 2: Basic groups of milk fatty acids in estimated farms (g/100g of estimated acids) at winter feeding of milking cows.

Breed of milking cows		SAFA	MUFA	PUFA	LA	CLA	ALA	ETA
Pinzgau (n=30)	x average	**63.96**	**24.47**	**2.93**	**1,43**	**0.74**	**0,61**	**0,09**
	x min	58.91	21.61	2.04	0,70	0.35	0,37	0,00
	x max	68.47	28.38	4.05	2,31	1.05	0,90	0,13
	Sx	2.81	2.28	0.69	0,61	0.21	0,16	0,03
Slovak pied (n=34)	x average	**58.64**	**28.18**	**3.76**	**2,18**	**0.6**	**0,69**	**0,11**
	x min	51.25	23.24	2.93	1,76	0.37	0,41	0,08
	x average	65.29	33.16	5.1	2,77	0.89	1,16	0,16
	Sx	4.04	2.84	0.52	0,27	0.15	0,23	0,02
Holstein (n=24)	x average	**66.15**	**22.18**	**2.7**	**1,66**	**0.46**	**0,39**	**0,11**
	x min	58.31	17.46	1.91	1,15	0.28	0,25	0,08
	x max	72.76	26.44	3.69	2,24	0.63	0,57	0,21
	Sx	3.06	2.07	0.4	0,28	0.09	0,08	0,03
Holstein x Pinzgau (n=30)	x average	**67.28**	**21.97**	**2.5**	**1,59**	**0.44**	**0,34**	**0,09**
	x min	55.8	16.18	1.41	0,84	0.31	0,19	0,07
	x max	79.14	30.79	3.33	2,07	0.64	0,46	0,12
	Sx	4.84	3.34	0.4	0,25	0.1	0,06	0,01
Holstein x Pinzgau x Red (n=30)	x average	**65.65**	**23.4**	**2.31**	**1,53**	**0.35**	**0,31**	**0,10**
	x min	58.88	19.42	1.88	1,26	0.22	0,22	0,07
	x max	71.01	28.7	3.03	1,95	0.65	0,41	0,15
	Sx	3.2	2.5	0.34	0,22	0.1	0,05	0,02

Fig. 1: The content of conjugated linoleic acid (CLA, g/100g of estimated acids) in estimated farms at pasture and winter feeding of milking cows.

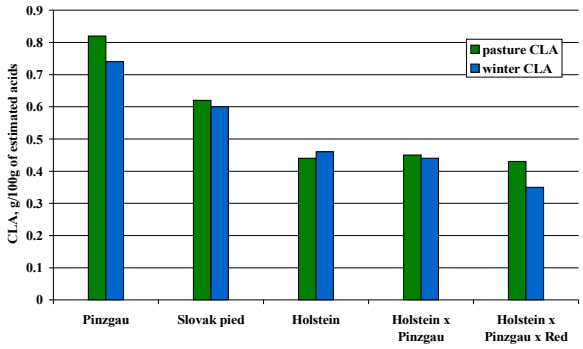
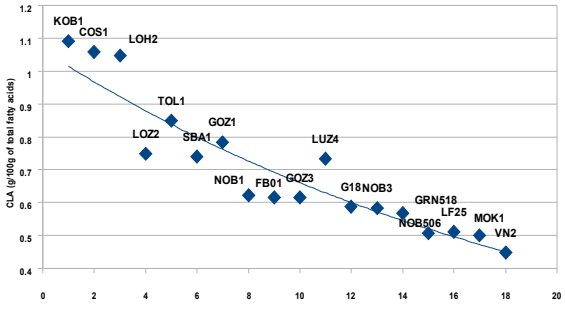


Fig. 2: The content of CLA in milk of Pinzgau cows in according to groups of daughters of named father (n=53)



CONCLUSION

These results confirm the assumption, that there is a basis for the genetic variation among breeds, which is related to rumen output of *trans*-11 C18:1 and to a lesser extent *cis*-9, *trans*-11 CLA, and to the tissue amount and activity of delta ^{9}-desaturase in the tissue of mammary gland. Authors dealing with ewe's milk consider, that the observed higher content of CLA in ewe's milk from Slovakia due to the higher content of its precursors in pasture plant composition