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THE QUALITY OF SLOVAK AND ALPINE MILK PRODUCTS BASED ON FATTY ACID HEALTH AFFECTING COMPOUNDS

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ABSTRACT

The contents of 53 fatty acids (FA) in milk products of ewes grazed on pastures in four Slovak localities were determined by GC-MS. Their contents with an emphasis on health affecting fatty acids, mainly *cis-9,trans-11* C18:2 (CLA), *trans-11* C18:1 (*t*VA), and α-linolenic acid (ALA), were compared with available milk product fatty acids contents of grazing cows in four Swiss Alpine localities. The composition of fatty acids in milk of ewes fed total mixed rations (TMR) was also determined. In spite of significant altitude differences between Slovak pastures (250-800 m above mean sea level) and Alpine pastures (1275-2120 m above m.s.l.) as well as differences in botanical composition, the milk and cheese contents of CLA, *t*VA, and ALA were found to be rather similar. The relative high contents of beneficial FAs in Slovak and Alpine milk products are linked to grazing the pasture with a high content of ALA. The content of *trans-11,cis-13* CLA isomer as the second-most abundant CLA isomer specified as an indicator of milk products of Alpine origin was also found in Slovak milk product of ewes grazing on lowland pastures, but not in the milk of ewes fed TMR. The investigated Slovak milk products of ewes grazed on pastures offer at least comparable content of health affecting FAs as the best Alpine cows' milk products. The CLA content in Slovak ewes' milk up to 3.2% and content of tVA up to 7.2% are higher than those in pasture-fed ewes and cows milk published previously.

Key words: GC-MS analysis; ewes´ milk FAs; Alpine cows´ milk FAs; pasture

INTRODUCTION

Several Swiss studies (Collomb et al., 2002; Kraft et al., 2003; Hauswirth et al., 2004; Leiber et al., 2005; Leiber et al., 2007) demonstrated that milk of cows grazing on high Alpine pastures (1275-2120 m a.s.l.) contains fat with a significantly improved fatty acids profile concerning the content of *cis-9,trans-11* octadecadienoic acid C18:2 (CLA), α-linolenic acid C18:3 n-3 (ALA), and *trans-11* C18:1 (*trans* vaccenic acid *t*VA), compared with that receiving conventional total mixed rations (TMR) diets. The cheese from cows grazed on Alpine pastures contained 4-fold higher ALA, 3-fold higher CLA, where as the amount of palmitic acid (PA) was 20% lower compared with cheddar-type cheese (Hauswirth, et al., 2004).

The above mentioned fatty acids (FA) are important for human metabolism and they exert different positive effects on human health. CLA isomers were found to have anticarcinogenic, antiatherosclerotic, and

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antidiabetic effects in animal models and have been used in weight reduction programmes in humans. ALA appears to be protective in the primary and secondary prevention of fatal cardiovascular events. The *t*VA shows a protective effect against development of mammary tumors. Generally, n-3 polyunsaturated fatty acids such as ALA, eicosapentaenoic C20:5 n-3 (EPA), and docosahexaenoic C22:6 n-3 (DHA) acids are known to be essential for human health. The EPA and DHA are even more specific and important for human health than C18:3 n-3, however, their content in milk fat is low. Health problems may arise if FA n-3 are ingested in markedly lower amount than FA n-6. The recommended ratio of n-6 : n-3 is < 5, yet in the Western diet containing large quantities of corn, safflower oils and meat, it ranges in order of 10 to 25 (Kobayashi et al., 2006). Also, the medium-chain saturated fatty acids (C6:0, C8:0, C10:0) (MCFA) are of special interest from a therapeutic point of view, because of their particular metabolism and hence their application to certain cases of metabolic illness (Sanz Sampelayo et al., 2007). MCFA are responsible for the characteristic flavour of ewes´ milk cheeses.

The milk FA composition is mainly determined by feed composition, i.e. the FA composition of the feed and feeding strategy. Grazing animals on pastures, feeding fresh forages, or increasing the amount of forage in the diet will elevate the content of CLA in milk products. The greatest potential for increasing the CLA intake of humans is to consume high-CLA containing dairy products (Dhiman et al., 2005). The presence of CLA and *t*VA in ruminant milk fat results from the isomerization and biohydrogenation of unsaturated FA by rumen bacteria as well as the Δ9-desaturase activity in the mammary gland. ALA and linoleic acid C18:2 n-6 (LA) are the predominant unsaturated fatty acids in pasture forage. *t*VA is an important product of biohydrogenation of both ALA and LA. The study of relationship between the pasture plant species consumed by ewes and the FA composition of their milk fat showed no higher differences with respect to cows (Sanz Sampelayo et al., 2007). However, unique differences in the lactation physiology, chemistry and even pathology of milk from ewes compared to cows have become evident (Haenlein, 2007). The CLA, ALA, *t*VA contents in dairy product fats (cheese, butter, milk powder) are very similar to those in the milk fat from which these products are produced (Bisig et al., 2007).

Swiss and French are the world leaders in cheese consumption. Despite higher intake of milk fat (55 g of cheese/day), they have paradoxically low cardiovascular mortality. It was suggested that a beneficial FA pattern of Alpine cheese might explain in part this "Swiss Alpine paradox" in analogy to French paradox (Hauswirth et al., 2004). Recently, Slovak ewes´ milk products Slovenská bryndza, Slovenský oštiepok, and Slovenská parenica were registered in the Register of the protected designations of origins and protected geographical indications of European Commission. Nevertheless, the detailed composition of fatty acid compounds of these ewes´ milk products was not known. The aim of this work was to determine the composition of health affecting fatty acids of dairy products of ewes grazing on natural pastures and to compare with that in Alpine milk products of cows grazing on Alpine pastures. The evaluation is based on milk quality concept which could reflect the health affecting fatty acids as well as the dairy processors' demands for raw milk quality, i.e. the contents of CLA, *t*VA, ALA, EPA, DHA, LA, MCFA, PA (palmitic acid), OA (oleic acid), AA (arachidonic acid C20:4 n-6), and ratio n-6 : n-3 in milk products.

MATERIAL AND METHODS

The ewes´ milk product samples were obtained from Research Institute of Animal Production in Trenčianska Teplá and from ewes´ farms in Ružomberok, Liptovská Anna and Tajov. The pasture samples from Trenčianska Teplá and Liptovská Anna were botanically elaborated in Grassland and Mountain Agriculture Research Institute in Banská Bystrica.

The ewes´ basic diet consisted of corn silage (2.5 kg), meadow and Lucerne hay (0.7 and 0.3 kg) commercial concentrated feed mixture (0.8 kg) and mineral supplements (0.02 kg) at the beginning of lactation. In the grazing period from mid-April to mid-September, the ewes grazed natural pastures and additionally received a concentrated feed at a dose of a 0.2 kg/day during machine milking only.

The ewes´ milk product samples (milk, cheese, bryndza-cheese, žinčica-milk) as well as pasture samples were extracted using chloroform/methanol mixture (2:1) and after derivatization by sodium methanolate in methanol analyzed as methyl esters of fatty acids (FAMEs) by GC-MS-FID in column 100 m x 0.25 mm I.D. coated with film thickness of 0.20 μm of CP-Sil 88 stationary phase. For FAMEs quickie analyses the column 60 m x 0.25 mm I.D. x 0.25 μm DB-23 was used (Meľuchová et al., 2008).

Gas chromatographically unseparated CLA isomers, mainly triplet *trans-7*,*cis-9*, *cis-9,trans-11*, and *trans-8*,*cis-10* CLA isomers, were resoluted by chemometric deconvolution (Blaško et al., 2008).

Statistical analysis of determined content of fatty acid compounds in pastures and milk samples were carried out using a one-way ANOVA statistical package. Significant differences were considered at the level $P < 0.05$ (Meľuchová et al. 2008).

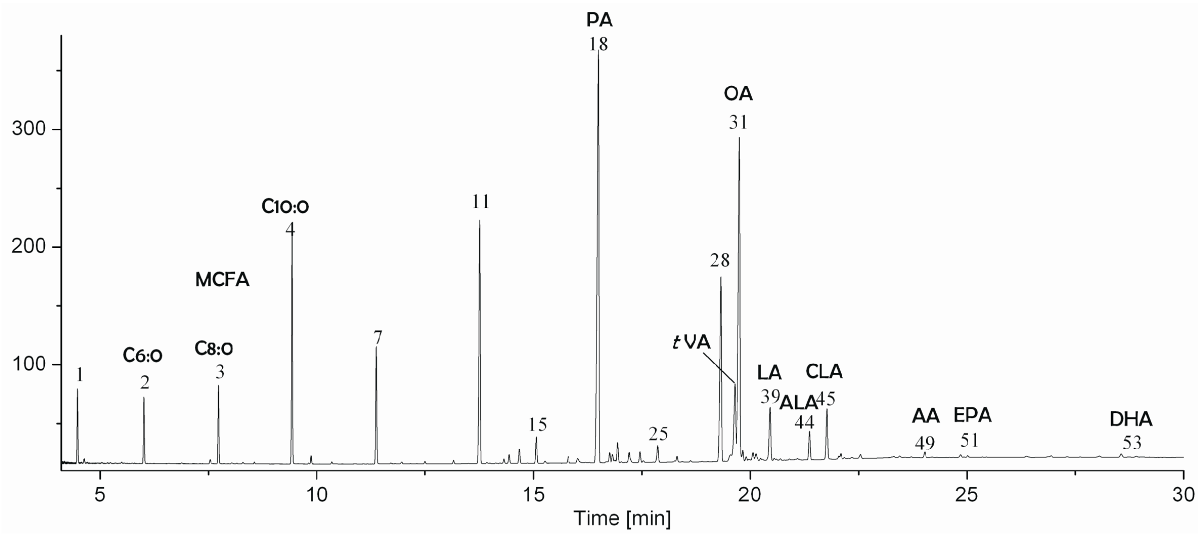

Fig. 1: **GC-MS chromatogram separation of C4-C24 fatty acid methyl esters from ewes´ milk fat sample using 60 m x 0.25 mm x 0.25 µm DB-23 column**

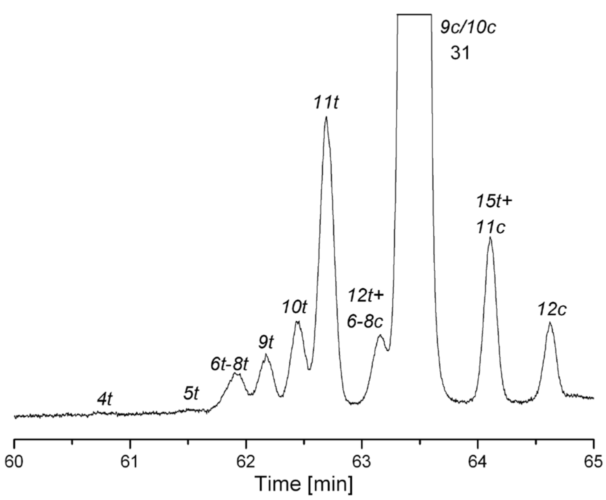

Fig. 2: **GC-MS separation of *trans* C18:1 isomers of ewes´ milk, including *trans-11* isomer (*t*VA), in 100 m x 0.25 mm x 0.2 µm CP-Sil 88 column at 150 °C**

RESULTS AND DISCUSSION

GC-MS chromatogram separation of 53 C4-C24 fatty acid methyl esters from ewes´ milk fat sample using 60 m x 0.25 mm x 0.25 µm DB-23 column by programmed temperature of 70-240 °C is presented in Fig. 1. GC-MS separation of *trans* C18:1 isomers, including *trans-11* isomer (*t*VA), in 100 m x 0.25 mm x 0.2 µm CP-Sil 88 column at 150 °C are shown in Fig. 2.

The results of GC analysis of pasture-fed ewes´ milk products (milk, cheese, bryndza, žinčica) at ewes´ farm Ružomberok are presented in Table 1. The investigated CLA, ALA, *t*VA contents in these dairy product fats (cheese, bryndza, žinčica) are similar to these in the milk fat from which these products are produced.

Health-promoting fatty acid milk profiles of ewes grazing on pastures and fed TMR from four Slovak localities: Trenčianska Teplá, Ružomberok, Liptovská Anna, and Tajov are presented in Table 2. The measured FA contents in bryndza cheese are not significantly different from the content of FA milk from which bryndza is produced. Obtained data in the table indicates that the content of CLA, *t*VA, ALA, and content ratio of n-6 : n-3 FAs can be modified by feeding the pattern of fat precursors that influences the mammary gland removes from blood for fat synthesis. The contents of these health affecting FAs in ewes´ milk are 4-fold higher for CLA, 3-fold for *t*VA, and up to 1.7-fold for ALA than in those fed with dry TMR diets. The measured content of 3.24% CLA and 7.20% *t*VA in milk of ewes grazed on pastures are higher compared with those in milk of cows and ewes grazing on pastures published so far.

Grazing ewes on pastures elevates the content of CLA, *t*VA, ALA in milk products. The measured fatty acid profiles of pasture herbage during pasture season from Trenčianska Teplá and Liptovská Anna are presented in Table 3. Predominant fatty acids in pasture forages are ALA > LA > PA > OA. Metabolic pathways of ALA, LA, and OA for the formation of CLA isomers include isomerization and microbial biohydrogenation in the rumen and enzymatic Δ9-desaturation of *t*VA in the mammary gland.

Table 1: Fatty acid profile of ewes´ milk products (milk, cheese, bryndza, žinčica) from Ružomberok (July 9, 2007) (mg.100 mg^{-1} FAME)

	FA	milk	žinčica	cheese	bryndza
1	C4:0	2.89	2.82	2.87	2.78
2	C6:0	1.73	1.48	1.58	1.53
3	C8:0	1.47	1.19	1.28	1.27
4	C10:0	4.72	3.64	4.04	4.03
5	C10:1	0.15	0.13	0.14	0.14
6	C11:0	0.05	0.04	0.04	0.04
7	C12:0	2.82	2.34	2.50	2.53
8	C12:1	0.07	0.07	0.07	0.07
9	C13:0	0.08	0.09	0.08	0.08
10	*iso*-C14:0	0.15	0.18	0.16	0.15
11	C14:0	8.96	8.26	8.78	8.74
12	C14:1	0.13	0.12	0.14	0.15
13	*iso*-C15:0	0.37	0.44	0.38	0.39
14	*anteiso*-C15:0	0.68	0.75	0.71	0.68
15	C15:0	1.21	1.28	1.32	1.24
16	C15:1	0.16	0.14	0.14	0.16
17	*iso*-C16:0	0.32	0.32	0.30	0.30
18	C16:0 (PA)	22.73	22.01	23.83	22.77
19	C16:1	0.56	0.50	0.47	0.47
20	C16:1	0.39	0.40	0.41	0.39
21	*9c*-C16:1	0.92	0.90	0.99	0.96
22	C16:1	0.02	0.02	0.02	0.02
23	*iso*-C17:0	0.61	0.61	0.58	0.61
24	*anteiso*-C17:0	0.46	0.51	0.45	0.48
25	C17:0	0.70	0.72	0.73	0.71
26	C17:1	0.30	0.39	0.32	0.38
27	*iso*-C18:0	0.06	0.06	0.06	0.05
28	C18:0	11.41	13.34	11.73	12.70
29	*5t-9t*-C18:1	0.64	0.62	0.59	0.63
30	*10,11,12t*-C18:1	6.37	5.29	5.04	4.96
31	*9c*-C18:1	17.48	20.85	18.71	19.70
32	*c*-C18:1	0.72	0.67	0.69	0.69
33	*c*-C18:1	0.25	0.24	0.28	0.28
34	*c*-C18:1	0.14	0.12	0.11	0.12
35	*tt*-C18:2	0.78	0.71	0.75	0.77
36	*c*-C18:1	0.71	0.66	0.74	0.76
37	C18:2	0.17	0.17	0.18	0.19
38	C18:2	0.08	0.08	0.09	0.08
39	C18:2 n-6 (LA)	2.98	2.59	3.08	2.73
40	C18:2	0.09	0.10	0.07	0.11
41	C18:2	0.12	0.11	0.14	0.12
42	C19:0	0.11	0.12	0.12	0.13
43	C18:2	0.30	0.32	0.30	0.32
44	C18:3 n-3 (ALA)	1.76	1.73	2.05	1.94
45	*9c,11t* CLA	2.59	2.31	2.23	2.13
46	*11t,13c* C18:2	0.13	0.08	0.14	0.09
47	C20:0	0.26	0.31	0.28	0.30
48	C20:1	0.21	0.18	0.28	0.16
49	C20:4 n-6 (AA)	0.15	0.12	0.13	0.12
50	C22:0	0.17	0.20	0.19	0.21
51	C20:5 n-3 (EPA)	0.09	0.10	0.11	0.10
52	C24:0	0.10	0.12	0.11	0.11
53	C22:6 n-3 (DHA)	0.06	0.07	0.09	0.08

The variations in the content of CLA in ewes´ milk fat and contents of ALA, LA, and OA in pasture samples from Trenčianska Teplá during pasture season are shown in Fig.3. Obtained relationships suggest that the variations of CLA milk content during pasture season are primarily determined by the content of ALA in pasture forage. The higher content of *cis-9*,*trans-11* CLA isomer in ewes´ milk fat during pasture season in May and September is proportional to the content of ALA in pasture forage, while for LA and OA such relationship was not observed.

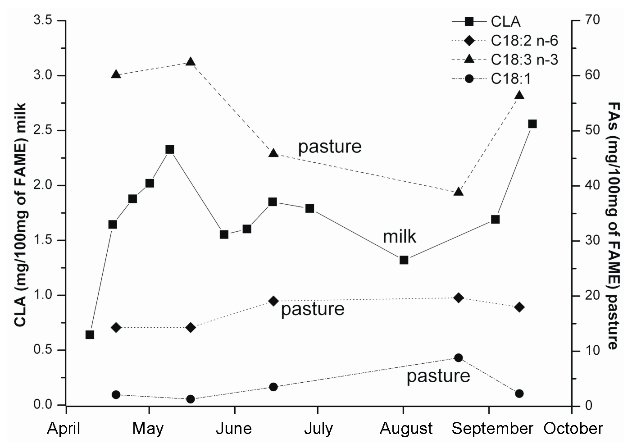

Fig. 3: The variations in the content of CLA in ewes´ milk fat, and content of ALA, LA, and OA in pasture samples from Trenčianska Teplá during pasture season

Fatty acid milk profile of cows grazing on pasture from four Swiss localities and that of TMR- fed are compiled in Table 4. The results show that the content of considered FAs in milk of cows grazing on Alpine pastures is rather different, especially for CLA content which is 2 two-folds higher in l'Etivaz cows´ milk fat than in Weisenstein. In general, the fatty acid milk profile of cows grazing on Alpine pastures is rather similar to Slovak milk profile of ewes grazing on pastures despite significant altitude differences between these pastures.

Recently, Leiber et al. (2007) hypothesized that the FA profile of cows´ milk was primarily not dependent on high altitude, but it was rather a consequence of combination of feed characteristics, which seemed to be particularly beneficial in botanically diverse and extensively managed Alpine pastures. The five plant species: *Leontodon hispidus, Plantago alpine, Aposenis foetida, Lotus corniculatus* (and *alpina*), and *Deschampina cespitosa* were predominant in Alpine mountains and

Table 2: Fatty acid profile of milk products of ewes grazing on pasture and fed TMR (mg.100 mg^{-1} FAME)

FA	TMR	Pasture (250 – 800 m a.s.l.)				SEM	S
	T. Teplá milk fat	T. Teplá milk fat	Ružomberok milk, bryndza	L. Anna milk, bryndza	Tajov milk fat		
CLA	0.71	2.40	2.59	2.63	3.24	0.07	***
*t*VA	1.83	5.10	5.29	4.36	7.20	0.19	***
ALA	1.06	1.24	1.76	1.89	0.98	0.05	***
EPA	0.05	0.08	0.10	0.09	0.08	0.01	***
DHA	0.04	0.07	0.08	0.07	0.05	0.01	***
AA	0.28	0.19	0.13	0.10	0.09	0.01	***
LA	2.94	2.30	2.98	2.78	2.03	0.08	***
PA	26.7	22.4	22.7	22.1	21.8	0.63	***
MCFA	8.93	8.10	8.00	9.60	11.5	0.53	***
n-6 : n-3	2.83	1.85	1.69	1.47	2.06	0.06	***

SEM: standard error of the means; S: significance

Table 3: Fatty acid profile of pasture herbage during pasture season from Trenč. Teplá and Lipt. Anna (mg.100 mg^{-1} FAME)

FA	Trenč. Tepla					Lipt. Anna		
	May	Aug	Sept	SEM	S	Sept	SEM	S
C4:0	ND	ND	ND	-	-	ND	-	-
C6:0	ND	ND	ND	-	-	ND	-	-
C8:0	ND	ND	ND	-	-	ND	-	-
C10:0	0.03	0.05	ND	0.01	**	ND	-	-
C12:0	0.15	0.60	0.19	0.02	***	0.14	0.01	NS
C14:0	0.40	1.65	0.45	0.07	***	0.39	0.02	NS
C14:1	0.04	0.07	0.05	0.01	**	0.03	0.01	*
C15:0	0.18	0.53	0.24	0.02	***	0.24	0.01	NS
C16:0	13.46	16.77	13.64	0.54	**	12.19	0.41	NS
C16:1 *cis*-9	0.54	0.65	0.38	0.03	***	0.25	0.02	*
C17:0	0.11	2.15	0.26	0.23	***	0.18	0.03	NS
C18:0	1.55	3.83	1.64	0.33	***	1.29	0.22	NS
C18:1 *trans*-11	ND	ND	ND	-	-	ND	-	-
C18:1 cis-9	1.32	8.77	2.34	0.36	***	1.79	0.11	**
C18:2 n-6	14.31	19.73	17.96	0.76	**	17.31	0.74	NS
C18:3 n-3	62.35	38.78	56.35	1.28	***	58.56	1.23	NS
C18:2 *c*-9,*t*-11	ND	ND	ND	-	-	ND	-	-
C20:0	0.60	1.13	0.75	0.07	***	0.36	0.02	***
C20:4 n-6 (AA)	ND	ND	ND		-	ND	-	-
C22:0	0.89	1.04	0.66	0.05	***	0.46	0.03	**
C20:5 n-3 (EPA)	ND	ND	ND	-	-	ND	-	-
C24:0	0.62	0.50	0.60	0.06	*	0.50	0.06	*
C22:6 n-3 (DHA)	ND	ND	ND	-	-	ND	-	-
SCFA (C4:0-C10:0)	ND	0.05	ND	-	-	ND	-	-
MCFA (C12:0-C16:1)	15.22	20.80	15.51	0.98	**	13.25	0.77	NS
LCFA (C17:0-C24:0)	84.78	79.15	84.49	1.65	NS	84.38	1.60	NS
SFA	17.98	28.25	18.43	0.82	***	15.75	2.32	*
PUFA	76.66	58.51	74.30	1.14	***	75.88	1.19	NS

SEM: standard error of the means; S: significance; NS: non-significant

Table 4: Fatty acid profile of Alpine cows´ milk pasture-fed products (mg.100 mg^{-1} FAME) and TMR-fed cows´ milk

FA	TMR	Alpine pastures (1275 – 2120 m a.s.l.)			
	Thuringia Kraft (2003) milk fat	Weisenstein Leiber (2005) milk fat	l'Etivaz 1 Collomb (2002) milk fat	Gstaad Hauswirth (2004) cheese fat	l'Etivaz 2 Kraft (2003) milk fat
CLA	0.28	1.34	2.18	2.50	2.67
*t*VA	0.33	3.12	5.10	-	3.86
ALA	0.35	1.15	1.15	1.60	1.30
EPA	0.04	0.08	-	0.04	0.10
DHA	0.06	0.01	-	-	0.11
AA	0.12	0.07	0.11	0.04	0.07
LA	1.63	1.57	1.33	-	1.31
PA	27.3	25.4	20.8	24.7	21.9
MCFA	7.10	5.00	4.70	-	5.70
n-6:n-3	3.92	1.37	1.16	1.10	1.01

highlands (1275-2120 m a.s.l.). The five most abundant plants found in Slovak lowlands (250-800 m above m.s.l.) pastures are: *Trifolium repens, Bromus inermis, Achillea millefolia, Festuca rubra,* and *Dactylis glomerata.* Thus, altitude is not a main factor determining quality of alpine milk, either different botanical composition of the fodder plant species, but similar FA composition of Slovak and Alpine pastures (ALA content about 60%) provides comparably high CLA, *t*VA, and ALA contents in milk products of ewes and cows grazing on pastures.

The second-most abundant CLA isomer in milk fat from cows grazing on high-altitude Alpine pastures was *trans-11*,*cis-13* CLA. Therefore, this isomer was presented as a useful indicator of milk products of Alpine origin (Kraft et al., 2003; Collomb et al., 2006). The authors suggested that the plants growing under lower environmental temperatures, i.e. in Alps, contain lipids with a higher ALA content (Kraft et al., 2003). In our study, however, we noted identical results for milk of ewes grazing on natural pastures in altitude range of 250 – 800 m above m.s.l. Partial GC-MS chromatograms of milk FAs separation with deconvoluted resolution of CLA isomers of ewes grazing on pasture in Trenčianska Teplá (CLA content 2.5%) and TMR-fed ewes´ milk sample (CLA content 0.5%) is presented in Fig. 4A,B. The content of *trans-11*,*cis-13* CLA isomer in milk of ewes grazing on pastures is about three-fold higher than that of *trans-7*,*cis-9* CLA isomer (0.18% vs. 0.066%), which is normally the second-most abundant CLA isomer in ruminant milk fat. The *trans-11*,*cis-13* / *trans-7*,*cis-9* CLA isomers content ratio in TMR-fed ewes´ milk sample is 0.10 (Fig.4B). Thus, *trans-11*, *cis-13* CLA isomer is the second-most abundant isomer in the milk of ewes or cows grazing on natural pastures that is characteristic by a relatively high content of *cis-9*,*trans-11* CLA isomer, but not in the milk of ewes fed TMR.

In summary, the milk of ewes grazing on Slovak natural pastures as well as of cows grazing on Alpine pastures show higher contents of CLA, *t*VA, ALA, and MCFA, slightly higher contents of EPA and DHA, lower contents of PA, AA, and lower n-6 : n-3 FAs ratio compared with that of TMR-fed animals. Higher CLA, *t*VA, and ALA contents in milk fat results from higher ALA content in grazed pastures, which, in fresh herbage, is the main precursor for CLA and *t*VA in milk.

Dhiman et al. (2005) published the minimum dietary CLA intake 0.05% of the diet, i.e. 300 mg/day of CLA. Consumption of thirty grams of "Slovenská bryndza" can lead to an intake of about 300 mg of *cis-9*,*trans-11* CLA isomer, which corresponds to a minimum dietary intake that has been shown to be effective in reducing the incidence of cancer in animal models.

Two remarkable studies associated with the intake of milk products were published recently. Plant-oil derived n-3 FAs, including ALA, were found to increase the risk of advanced prostate cancer (Leitzmann et al., 2004; Kobayashi et al., 2006). Mitrou et al. (2007) found that men with higher dietary intake of calcium (more than 2000 mg/day) had a 63% higher risk of prostate cancer compared with those getting less than 1000 mg/day because excess dietary calcium inhibits activation of vitamin D in the body. As the content of *cis-9*,*trans-11* CLA and *t*VA in milk of ewes or cows grazing on pastures are approximately by half till one order higher than those in TMR-fed cows´ milk, a similar health promoting effect can be achieved with correspondingly lower intake of milk of ewes grazing on pastures compared with the current commercial milk of TMR-fed cows.

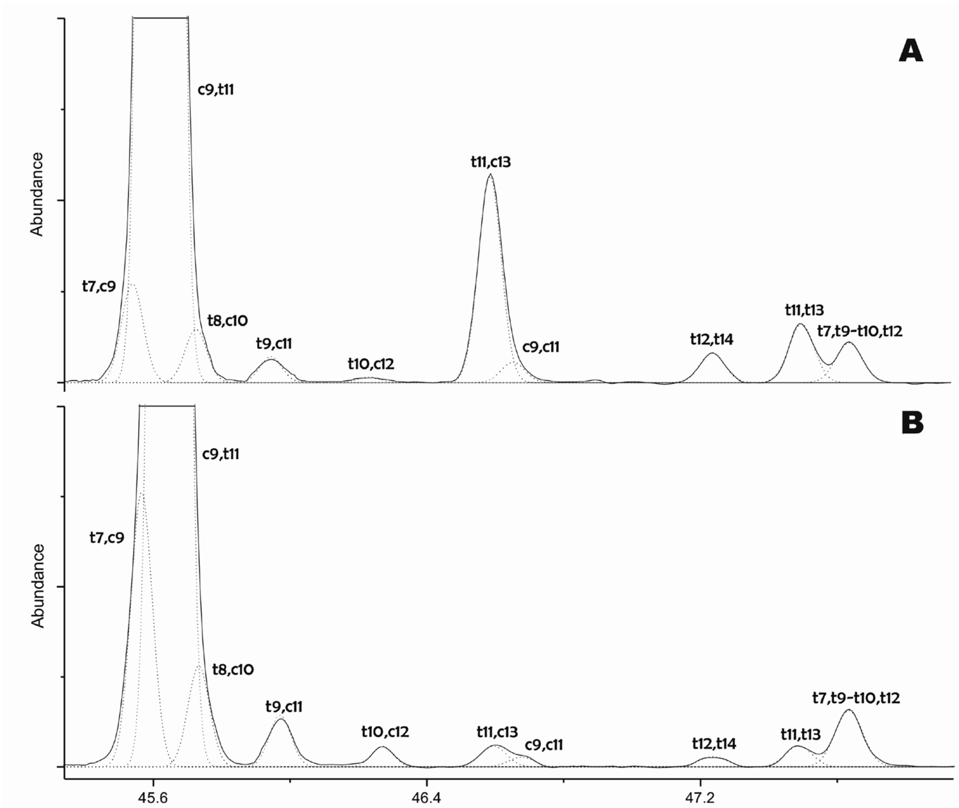

Fig. 4: Partial GC-MS chromatograms of FAs separation with deconvoluted resolution of CLA isomers from Trenčianska Teplá: A - milk sample of ewes grazing on pastures (CLA content 2.5%); B - milk sample of ewes fed TMR (CLA content 0.5%).

CONCLUSIONS

Comparison of Slovak and Alpine FA content of milk products indicates that milk of ewes grazing on Slovak lowlands as well as of cows grazing on Alpine pastures contain substantially higher contents of CLA, *t*VA, ALA, and MCFA, slightly higher contents of EPA and DHA, lower contents of PA, AA, and lower n-6 : n-3 FAs ratio compared with that of TMR-fed animals. Higher CLA, *t*VA, and ALA contents in milk fat results from higher ALA content in grazed pastures and not from specific Alpine pasture effect. Moreover, the content of *trans-11*,*cis-13* CLA isomer being the second-most abundant CLA isomer, which has been reported as an indicator of Alpine milk products, was also found in Slovak milk products of ewes grazing on lowlands pastures. The CLA and *t*VA contents of investigated Slovak ewes´ milk are higher than those from animals grazing on pastures published so far. The investigated Slovak pasture ewes´ milk products offer at least comparable contents of health affecting FAs as the best Alpine cows´ milk products (l′Etivaz 2). The comparison of best Slovak and Alpine milk (Table 5) shows that the content of *t*VA, MCFA, and LA in Tajov ewes´ milk is about two-fold higher, the content of OA 60% similar high, the content of CLA 20% higher, and the content of ALA 30% lower compared with l'Etivaz 2 cows´ milk.

Table 5: Fatty acid profile of best Slovak ewes´ milk and best Alpine cows´ milk fat based on health affecting fatty acids (mg.100 mg^{-1} FAME)

FA	Tajov ewes´ milk fat	l'Etivaz 2 Kraft (2003) cows´ milk fat
CLA	3.24	2.67
*t*VA	7.20	3.86
ALA	0.98	1.30
EPA	0.08	0.10
DHA	0.05	0.11
AA	0.09	0.07
LA	2.03	1.31
PA	21.8	21.9
MCFA	11.5	5.70
n-6 : n-3	2.06	1.01

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