VARIABILITY OF UNSATURATED FATTY ACIDS IN MILK FROM DIFFERENT FARMS OF THE CZECH REPUBLIC*

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Milk samples from seven farms and one dairy plant were analyzed during the period of two years. The total fat content and the composition of fatty acids in milk fat were determined. Compared to the other breeds, the milk of Jersey dairy cows had a statistically lower percentage of unsaturated fatty acids except palmitoleic acid and statistically higher percentage of palmitic acid. The mean percentage of monounsaturated fatty acids in total fatty acid content in milk fat was 27.70 ± 2.74% for F1–F6 (F1, F6 – Holstein breed x Czech Spotted Cattle; F2 – Czech Spotted Cattle; F3, F4, F5 – Holstein breed), resp. 22.16 ± 0.86% for F7 (Jersey breed) and of polyunsaturated fatty acids was 2.53 ± 0.36% for F1–F6, resp. 1.93 ± 0.22% for F7. The mean percentage of selected unsaturated fatty acids in milk fat were as follows (F1–F6 and F7, resp.): oleic acid 25.06 ± 2.84% and 19.78 ± 0.85%, linoleic acid 2.16 ± 0.31% and 1.70 ± 0.18%, linolenic acid 0.33 ± 0.08% and 0.22 ± 0.05%. The breed and the conditions of breeding at individual farms have main influence on the milk fat content and composition; the seasonal variations are less significant. The composition of fatty acids in milk fat has a close relation to the total fat content.

milk fat; linoleic acid; linolenic acid; oleic acid; dairy cow; gas chromatography

INTRODUCTION

At present, milk and dairy products constitute an important part of human nutrition. Milk fat is among the basic nutrients contained in milk, in addition to proteins, saccharides and minerals, and is present in almost all dairy products, with some exceptions, such as fat-free yoghurts. It is generally known that nutritional value of fats is determined in particular by the percentage of carboxylic fatty acids, which are chemically bound in the fat in the form of triacylglycerols.

More detailed information on the percentage of fatty acids in milk fat is primarily related to the development of gas chromatography. This technique enables a very effective separation and quantification of individual fatty acids contained in the analyzed sample (most frequently in the form of methyl esters following derivatization).

Many health professionals recommend diets higher in unsaturated and lower in saturated fatty acids. Essential fatty acids constitute an important group of substances contained in milk fat, in terms of physiological effects. It is a group of fatty acids with two or more double bonds. According to conventional classification, this group comprises linoleic acid, alpha-linolenic acid, gamma-linolenic acid, and arachidonic acid (Holman, 1976).

Linoleic acid is reported to be the most abundant essential fatty acid in the milk (0.3 to 2.2%, Velíšek, 2002), and it is considered to be most important in this group as well, as it can serve as a source for synthesis of the other above-mentioned unsaturated fatty acids in the human body. The main advantage of milk as a source of linoleic acid is that this compound is present in the milk along with natural antioxidants and mineral substances that increase its effects. In contrast, excess intake of unsaturated fatty acids degraded for example through high temperatures during frying can be harmful to the body due to the presence of oxidative products. According to Velíšek (2002) milk fat contains 53 to 72% of saturated fatty acids, 26 to 42% of monounsaturated fatty acids (MUFA), and 2 to 6% polyunsaturated fatty acids (PUFA).

Based on studies published so far, it can be expected that composition of food is the main factor influencing the percentage of fatty acids in milk fat (Grummer, 1991; Wagner et al., 1998; Chiofalo et al., 1996). However, other factors may also play a role, such as the breed (Beaulieu, Palmquist, 1995), climate, or grazing altitude (Collomb et al., 1999, 2002) as well as stage of lactation, seasonal variation, low milk fat syndrome, genetic variation, and changes in the energy status of the cow due to administration of bovine somatotropin (Hall, 1970; Christie, 1979; Baer, 1991; Bauman, Griinari, 2003). Utilization of feeding, genetic variation and bovine somatotropin should produce a milk fat lower in saturated and higher in unsaturated fatty acids (Baer, 1991).

The objective of our work was to compare the composition of selected fatty acids in the milk fat of dairy cows with different conditions of breeding. We firstly focused our attention on the determination of unsaturated fatty acids with emphasis on essential linoleic and linolenic acids.

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MATERIAL AND METHODS

Samples of milk from seven selected farms in Central and Northern Bohemia and from dairies which were supplied with milk from these farms (except for Farm 7) were analyzed during the years 2002 to 2004. During the course of the experiment, cooperation with Farm 4 was stopped as it was transferred to another supply area. Farm 7 was not included in the group of study farms until 2003 (when it replaced Farm 6). No feeding dose in any farm contained additives that would intentionally change the composition of milk fat in the milk of dairy cows.

The characteristics of breeding conditions at individual farms were as follows. **F1:** Holstein breed (70%) x Czech Spotted Cattle (30%), 340 dairy cows, free box stall, corn silage and haylage, rapeseed cake added to the feeding mixture; **F2:** Czech Spotted Cattle, 350, free box stall, mixture of corn silage and rapeseed cake, summer pasture; **F3:** Holstein, 230, tie stall, corn silage and haylage, no rapeseed cake, **F4:** Holstein, 450, free box stall, corn silage and haylage, rapeseed cake; **F5:** Holstein, 220, free box stall, corn silage and haylage, no rapeseed cake; **F6:** Holstein x Czech Spotted Cattle, 300, free box stall, corn silage during winter, green feed during summer, no rapeseed cake; **F7:** Jersey, 90, free stall, corn silage and haylage, rapeseed cake added to the feed mixture, summer pasture.

Samples of milk were usually collected from each farm once a month. The total fat content and the composition of fatty acids in milk fat were determined in all samples. Fatty acids were analyzed as methyl esters after trans-esterification by gas chromatography. Fourteen fatty acids were quantified in each sample.

The method according to AOAC was used for fat extraction (C u n n i f f , 1995; ČSN EN 1528-2, 1998). This method is based on a similar principle of the reference method for the determination of fat according to Röss-Gottlieb, which is specified in the IDF No. 172 (1995) standard. The main difference between the methods is that the AOAC method uses a saturated potassium oxalate solution rather than a saturated ammonia solution for the pretreatment of milk before the extraction. This is advantageous mainly in terms of hygiene and work safety. The method according to the standard ČSN ISO 5509 (1994) was used for the preparation of methyl esters. This method is based on saponification of fat and esterification of liberated fatty acids by methanol in the presence of boron fluoride.

Varian 3300 Gas Chromatograph equipped with fused silica open tubular column DB 23 (30 m x 0.25 mm, film thickness 0.25 μm) and flame ionization detector was used for the analysis of methyl esters. The chromatogram was evaluated by an internal normalization method using a computer program (Varian Star Chromatography Workstation verse 4.51) without correction factors. Each GLC analysis was carried out at least in duplicate and the result was expressed as arithmetic mean in percentages.

The results were statistically evaluated in the Excel computer program using a two-factor analysis of variance ANOVA (with and without repetition) at the significance level $\alpha = 0.05$.

RESULTS AND DISCUSSION

Total milk fat content and percentage of the individual fatty acids in the milk fat was determined in the analyzed samples of milk. Along with main saturated fatty acids (palmitic, stearic, and myristic acids) we focused on three monounsaturated fatty acids (oleic, palmitoleic and myristoleic acid) and two essential polyunsaturated fatty acids (linoleic and alpha-linolenic acid).

Fat content in the milk samples from the individual farms and in the bulk tank milk sample from the dairy are shown in Fig. 1. Fat contents in the milk samples from the study dairy cows (except for Jersey dairy cows bred on farm F7) ranged from 2.72% to 4.57%, with the average value of 3.83 ± 0.35% (median 3.88%). This value corresponds very well to the average fat content 3.87 ± 0.31% (median 3.95%) in the bulk tank milk samples from the dairy. The average fat content in the milk of Jersey dairy cows was statistically significantly higher, as expected, and amounted to 5.61 ± 0.20% (median 5.56%). Statistically significant differences in the fat content were also found in the milk of dairy cows bred in other study farms (high fat contents were found in particular in the milk of dairy cows bred on farms F3 and F4), while in most cases no significant differences were demonstrated between the individual sample collections during the study period. It can be concluded that the higher fat content showed dairy cows which were not supplied with the rape-cake in feed. The probable reason is that the substances contained in the rape-cake influence the fat content in milk through the thyroid activity by their thyreostatic effects. The connection between the thyroid activity and the fat content in milk was described already in the first half of the 20th century by G r a h a m (1934), but the research of this topic has not been further continued.

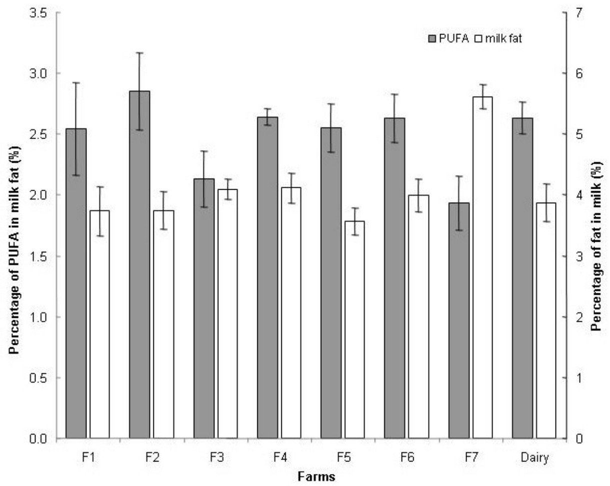

Fig. 1. Relation between percentage of polyunsaturated fatty acids and milk fat content (the breeds of dairy cows bred on the individual farms: F1, F6 – Holstein x Czech Spotted Cattle; F2 – Czech Spotted Cattle; F3, F4, F5 – Holstein; F7 – Jersey)

The percentage of unsaturated, monounsaturated and polyunsaturated fatty acids in milk fat of dairy cows from different farms and from bulk tank milk samples is given in Tables 1, 2 and 3. The coefficient of variation of the abundance of unsaturated fatty acids in the individual farms during study period is not higher than 15%. The mean percentage of unsaturated fatty acids (oleic, linoleic, palmitoleic, myristoleic, and linolenic acids) in the milk fat of Jersey dairy cows was 24 ± 1.03%, while it was 29.64 ± 2.94% in other breeds. The mean content of monounsaturated fatty acids was 27.12 ± 2.86% for F1–F6, resp. 22.16 ± 0.86% for F7 and of polyunsaturated fatty acids was 2.53 ± 0.36% for F1–F6, resp. 1.93 ± 0.22% for F7. Compared to V e l í š e k (2002) (26 to 42% of MUFA, and 2 to 6% PUFA) the percentage of unsaturated fatty acids appears on lower bound for declared range. Statisti-

Table 1. Percentage of unsaturated fatty acids in milk fat (in %)

Farm	Breed	Range of values	Mean	Median	Standard deviation	Coefficient of variation
F1	H x CSC	25.75–36.31	32.30	33.42	3.23	10.00
F2	CSC	26.43–33.31	30.66	30.68	1.80	5.87
F3	Holstein	27.50–33.05	30.47	30.66	1.60	5.25
F4	Holstein	27.25–28.68	27.94	27.89	0.72	2.58
F5	Holstein	24.34–33.13	27.26	26.91	2.14	7.84
F6	H x CSC	25.48–32.89	30.24	30.99	2.88	9.52
F7	Jersey	22.67–25.14	24.09	24.04	1.03	4.28
Dairy	–	26.81–32.88	30.22	30.4	1.47	4.86
F1 – F6	–	24.34–36.31	30.06	30.42	2.80	9.31
F1 – F7	–	22.67–36.31	29.71	30.25	3.06	10.30

H = Holstein, CSS = Czech Spotted Cattle

Table 2. Percentage of monounsaturated fatty acids in milk fat (in %)

Farm	Breed	Range of values	Mean	Median	Standard deviation	Coefficient of variation
F1	H x CSC	24.00–33.86	29.77	30.64	2.96	9.94
F2	CSC	23.99–30.28	27.82	27.92	1.64	5.90
F3	Holstein	25.47–31.11	28.33	28.45	1.56	5.51
F4	Holstein	24.55–26.04	25.30	25.30	0.72	2.85
F5	Holstein	21.78–30.54	24.71	24.30	2.09	8.46
F6	H x CSC	23.19–30.19	27.62	28.21	2.77	10.03
F7	Jersey	20.97–22.96	22.16	22.34	0.86	3.90
Dairy	–	24.37–30.36	27.59	27.72	1.40	5.07
F1 – F6	–	21.78–33.86	27.70	27.94	2.74	9.89
F1 – F7	–	20.97–33.86	27.36	27.86	2.98	10.89

H = Holstein, CSS = Czech Spotted Cattle

Table 3. Percentage of polyunsaturated fatty acids in milk fat (in %)

Farm	Breed	Range of values	Mean	Median	Standard deviation	Coefficient of variation
F1	H x CSC	1.75–2.94	2.54	2.62	0.38	14.96
F2	CSC	2.11–3.40	2.85	2.88	0.32	11.13
F3	Holstein	1.67–2.58	2.13	2.10	0.23	10.80
F4	Holstein	2.57–2.73	2.64	2.62	0.07	2.65
F5	Holstein	2.20–2.81	2.55	2.57	0.20	7.84
F6	H x CSC	2.29–2.89	2.63	2.66	0.20	7.49
F7	Jersey	1.70–2.21	1.93	1.96	0.22	11.40
Dairy	–	2.42–2.89	2.63	2.65	0.13	4.94
F1 – F6	–	1.67–3.40	2.53	2.59	0.36	14.23
F1 – F7	–	1.67–3.40	2.50	2.58	0.38	15.20

H = Holstein, CSS = Czech Spotted Cattle

Table 4. Statistically significant differences in the content of monounsaturated fatty acids among farms

MUFA	F1	F2	F3	F4	F5	F6	F7
F1	–	S	A	S	S	S	S
F2	S	–	A	S	S	N	S
F3	N	N	–	S	S	N	S
F4	S	S	S	–	N	S	S
F5	S	S	S	N	–	S	S
F6	S	N	A	S	S	–	S
F7	S	S	S	S	S	S	–

The breeds of dairy cows bred on the individual farms: F1, F6 – Holstein x Czech Spotted Cattle; F2 – Czech Spotted Cattle; F3, F4, F5 – Holstein, F7 – Jersey; N = statistically nonsignificant, S = statistically significant

Table 5. Statistically significant differences in the content of polyunsaturated fatty acids among farms

PUFA	F1	F2	F3	F4	F5	F6	F7
F1	–	S	S	N	N	N	S
F2	S	–	S	S	S	S	S
F3	S	S	–	S	S	S	S
F4	A	S	S	–	N	N	S
F5	A	S	S	N	–	N	S
F6	A	S	S	N	N	–	S
F7	S	S	S	S	S	S	–

The breeds of dairy cows bred on the individual farms: F1, F6 – Holstein x Czech Spotted Cattle; F2 – Czech Spotted Cattle; F3, F4, F5 – Holstein; F7 – Jersey; N = statistically nonsignificant, S = statistically significant

cally significant differences in the percentage of MUFA and PUFA were found also in the milk fat of dairy cows bred in some other farms (see Tables 4 and 5).

Compared to the other breeds, the milk of Jersey dairy cows had a statistically significantly higher percentage of palmitic acid 37.22 ± 1.34% vs. 31.27 ± 6.64% and lower percentage of oleic acid 19.78 ± 0.85% vs. 25.06 ± 2.84% (Table 6). The lower percentage of oleic acid in the milk fat of Jersey dairy cows was also reported by Beaulieu and Palmquist (1995). In addition to the statistically significantly lower percentage of oleic acid, the milk fat of Jersey dairy cows also has a significantly lower percentage of other unsaturated fatty acids, linoleic, linolenic and myristoleic acids (0.828 ± 0.023%). Only the mean percentage of palmitoleic acid was the same 1.54 ± 0.123% and 1.56 ± 0.11%. The mean contents of other selected unsaturated fatty acids in milk fat are given in Table 6. For this reason, Jersey dairy cows have a lower total quantity of unsaturated fatty acids in the milk fat.

The connection between the changes of the biohydrogenation of essential fatty acids and the specific inhibition of the fat synthesis in milk gland was described in literature (Bauman, Griinari, 2003). The authors of this article have also concluded, that the feed with low fiber content causes the changes in the biohydrogenation process transforming linoleic acid to *trans*-10-*cis*-12 CLA, which is the potential inhibitor of the fat content in milk. On the basis of these findings and experimental data acquired during our study it appears probable that there is a connection between the percentage of the sum of unsaturated fatty acids and the fat content in milk as the consequence of the biohydrogenation changes, which have been not fully explained so far. In our study, the closest relation has been found among the percentage of polyunsaturated fatty acids in fat and the fat content in milk (Fig. 1), which can be described by the equation $y = -0.363\ x + 3.958$ (coefficient of correlation $R^2 = 0.621$, y = percentage of PUFA in fat, x = fat content in milk).

The percentage of the four main acids ranged from approximately 76 to 79%. Analyses revealed that an increasing content of palmitic acid above a certain average value is associated with a low content of oleic and stearic acids (Fig. 2). A similar trend was also observed by Boatman, Hammond (1965) and Hall (1970). According to these authors, a lower content of palmitic acid and higher content of stearic and oleic acids can be expected during summer months. Transfer from winter to summer feeding probably has the biggest influence on seasonal changes in the composition of fatty acids (Christie, 1979; Christie, Clapperton, 1982).

Percentage of linoleic acid in the milk fat of dairy cows and in bulk tank milk samples is shown in Table 7. A statistically significantly lower percentage of linoleic acid during the entire study period was found in the milk of dairy cows bred on the farm F7 (Jersey cows) (1.70 ± 0.18%) and on farm F3 (1.89 ± 0.20%). During the same period, the average content of linoleic acid in the other farms was 2.16 ± 0.31%. An increased percentage of linoleic acid in the milk fat during the summer period was not proven, unlike the data reported by Christie and Clapperton (1982).

Table 6. Percentage of selected fatty acids in milk fat (in %)

Item	Farm	Range of values	Mean	Median	Standard deviation	Coefficient of variation
Palmitic acid	F1 – F7	26.56–38.99	31.62	30.71	6.60	20.87
	F1 – F6	26.56–35.22	31.27	30.32	6.64	21.23
	F7 (Jersey)	35.65–38.99	37.22	37.13	1.34	3.60
	Dairy	28.25–33.98	30.57	30.76	1.47	4.81
Oleic acid	F1 – F7	18.69–31.49	24.76	25.20	3.03	12.24
	F1 – F6	19.28–31.49	25.06	25.32	2.84	11.33
	F7 (Jersey)	18.69–20.54	19.78	20.10	0.85	4.28
	Dairy	21.95–28.14	25.23	25.46	1.51	5.98
Myristic acid	F1 – F7	9.1–13.44	11.65	11.76	0.84	7.18
	F1 – F6	9.1–13.44	11.65	11.76	0.86	7.27
	F7 (Jersey)	11.32–11.71	11.49	11.43	0.15	1.32
	Dairy	10.14–11.90	11.09	11.06	0.47	4.22
Stearic acid	F1 – F7	6.95–12.88	10.33	10.40	1.24	12.00
	F1 – F6	6.95–12.88	10.29	10.39	1.24	12.05
	F7 (Jersey)	10.22–11.44	10.74	10.72	0.50	4.61
	Dairy	9.23–11.97	10.50	10.55	0.77	7.32
Linoleic acid	F1 – F7	1.45–2.77	2.14	2.21	0.32	14.95
	F1 – F6	1.45–2.77	2.16	2.21	0.31	14.35
	F7 (Jersey)	1.52–1.94	1.70	1.72	0.18	10.59
	Dairy	2.06–2.45	2.24	2.25	0.11	4.91
Palmitoleic acid	F1 – F7	1.17–2.22	1.55	1.54	0.16	10.00
	F1 – F6	1.17–2.22	1.55	1.54	0.15	9.81
	F7 (Jersey)	1.44–1.68	1.56	1.55	0.11	7.05
	Dairy	1.37–1.74	1.50	1.50	0.09	5.81
Myristoleic acid	F1 – F7	0.62–1.23	0.91	0.90	0.12	13.44
	F1 – F6	0.62–1.23	0.91	0.91	0.12	13.58
	F7 (Jersey)	0.80–0.86	0.83	0.82	0.02	2.78
	Dairy	0.75–1.01	0.86	0.85	0.07	8.39
Linolenic acid	F1 – F7	0.15–0.52	0.32	0.32	0.08	26.17
	F1 – F6	0.15–0.52	0.33	0.33	0.08	25.15
	F7 (Jersey)	0.16–0.27	0.22	0.24	0.05	22.07
	Dairy	0.29–0.53	0.39	0.38	0.07	17.05

The breeds of dairy cows bred on the individual farms: F1, F6 – Holstein x Czech Spotted Cattle; F2 – Czech Spotted Cattle; F3, F4, F5 – Holstein; F7 – Jersey

The average percentage of alpha-linolenic acid was 0.321 ± 0.084% in the milk fat of dairy cows from all study farms, and 0.393 ± 0.067% in the milk fat of bulk tank milk samples. Statistically significantly lower content of linolenic acid (0.222 ± 0.049%) was found in the milk fat of Jersey dairy cows in farm F7 (Table 6).

Although the results of the statistical evaluation of experimental data are not quite unambiguous, and the contents of some acids in the milk of dairy cows in some farms were statistically significantly different from the average value, the percentage of the individual fatty acids in the milk fat can be considered, to a certain extent, as being stable and the differences in the percentage were statistically nonsignificant, especially if the dairy cows are not put out to pasture and the feeding dose is constant throughout the year.

This statement is also confirmed by the analysis of milk fat in the bulk tank milk sample from the dairy, which was supplied by the individual farms (Figs 2 and 3). The variability in the composition of the four main acids expressed as relative standard deviation ranges from 4.22% (myristic acid) to 7.32% (stearic acid), and no seasonal changes in the milk fat composition were found. The highest variability was found for alpha-linolenic acid (17.05%) in natural agreement with its low contents in fat.

The average milk fat composition of the bulk tank milk sample from the dairy corresponds very well with the average milk fat composition in dairy cows bred on the study farms. This means that the average milk fat composition of dairy cows bred on the farms, from which the milk was not analyzed but was transferred to the study dairy, is not different from the study farms.

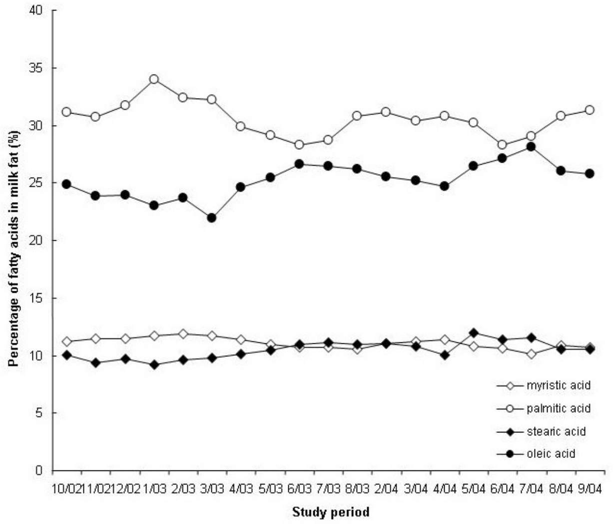

Fig. 2. Percentage of four major fatty acids in the milk fat of bulk tank milk sample

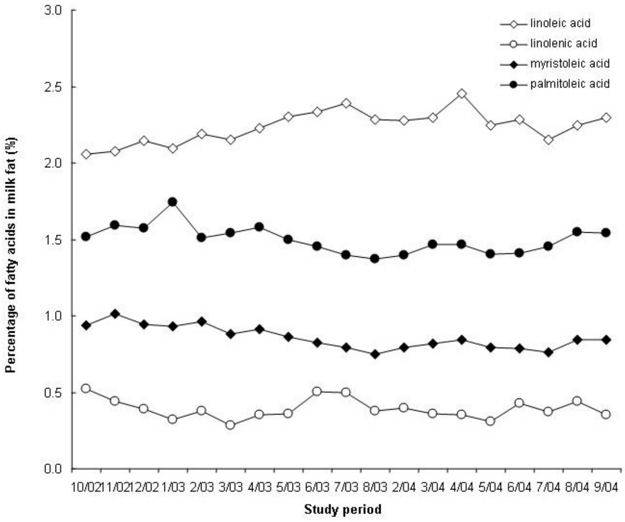

Fig. 3. Percentage of minor unsaturated fatty acids in the milk fat of bulk tank milk sample

Table 7. Percentage of linoleic acid in milk fat (in %)

Period	Farm							Mean	Min.	Max.	Dairy
	F1	F2	F3	F4	F5	F6	F7				
10/02	2.19	2.38	–	2.19	2.15	–	–	2.23	2.15	2.38	2.06
11/02	2.44	2.30	1.85	2.25	–	2.02	–	2.17	1.85	2.44	2.08
12/02	1.55	2.10	1.67	2.31	–	–	–	1.91	1.55	2.31	2.15
1/03	1.55	1.89	1.76	2.22	1.91	–	–	1.86	1.55	2.22	2.10
2/03	2.21	2.77	1.94	2.20	1.99	–	–	2.22	1.94	2.77	2.19
3/03	2.22	2.58	1.84	2.36	2.10	2.35	–	2.24	1.84	2.58	2.15
4/03	2.38	2.63	1.78	–	2.29	2.33	–	2.28	1.78	2.63	2.23
5/03	1.89	2.74	1.90	–	2.49	–	–	2.25	1.89	2.74	2.30
6/03	–	–	1.45	–	2.49	2.37	–	2.10	1.45	2.49	2.34
7/03	2.27	2.69	1.83	–	2.26	2.58	–	2.32	1.83	2.69	2.39
8/03	2.25	2.21	1.87	–	1.89	2.31	–	2.11	1.87	2.31	2.29
2/04	2.43	2.75	2.14	–	2.38	–	–	2.43	2.14	2.75	2.28
3/04	2.46	2.29	2.22	–	2.31	–	–	2.32	2.22	2.46	2.30
4/04	2.38	2.99	2.17	–	2.39	–	1.72	2.33	1.72	2.99	2.45
5/04	–	2.50	1.87	–	2.24	–	1.80	2.10	1.80	2.50	2.25
6/04	2.32	2.65	1.90	–	2.12	–	1.94	2.18	1.90	2.65	2.29
7/04	1.93	2.56	1.79	–	–	–	1.54	1.95	1.54	2.06	2.15
8/04	2.08	2.37	1.79	–	2.10	–	1.52	1.97	1.52	2.37	2.25
9/04	2.41	2.36	2.22	–	2.30	–	–	2.32	2.22	2.41	2.30
Mean	2.17	2.49	1.89	2.25	2.21	2.32	1.70	–	–	–	2.24
SD	0.29	0.27	0.20	0.07	0.19	0.18	0.18	–	–	–	0.11

The breeds of dairy cows bred on the individual farms: F1, F6 – Holstein x Czech Spotted Cattle; F2 – Czech Spotted Cattle; F3, F4, F5 – Holstein; F7 – Jersey; SD = standard deviation

CONCLUSION

According to the results obtained in this study, the content and composition of milk fat is primarily influenced by the mode of breeding the dairy cows at the individual farms, including but not only limited to different feeding techniques. No statistically significant seasonal changes in the milk fat composition were demonstrated when applying an unchanged year-round feeding dose. The composition of the milk fat, as well as total content milk fat, can be influenced by the breed, too. A higher percentage of palmitic acid and lower percentage of unsaturated fatty acids (oleic, palmitoleic, myristoleic, linoleic, and alpha-linolenic acid) was statistically confirmed in the milk fat of dairy cows on the farm breeding Jersey cows. Statistically significant differences in the content of monounsaturated and polyunsaturated fatty acids in the milk fat were found in this study.

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HEJTMÁNKOVÁ, A. – TÁBORSKÝ, J. – DRAGOUNOVÁ, H. – NOVOTNÝ, O. (Česká zemědělská univerzita, Fakulta agrobiologie, potravinových a přírodních zdrojů, Praha, Česká republika):

Změny v obsahu nenasycených mastných kyselin v mléce dojnic z různých farem v České republice.

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V letech 2002–2004 bylo analyzováno mléko dojnic chovaných na 7 různých farmách (F1–F7) situovaných ve středních a severních Čechách. Současně byly analyzovány bazénové vzorky mléka z mlékárny, do níž bylo mléko z jednotlivých farem sváženo. Vzorky mléka byly odebírány jednou měsíčně. V každém vzorku byl stanoven obsah tuku a 14 mastných kyselin nejvíce v mléce zastoupených. Mastné kyseliny byly analyzovány metodou plynové chromatografie po transesterifikaci na příslušné methylestery za použití kapilární kolony DB-23. Průměrný obsah tuku v mléce z farem F1–F6 (F1, F6 – plemeno holštýnské x český strakatý skot; F2 – český strakatý skot; F3, F4, F5 – plemeno holštýnské) byl 3,83 ± 0,35 %, resp. 5,61 ± 0,20 % z farmy F7, na které bylo chováno plemeno jersey. Mléko dojnic jerseyského plemene ve srovnání s mlékem dojnic ostatních plemen vykazovalo statisticky významně nižší procentuální zastoupení nenasycených mastných kyselin (s výjimkou kyseliny palmitoolejové) a naopak statisticky významně vyšší zastoupení kyseliny palmitové. Průměrný obsah mononenasycených mastných kyselin z celkového množství mastných kyselin v mléčném tuku byl 27,70 ± 2,74 % pro farmy F1–F6, resp. 22,16 ± 0,86 % pro farmu F7. Průměrný obsah polynenasycených mastných kyselin z celkového množství mastných kyselin v mléčném tuku pro farmy F1–F6 byl 2,53 ± 0,36 %, resp. 1,93 ± 0,22 % pro farmu F7. Průměrné zastoupení vybraných nenasycených mastných kyselin z celkového množství mastných kyselin v mléčném tuku bylo následující (pro mléko z farem F1–F6, resp. F7): kyselina olejová 25,06 ± 2,84 %, resp. 19,78 ± 0,85 %, kyselina linolová 2,16 ± 0,31 %, resp. 1,70 ± 0,18 %, kyselina palmitoolejová 1,55 ± 0,16 %, resp. 1,55 ± 0,15 %, kyselina myristoolejová 0,913 ± 0,124 %, resp. 0,28 ±

0,23 %, kyselina linolenová 0,326 ± 0,082 %, resp. 0,222 ± 0,049 %. Vzhledem k výsledkům dosaženým v této práci lze předpokládat, že největší vliv na obsah mléčného tuku a jeho složení má plemeno dojnic a podmínky jejich chovu na jednotlivých farmách, sezonní vlivy jsou méně významné. Zastoupení jednotlivých mastných kyselin v mléčném tuku má úzký vztah k celkovému obsahu tuku v mléce, se vzrůstajícím obsahem tuku v mléce klesá zastoupení nenasycených mastných kyselin.

mléčný tuk; kyselina linolová; kyselina linolenová; kyselina olejová; dojnice; plynová chromatografie

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