Assesment of bovine milk fat quality from the view of human health

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Background

Nutritional value and composition of milk fat can be affected through the nutrition of dairy cows. E.g. It is possible to significantly reduce the content of saturated fatty acids (FA) in milk fat [1] or increase the content of the n-3 FA and conjugated linoleic acid that may help prevent cardiovascular disease. A targeted modification of the FA profile of milk fat can be used for the production of milk with higher added value. For evaluation of milk fat quality some indices (e.g. AI, TI, HPI or HH) have been proposed [2, 3, 4].

The aim of this study was to evaluate the quality of milk fat from the view of human health from cow´s milk under on-farm conditions.

Methods

The study was performed on individual milk samples collected from four dairy farms breeding Holstein cows. The diets used on those farms were based on maize silage, hay and supplemental mixtures containing rapeseed oil and cake (**Farm 1**), extruded full-fat soybean (**Farm 2**), rapeseed cake + extruded full-fat soybean (**Farm 3**) or flaxseed + soybean meal (**Farm 4**). Milk samples were taken from four representative average yielding cows per herd and were analysed on the content of FA in milk fat. Samples of feedstuffs were taken at the same time as milk samples and were analysed on the content of dry matter (DM) and basic nutrients. Based on the FA profile sums of SFA, MUFA, PUFA, n-3 and n-6 FA were calculated as well as following indices of milk fat quality:

- ***atherogenic index*** (AI): AI = (C12:0 + 4 x C14:0 + C16:0) / ΣUFA [2]
- ***thrombogenic index*** (TI): TI = (C14:0+C16:0+C18:0) / ((0.5 x ΣMUFA + 0.5 x Σ(n-6) + 3 x Σ(n-3)) + (Σ(n-3)/ Σ(n-6))) [2]
- ***health-promoting index*** (HPI): HPI = (ΣMUFA + ΣPUFA) / (C12:0 + 4 x C14:0 + C16:0) [3]
- ***hypocholesterolaemic / hypercholesterolaemic ratio*** (HH):

  HH = (C18:1 n-9 + C18:2 n-6 + C20:4 n-6 + C18:3 n-3 + C20:5 n-3 + C22:5 n-3 + C22:6 n-3) / (C14:0 + C16:0) [4]

Results

The content of SFA ranged from 61.29 (Farm 1) to 68.36 g/100 g FA (Farm 3). The highest content of MUFA was in milk from Farm 1 (34.71 g/100 g FA) and lowest in milk from Farm 3 (27.59 g/100 g FA). The content of PUFA was similar in Farms 1 and 3 and higher in Farms 2 and 4. AI ranged from 1.89 (Farm 1) to 2.77 (Farm 3). TI were similar in Farms 1, 2 and 4 ranging between 2.36 and 2.58 and it was high in Farm 3 being 3.56. The highest HPI was found in milk in Farm 1 and the lowest in Farm 3. HH index was high in Farms 1 and 2 being 0.93 and 0.84, respectively and low in Farms 3 and 4 (0.53 and 0.59, respectively).

FA	Farm 1	Farm 2	Farm 3	Farm 4
SFA (g/100 g FA)	61.29	62.32	68.36	64.87
MUFA (g/100 g FA)	34.71	32.14	27.59	30.28
PUFA (g/100 g FA)	4.00	5.54	4.05	4.85
Atherogenic index (AI)	1.89	2.07	2.77	2.35
Thrombogenic index (TI)	2.36	2.36	3.56	2.58
Health-promoting index (HPI)	0.53	0.49	0.36	0.43
Hypocholesterolaemic/ Hypercholesterolaemic ratio (HH)	0.93	0.84	0.53	0.59

Conclusion

Using indices for evaluation of milk fat quality allows us deeper insight into the impact of FA on human health. Results of our study showed that health properties of milk fat differed among farms. That dairy nutrition contributed greatly on the variability in milk FA profile.

References

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