WARSAW UNIVERSITY OF LIFE SCIENCES

The use of thermal and chromatographic methods in the assessment of fat isolated from micellar casein

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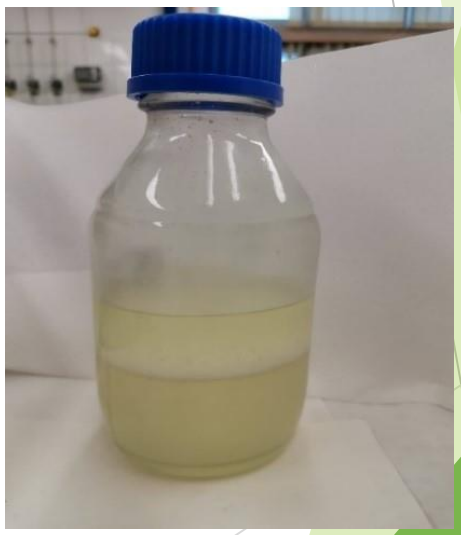
The aim of the study was to analyze the fat extracted from natural and two flavored casein. Casein is the main protein in milk. It is made of structures called micelles. Pure casein is obtained through technological processes and contains a small amount of fat that has not been characterized yet.

	Manufacturer's declaration	Extracted fat
KN	1,1 g	1,0±0,1 g
KS_1	4,5 g	4,3±0,1 g
KS_2	1,4 g	1,3±0,1 g

KN – natural casein,
KS_1 - flavored casein 1,
KS_2 - flavored casein 2

Micellar casein



Casein during fat extraction (Folch's method)

The fatty acid profile of the separated fats was determined using gas chromatography (YL6100 GC). 20 fatty acids were found and their content was compared with the literature data of milk fat. The analysis showed that the tested fat was dominated by saturated fatty acids, of which palmitic acid had the highest content - 31.93%. The obtained results for all three tested caseins were comparable to each other, no significant differences were noticed when comparing them to milk fat.

Fatty acid	1	2	3	KN	KS1	KS2
(C10:0)	3,26	2,31	3,95	3,36 ± 0,65	2,25 ± 0,21	2,45 ± 1,01
(C12:0)	4,00	3,13	4,38	4,46 ± 0,86	3,10 ± 0,28	3,18 ± 1,05
(C14:0)	12,25	11,76	13,55	12,76 ± 1,15	10,90 ± 0,57	10,90 ± 2,23
(C14:1)	1,03	0,49	1,09	1,16 ± 0,09	0,85 ± 0,07	0,93 ± 0,22
(C15:0)	1,27	1,74	1,28	1,46 ± 0,05	1,40 ± 0,00	1,43 ± 0,13
(C15:1)	-	0,38	-	0,30 ± 0,00	0,40 ± 0,00	0,40 ± 0,00
(C16:0)	33,71	30,92	34,47	33,5 ± 1,09	30,90 ± 0,14	31,40 ± 1,22
(C16:1)	1,29	-	0,30	2,22 ± 0,04	1,90 ± 0,00	2,00 ± 0,00
(C17:0)	0,58	0,88	0,44	0,64 ± 0,05	0,80 ± 0,00	0,78 ± 0,05
(C17:1)	0,37	0,35	0,24	0,26 ± 0,05	0,35 ± 0,07	0,38 ± 0,05
(C18:0)	11,05	11,61	8,71	9,64 ± 1,18	13,90 ± 0,57	11,93 ± 1,28
(C18:1 n-9t)	1,01	2,05	-	0,92 ± 0,61	2,00 ± 0,00	1,78 ± 0,53
(C18:1 n-9c)	19,51	19,10	17,29	18,84 ± 1,88	22,45 ± 0,64	22,63 ± 3,75
(C18:2 n-6c)	2,08	-	1,30	3,46 ± 0,25	3,00 ± 0,14	3,50 ± 1,07
(C18:3 n-3)	0,60	-	0,50	0,40 ± 0,00	0,80 ± 0,00	0,75 ± 0,13
(C20:0)	0,17	0,14	0,13	0,48 ± 0,04	1,15 ± 0,07	0,93 ± 0,25

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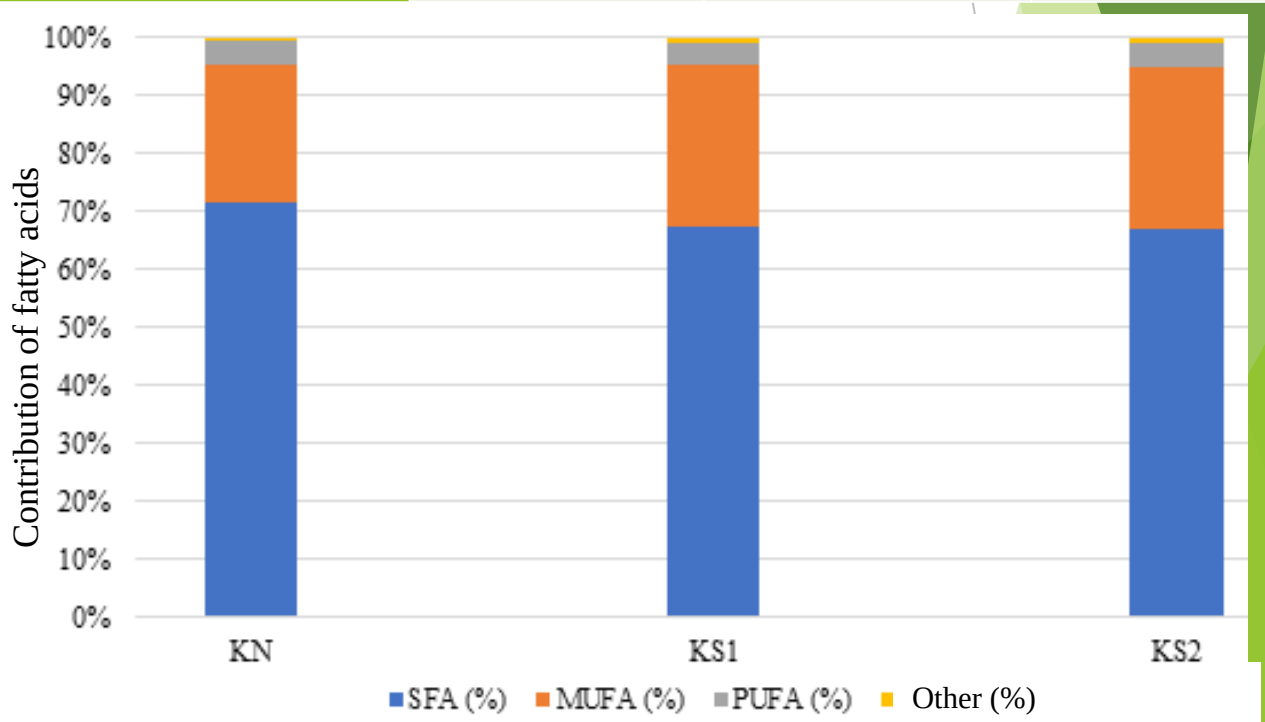
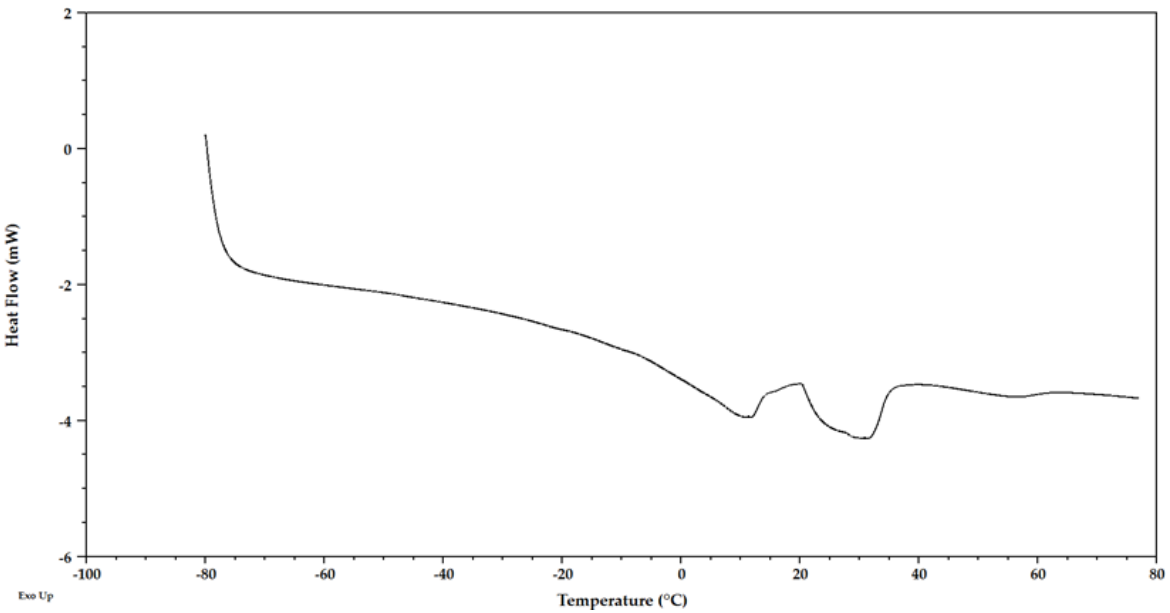
2. Barłowska J., Litwińczuk Z., Domaradzki P., Pastuszka R., Wójcik-Saganek A. **2016**: Wpływ sezonu na skład chemiczny i profil kwasów tłuszczowych mleka krowiego i koziego produkowanego w gospodarstwach ekologicznych. *Żywność. Nauka. Technologia. Jakość*, 1 (104), 45-56
3. Bonczar G., Pustkowiak H., Domagała J., Najgebauer-Lejko D., Sady M., Walczycka M., Wszołek M. **2016**: Zawartość cholesterolu i profil kwasów tłuszczowych w śmietance i śmietanie z mleka trzech ras krów. *Żywność. Nauka. Technologia. Jakość*, 2 (105), 81-94

The melting profiles of fat were analyzed by DSC technique (DSC-Q200) and it was found that an endothermic transition had occurred.

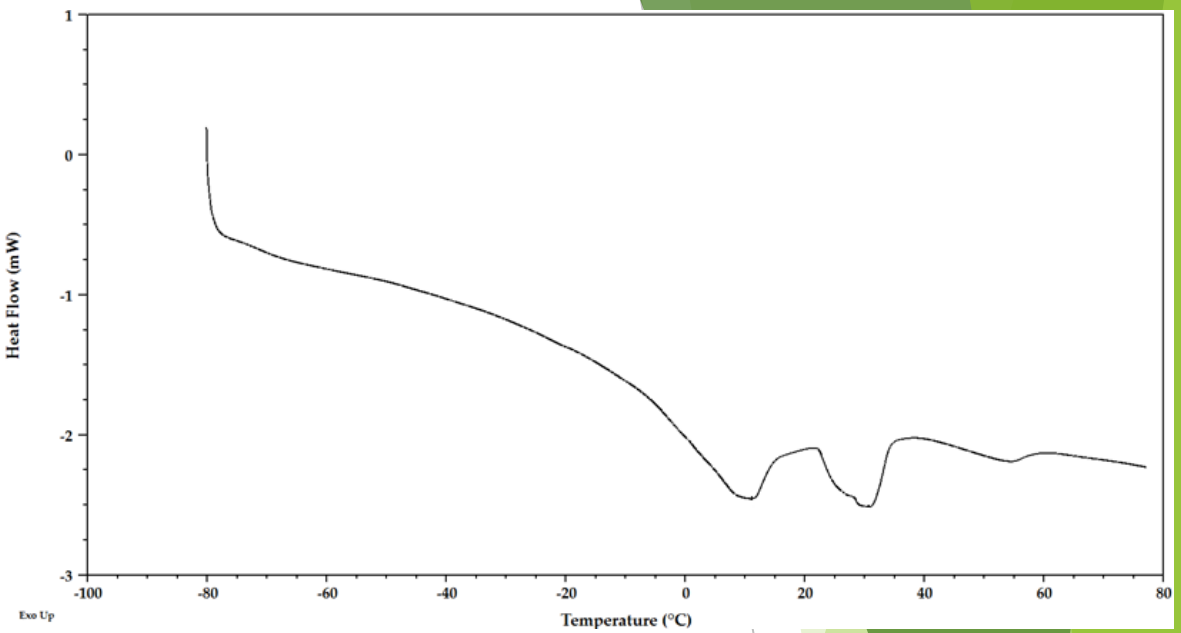
Differences in the number of endothermic peaks were noticed comparing the tested fat to milk fat. The fat from the casein contained two endothermic peaks for the medium-melting and high-melting fractions, while there was also an endothermic peak in the milk fat for the low-melting fraction.

	KN	KS_1	KS_2
max. peak 1 (°C)	11,43 ± 0,25	11, 48 ± 0,22	11,56 ± 0,21
max. Peak 2 (°C)	31,05 ± 0,06	30,97 ± 0,11	30,67 ± 0,19
enthalpy peak 1 (J/g)	5,48 ± 1,27	6,14 ± 0,94	6,87 ± 1,22
enthalpy peak 2 (J/g)	13,40 ± 1,04	7,54 ± 1,01	6,30 ± 1,35

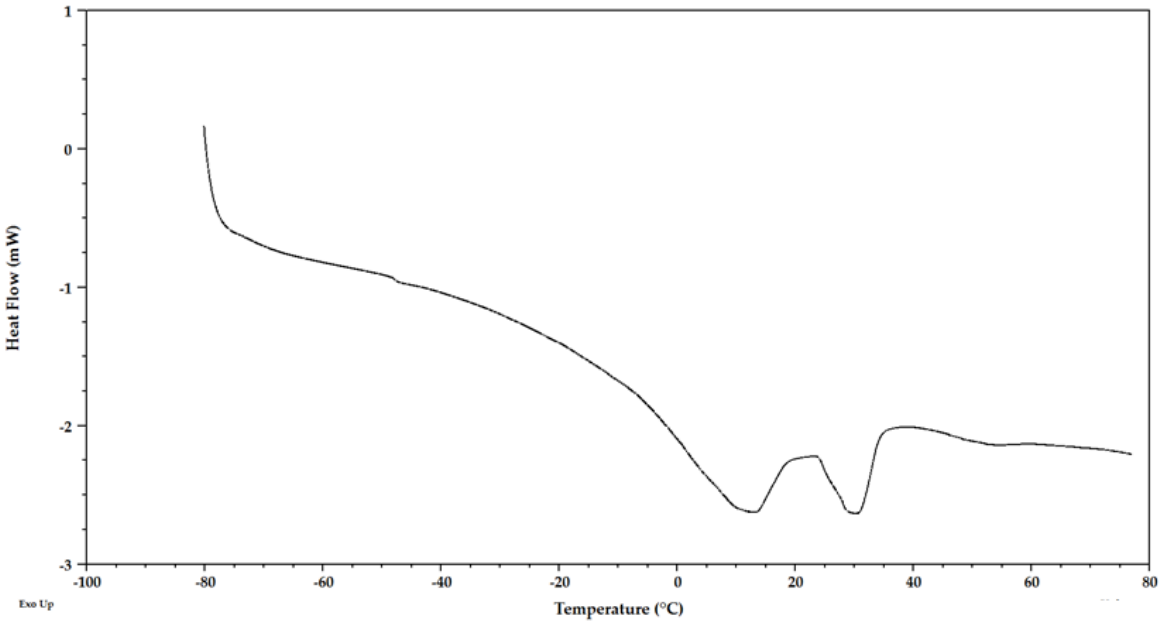




DSC melting profile of KN.



DSC melting profile of KS_1.



DSC melting profile of KS_2.

Conclusions

- The tested caseins were characterized by a high content of saturated fatty acids. Palmitic acid (31.93%), stearic acid (11.82%) and myristic acid (11.52%) had the highest average content.
- No significant differences were found comparing the MUFA / PUFA, MUFA / SFA and PUFA / SFA ratios of the fat extracted from caseins.
- Oleic acid had the highest avarage content (21%) among the unsaturated fatty acid.
- The fat of the flavored caseins contains a comparable ratio of omega-6 to omega-3 to the literature results.
- The melting profiles of casein fats show two endothermic peaks in the temperature range for the medium-melting fraction (predominance of monounsaturated fatty acids) and the high-melting fraction (predominance of saturated fatty acids). The lack of the low-melting fraction may be due to the presence of insignificant amount of polyunsaturated fatty acids or the overlapping of peaks.
- The melting of casein fats is an endothermic process. In natural casein, more energy was supplied to melt the high-melting fraction, which proves its greater content. In the case of the flavored caseins, the amount of medium-melting and high-melting fractions was comparable.