Qualitative characteristics of fat fraction of oats based products

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Introduction

Cereal products are an important part of the human diet. Oatmeal products are often chosen by people leading a healthy lifestyle for their health-promoting properties. The chemical composition of oats and the health-promoting nutrients present in it contribute to the increasing use of this grain in food production. Oats and oats products are characterized by a higher content of fat with a favorable fatty acid composition compared to other cereals. Fat both in products containing large amounts of this ingredient and in products characterized by a low level of lipids, undergoes many changes in natural conditions and during technological processes. These processes can lead to the formation of diacylglycerols, monoacylglycerols and free fatty acids. The acids released as a result of hydrolysis may undergo further secondary changes of oxidative nature. This seems to be an important problem and should be monitored, as such processes often limit or even prevent the use and further storage of food products.

Taking the above into consideration, the purpose of the study was qualitative characteristics of fat fraction isolated from oats products.

Materials and methods

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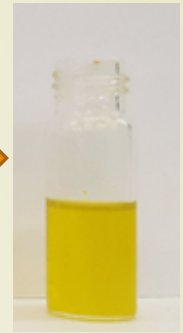
The research material consisted of fat samples isolated from oats based products, such as: whole grain oatmeal, mountain oatmeal and instant oatmeal, which were purchased at a local store.

whole grain oatmeal

mountain oatmeal

instant oatmeal



- The samples of oatmeal were ground and extracted with hexane by shaking for 30 min. Then, the mixture was filtered and the solvent was evaporated. The residue of hexane was dried under nitrogen. Obtained oil was intended for further research, such as:
  - the composition of fatty acids by gas chromatography;
  - distribution of fatty acids in the internal and external positions of triacylglycerols by the method based on the ability of the pancreatic lipase to selectively hydrolyze ester bonds in the *sn-1,3* positions;
  - the oxidative stability of the tested fat by pressure differential scanning calorimetry;
  - melting characteristics of the analyzed fat by differential scanning calorimetry.

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Results

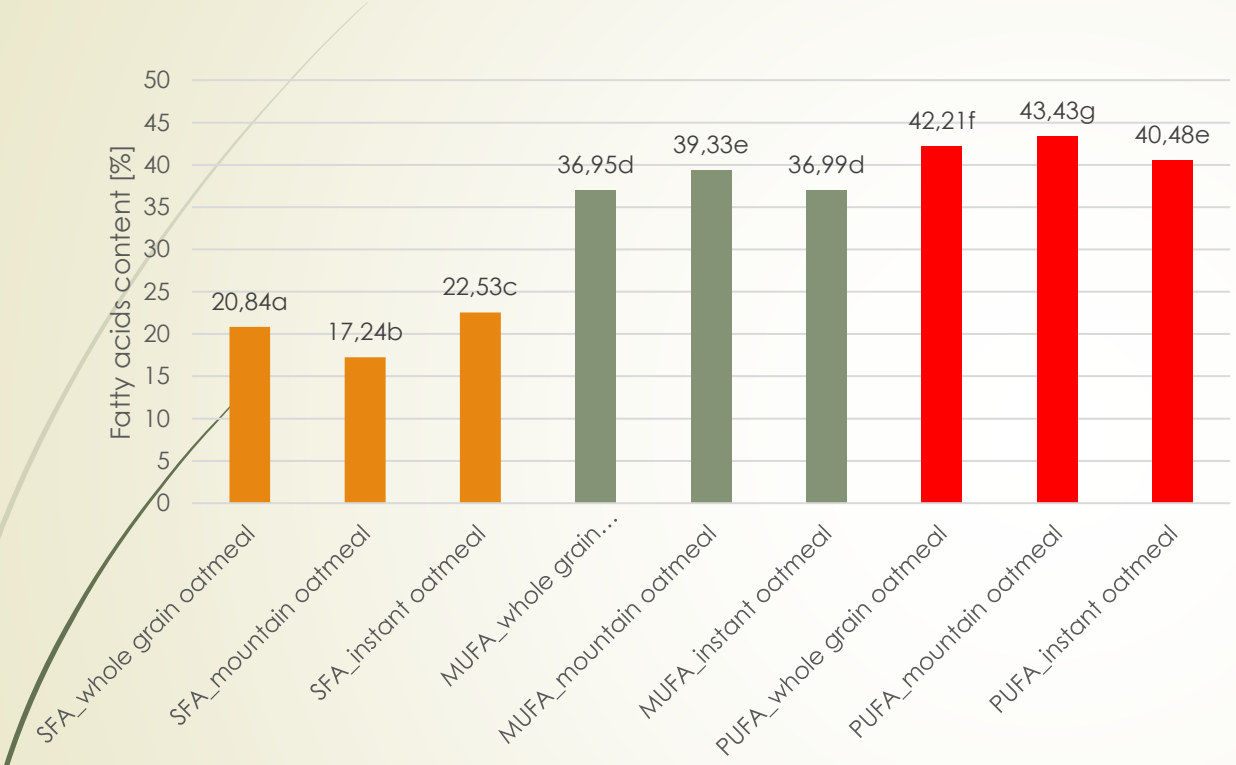

Figure 1. Content of fatty acids groups in fat isolated from oats based products
(SFA – saturated fatty acids; MUFA – monounsaturated fatty acids;
PUFA – polyunsaturated fatty acids).

The results shown in Figure 1 present the content of saturated, mono- and polyunsaturated fatty acids. Fat isolated from mountain oatmeal turned out to be the richest source of unsaturated fatty acids (82,76%) with high content of mono- and polyunsaturated fatty acids. In fat extracted from instant oatmeal the highest content of saturated fatty acids (22.53%) was determined in comparison to other studied samples. The fat was also characterised by the lowest content of unsaturated fatty acids.

Results

Table 1. Composition of chosen fatty acids in *sn-2* and *sn-1,3* positions of triacylglycerols in fat extracted from whole grain oatmeal and a share of fatty acids in internal position.

Fatty acid	Fatty acid composition in TAG [%]	Fatty acid composition in positions		Fatty acid share in sn-2 position [%]
		sn-2	*sn-1,3*	
C 16:0	18.02	3.41	25.33	6.30
C 18:0	1.87	0.51	2.56	9.00
C 18:1 n-9	35.12	48.59	28.39	46.12
C 18:2 n-6	39.83	44.73	37.39	37.44
C 18:3 n-3	1.71	1.66	1.73	32.36

Table 2. Composition of chosen fatty acids in *sn-2* and *sn-1,3* positions of triacylglycerols in fat extracted from mountain oatmeal and a share of fatty acids in internal position

Fatty acid	Fatty acid composition in TAG [%]	Fatty acid composition in positions		Fatty acid share in sn-2 position [%]
		sn-2	*sn-1,3*	
C 16:0	16.13	4.14	22.12	8.56
C 18:0	1.28	0.67	1.59	17.33
C 18:1 n-9	37.57	48.28	32.23	42.83
C 18:2 n-6	41.57	44.08	40.32	35.35
C 18:3 n-3	0.61	1.57	0.13	35.51

Table 3. Composition of chosen fatty acids in *sn-2* and *sn-1,3* positions of triacylglycerols in fat extracted from instant oatmeal and a share of fatty acids in internal position.

Fatty acid	Fatty acid composition in TAG [%]	Fatty acid composition in positions		Fatty acid share in sn-2 position [%]
		sn-2	sn-1,3	
C 16:0	18.81	4.45	25.99	7.88
C 18:0	2.27	0.81	3.00	11.85
C 18:1 n-9	35.32	48.11	28.93	45.41
C 18:2 n-6	38.35	43.64	35.71	37.94
C 18:3 n-3	1.49	1.46	1.51	32.66

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Results

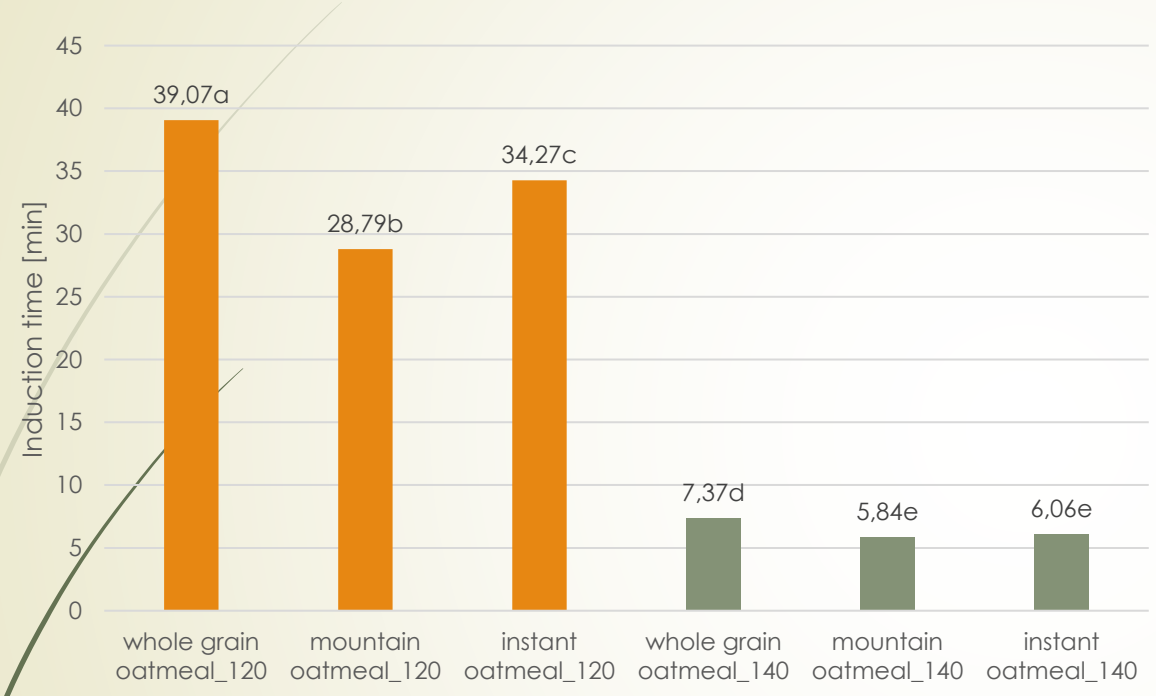

Figure 2. Induction time of oxidation [min] of fat isolated from oats based products measured at 120°C and 140°C.

Time of induction of fat oxidation is presented in Figure 2. When analysing the obtained results it can be observed that fat isolated from whole grain oatmeal is of highest stability with time of oxidation reaching 39.07 min. and 7.37 min at 120°C and 140°C, respectively. Fat extracted from mountain oatmeal turned out to be of lowest oxidative stability. In the case of fat from mountain oatmeal the induction time of oxidation reached the value of 28.79 min. at 120°C and 5.84 min. at 140°C.

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Results

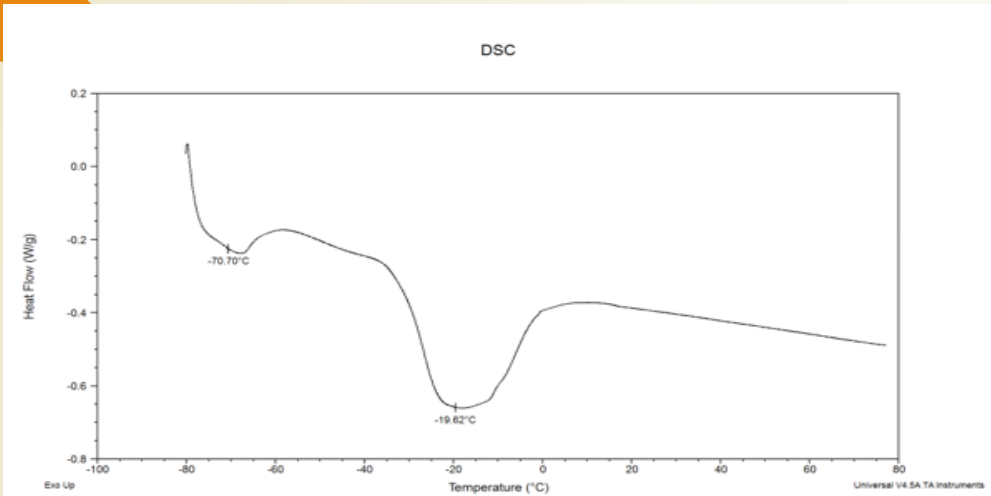

Figure 3a. DSC curve of melting of fat isolated from whole grain oatmeal

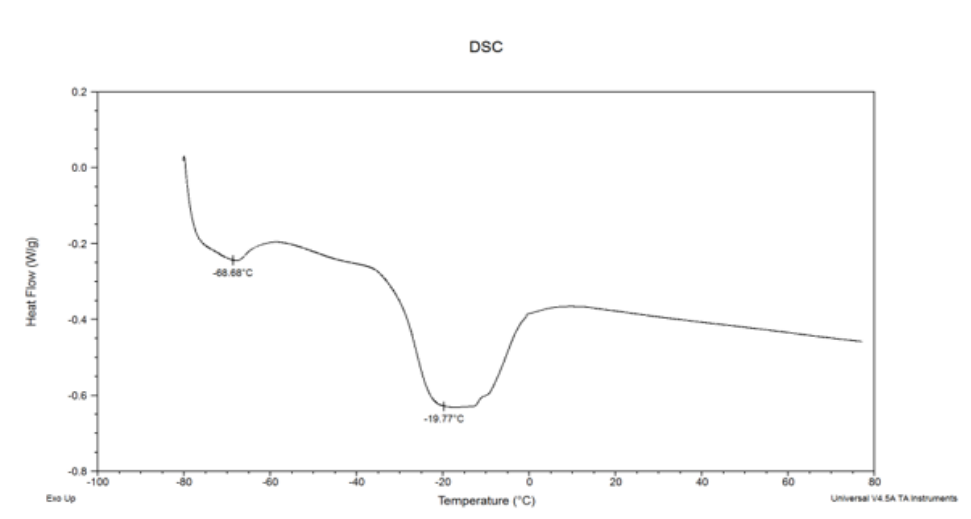

Figure 3b. DSC curve of melting of fat isolated from mountain oatmeal

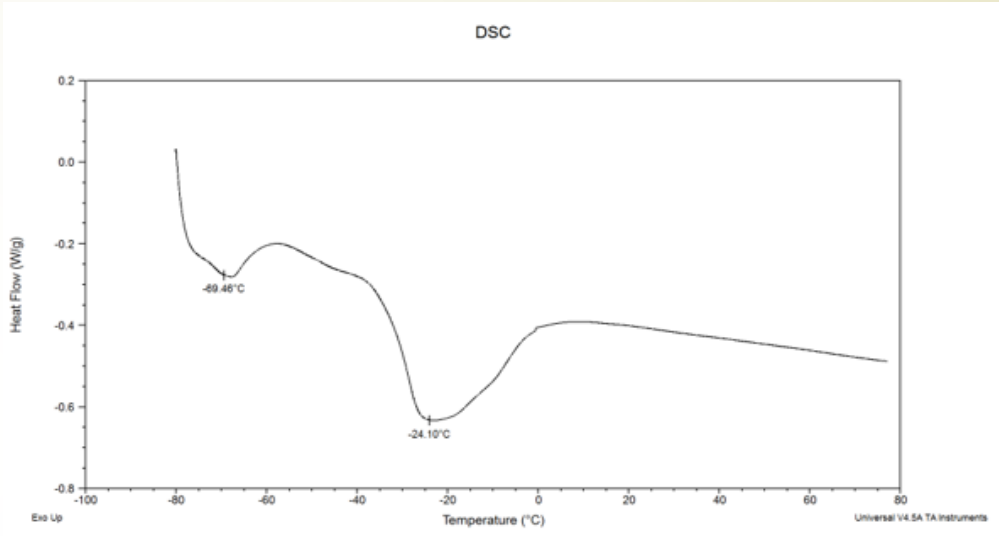

Figure 3c. DSC curve of melting of fat isolated from instant oatmeal

In the course of curve two endothermic transitions can be observed. The first mild peak was detected in the region from -70.70°C in the case of fat isolated from whole grain oatmeal to - 68.68°C for fat from mountain oatmeal. The second intensive event can be observed at temperature reaching -19.62°C for whole grain oatmeal, -19.77°C for mountain oatmeal and -24.10°C for instant oatmeal.

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Conclusions

- fat isolated from the examined oat products is a rich source of unsaturated fatty acids with high share of oleic acid in *sn-2* position of triacylglycerols,
- fat isolated from oats based products is characterised by similar oxidative stability to extra virgin oil and huzelnut oil, but it is much less stable than rapeseed oil,
- in the course of the melting curves of fat, two distinct endothermic peaks are the evidence of the presence of low-melting triacylglycerols containing mainly unsaturated fatty acids.

Thank You very much for Your attention