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*Content of Fatty Acids in Reserve and Tissue Fat of Red-Deer
(Cervus elaphus) and Roe-Deer (Capreolus capreolus)
Obtained in Central-Eastern Poland*

Skład kwasów tłuszczowych w tłuszczu zapasowym i tkankowym jeleni (*Cervus elaphus*) i saren
(*Capreolus capreolus*) pozyskanych w makroregionie Polski środkowowschodniej

Polyunsaturated fatty acids are considered to be responsible for the regulation of cholesterol transformations, which is one of the factors of circulatory system diseases. Monounsaturated fatty acids are especially valuable in view of the latest studies (6). Among animal products, wild-animals meat can be accepted not only as delicious, but also of nutritional values, which makes it safe for humans health. It is true both for wild-animals meat from farms and from hunting.

Results of analyses of fatty acids composition of lipid fraction from *musculus longissimus dorsi* and reserve fat of red-deer (*Cervus elaphus*) and roe-deer (*Capreolus capreolus*) obtained in middle-eastern Poland, are presented in the research.

MATERIAL AND METHODS

The study material was sampled from red-deer (n=46) and roe-deer (n=38) carcasses in 1997/1998 hunting season in middle-eastern Poland. The composition and content of fatty acids regarding saturated and unsaturated (monounsaturated and polyunsaturated) ones were recorded in *musculus longissimus dorsi*, and samples of reserve fat were taken from kidney fat. Fatty acids analyses were made using gas chromatograph Unicam 610.

The results were statistically worked out applying variance analysis according to the least squares (2). Significance of differences marked in tables in column Fat refers to differences of fatty acids

content in reserve fat between the species, and in column Species – to differences between tissue fat of red-deer and roe-deer. The results were listed in tables giving mean values of the least squares (LSM) and their standard errors (SE).

RESULTS AND DISCUSSION

In a group of saturated acids, regardless of the animal species and fat type, palmitic (C16:0) and stearic acid (C18:0) contents were the highest; their amounts ranged from 18.68% in roe-deers kidney fat to 27.78% red-deers kidney fat (Table 1). Statistically significant differences ($P \leq 0.01$) of fatty acids were found between

Table 1. Percentage of saturated fatty acids (%) in reserve (kidney) and tissue (*musculus longissimus dorsi*) fat for red-deer and roe-deer obtained in central-eastern Poland

Fatty acids	Roe-deer				Red-deer				Difference significance	
	tissue fat		reserve fat		tissue fat		reserve fat			
	LSM	SE	LSM	SE	LSM	SE	LSM	SE	species	fat
Capric C _{10:0}	0.12	0.01	0.03	0.01	0.04	0.01	0.07	0.01		xx
Lauric C _{12:0}	0.01	0.06	0.13	0.05	0.01	0.06	0.32	0.03		xx
Tridecanoic C _{13:0}	0.05	0.02	0.05	0.02	0.07	0.02	0.12	0.01		
Myristic C _{14:0}	1.06	0.70	3.57	0.55	1.56	0.73	5.64	0.37		xx
Pentadecanoic C _{15:0}	0.45	0.14	1.24	0.11	1.19	0.15	1.21	0.08		xx
Palmitic C _{16:0}	23.18	1.09	18.68	0.86	21.98	1.14	21.82	0.58		xx
Heptadecanoic C _{17:0}	1.04	0.20	2.31	0.16	1.46	0.21	1.96	0.11		xx
Stearic C _{18:0}	24.47	1.30	29.31	1.03	18.72	1.36	27.78	0.69	x	xx
Nonadecanoic C _{19:0}	0.44	0.06	0.40	0.05	0.01	0.06	0.35	0.03	xx	xx
Arachidic C _{20:0}	0.45	0.07	0.38	0.06	0.26	0.07	0.33	0.04	xx	
Total	52.12	1.70	59.53	1.52	43.44	1.77	57.24	1.03	x	xx

tissue and reserve fat, except for tridecanoic (C13:0) and arachidic (C20:0) acids. Intra-species differences as regards fatty acids were found for acids with longer carbon chains, i.e. for stearic (C18:0) ($P \leq 0.05$) as well as nonadecanoic (C19:0) and arachidic (C20:0) acids ($P \leq 0.01$). In all the three cases, higher contents of these acids were found in roe-deer tissues.

Table 2. Percentage of unsaturated fatty acids (%) in reserve (kidney) and tissue (*musculus longissimus dorsi*) fat for red-deer and roe-deer obtained in central-eastern Poland

Fatty acids	Roe-deer				Red-deer				Difference significance	
	tissue fat		reserve fat		tissue fat		reserve fat			
	LSM	SE	LSM	SE	LSM	SE	LSM	SE	Species	Fat
Laurenic C _{12:1}	0.50	0.01	0.03	0.01	0.01	0.01	0.06	0.01	xx	xx
Dodecadienic C _{12:2}	0.04	0.04	0.14	0.03	0.10	0.04	0.17	0.02	x	xx
Myristoleic C _{14:1}	0.61	0.28	1.21	0.22	2.15	0.29	1.38	0.15	xx	
Tetradecadienic C _{14:2}	0.53	0.06	0.69	0.05	0.56	0.06	0.48	0.03	x	
Palmitoleic C _{16:1}	1.78	0.75	4.33	0.67	4.22	0.78	3.47	0.45		x
Palmitolinoleic C _{16:2}	0.61	0.15	0.59	0.13	1.33	0.15	0.72	0.09	x	xx
Oleic C _{18:1}	31.55	1.50	24.18	1.35	26.76	1.57	27.55	0.91		xx
Linoleic C _{18:2}	2.86	0.41	4.10	0.37	2.14	0.43	4.67	0.25		xx
Linolenic C _{18:3}	4.88	0.55	2.80	0.49	4.96	0.57	2.82	0.33		xx
Eicosenic C _{20:1}	0.55	0.22	0.65	0.20	0.06	0.23	0.70	0.13		xx
Eicosodienic C _{20:2}	0.17	0.19	0.36	0.17	0.04	0.20	0.52	0.11		xx
Arachidonic C _{20:4}	1.31	0.83	0.26	0.75	11.11	0.86	0.32	0.50	xx	xx
Timnodonic C _{20:5}	1.89	0.36	0.35	0.32	2.64	0.37	0.24	0.22		xx
Cervonic C _{22:6}	0.65	0.20	0.13	0.18	0.72	0.21	0.08	0.12		xx
Total	47.88	1.67	40.46	1.53	56.46	1.77	42.76	1.03	x	xx
Monounsaturated	34.87	1.83	30.96	1.64	33.19	1.90	32.75	1.11		x
Polyunsaturated	13.01	1.54	9.51	1.39	23.27	1.61	10.00	0.93	x	xx

xx - Significant differences between species and fat for "x" - $P \leq 0.05$
for "xx" - $P \leq 0.01$.

Palanska *et al.* obtained similar results comparing the fatty acids content in tissue fat of red-deer and roe-deer that live freely (5).

Among unsaturated acids, oleic acid amounts were the highest both in red-deer and roe-deer regardless of the fat type (Table 2). Its content ranged from 24.18% in roe-deer kidney fat to 31.55% in roe-deer tissue fat. Significant differences of polyunsaturated fatty acid C20:4 that amounted to 11.11% in tissue fat of red-deer were recorded, while in roe-deer it amounted to 1.31% (statistically significant difference at $P \leq 0.01$). A similar situation was observed for myristoleic acid (C14:1), whose amounts in red-deer and roe-deer were analyzed as 2.15% and 0.61%, respectively. Differences appeared to be similar to the above ($P \leq 0.01$). Totally, more unsaturated fatty acids were found in red-deer (56.46% of tissue fat and 42.75% of reserve fat) as compared to roe-deer (47.88% of tissue fat and 40.46% of reserve fat), and the differences were statistically confirmed ($P \leq 0.05$).

When analyzing the unsaturated fatty acids content depending on the saturation degree, it was found that more polyunsaturated acids were in red-deer tissue fat than in roe-deer (23.27% and 13.01%, respectively) and the difference was statistically significant ($P \leq 0.05$). The content of polyunsaturated fatty acids in reserve fat did not differentiate the species under study reaching the levels of 9.51% for roe-deer and 10.00% for red-deer. Monounsaturated acids content was similar in both species, but their higher content was recorded in tissue fat.

Comparisons of the results with similar ones for farm livestock (1, 4) show great similarity of tissue fat composition of red-deer and cattle, sheep and goats. However, special attention should be paid to the content of fatty acids in lipid fraction of muscle tissue in red-deer and roe-deer, which is characterized by high percentage of necessary unsaturated fatty acids (NNKW): linoleic C18:2 and linolenic C18:3. It is very important from nutritional point of view (3).

CONCLUSIONS

1. Roe-deer are characterized by higher percentage of saturated fatty acids both in tissue and reserve fat.
2. Fatty acids composition in red-deer tissue fat is characterized by higher share of polyunsaturated fatty acids as compared to roe-deer.
3. Fatty acids profile, high percentage of unsaturated fatty acids allow to qualify the wild-animal meat from red-deer and roe-deer as that of great nutritional value.

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STRESZCZENIE

Przedstawione zostały wyniki analizy składu kwasów tłuszczowych w tłuszczu tkankowym *musculus longissimus dorsi* i tłuszczu okołonerkowym jeleni (*Cervus elaphus*) i saren (*Capreolus capreolus*) pozyskanych w makroregionie środkowowschodniej Polski.

W grupie kwasów nienasyconych bez względu na gatunek i rodzaj tłuszczu najwięcej było kwasu palmitynowego ($C_{16:0}$) i stearynowego ($C_{18:0}$), a ilość każdego z nich wahała się od 18,65 do 29,31%. Kwasy nasycone w całości kwasów tłuszczowych określonych w tłuszczu tkankowym stanowiły 52,12% i 43,44% odpowiednio u saren i jeleni, a w tłuszczu zapasowym 59,53% oraz 57,24%. W grupie kwasów nienasyconych stwierdzono znaczny udział kwasów 1-nienasyconych, których ilość w całości kwasów tłuszczowych wahała się od 30,96% do 34,87%. Kwasy wielonienasycone stanowiły 9-13% ogółu kwasów, wyjątkowo w tłuszczu tkankowym jeleni ilość omawianych kwasów osiągnęła wartość 23,27%.

Szczegółowa analiza statystyczna uzyskanych wyników pozwala na stwierdzenie, że gatunek był czynnikiem różnicującym ilość kwasów tłuszczowych, przy czym wśród kwasów nienasyconych dotyczyło to jedynie kwasów wielonienasyconych.