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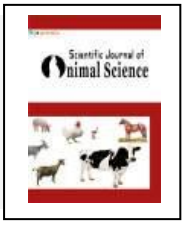

Original article

Comparative study of fatty acid composition of meat material from various animal species

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ABSTRACT

Fatty acid composition of lipid components as a part of recipes of meat products has been investigated. Factors influencing the results of analytical determination of individual fatty acids are shown. The main ratios of fatty acid composition describing fats of sheep, sow, boar, cow, turkey, horse, chicken, pheasant, and wild boar are presented, allowing their use in manufacture of modern meat products with variable nutrition value.

1. Introduction

The role of fat in human nutrition is well known (Valsta, Tapanainen & Männistö, 2005). Recent trends are related to the appearance of new meat products being complex nutritional compositions with specific ingredients. Now we can speak about novel food mixtures with a variety of useful additives extending the functional properties of meat-based products instead of traditional meat products based on one or two meat components (Saadoun & Cabrera, 2008).

Many diseases, particularly age-related diseases, are directly associated with the diet. The role of fat in this respect is dominant. Fat composition is very important when we characterize the nutritional value of a particular product. It is recognized that the pork fat, vegetable oil, butter, beef fat, and sheep fat are absorbed during digestion by 96–98 %, 95–99 %, 93–99 %, 80–94 %, and 80–90 %, respectively (Ivankin, 2007). It is generally accepted that a human should consume 10–20 % of polyunsaturated fatty acids, 50–60 % of monounsaturated fatty acids, and 30% of saturated C_{6-24} fatty acids. Such a balanced diet should contain approximately 1/3 of vegetable oils and 2/3 of animal fats (British Nutrition Foundation, 1992, Shilina & Kon, 2004, Lisitsyn & Shumkova,

2002). For elderly people the content of linoleic acid should be appr. 40% and that of linolenic acid, 4%, while the ratio of polyunsaturated (PUFA) and saturated (SFA) acids should be 2:1 (German et al., 2002, Lisitsyn et al., 2004, Neklyudov & Ivankin, 2002).

Recently, scientists from European countries conduct intensive researches showing so-called favorable ratio of ω6/ω3 (n6/n3) unsaturated fatty acids, in addition to the above-mentioned criteria (ICoMST 46–53, 1999 – 2007). In modern classification, number of C-atoms from the end of fatty acid to the nearest double bond can attribute this fatty acid to n-3, n-6, n-7, or n-9 family and so on, while the high proportion of n-3 acids in diet helps to prevent certain diseases, particularly cancer. Japanese consuming a lot of seafood high in n-3fatty acids, are not only long-livers, but also they are less susceptive to diseases in old age (Rozantsev, 2006). Recently, the world's scientific literature pays much attention to the content of fatty acids in animal raw material of various origin. The fatty acid profile of hind leg muscle in female and male nutria fed with green forage diet was examined. The authors showed that the composition of forage influence on changing the ratio of n6:n3 fatty acids. For example, lower ratis of n6:n3 fatty acids (2.6–3.0) were found in muscle tissue of nutria legs when giving animals a special diet, compared to the usual level (16.8–28.9). The results obtained suggest economical way to improve the fatty acid composition of meat (Głogowski et al., 2010). The authors showed influence of the slaughter season (October–June) on intramuscular veal fat composition, particularly that of linoleic acid isomers content (Alfaia, et al., 2007). The fatty acid and tocopherol composition of *M. longissimus dorsi* of male, castrated male and female pigs was examined. There were no differences in the total fat content of animals grown in similar conditions. The levels of n-6 highly unsaturated fatty acids (HUFA) were higher in male and female compared to castrated male pigs. The level of n-3 polyunsaturated fatty acids (PUFA) in the muscles of males was a little higher compared to female and castrated male animals. There were also some differences in the content of 18:2 n-6 fatty acids between indoor and outdoor animals (Högberg, Pickova, Stern & Bylund, 2004). Gas chromatography analysis of the basic fatty acids content, PUFA:SFA ratio, and n-6:n-3 ratio of different raw materials: goat fat (Coltro, et al., 2005), European sheep fat (Diaz et al., 2005), ewe fat (Oriani et al., 2005), veal fat (Costa, et al., 2006), lamb fat (Demirel, Ozpinar, Nazli, B. & Keser, 2006) were carried out. The chemical structure of edible animal fats represents mainly a mixture of triglycerides with the general formula $ROCH_2CH(OR)CH_2OR$, where R is fatty acid residue. Chromatographic analysis of R-fatty acids content can estimate the origin and quality of fat (Rudacov, Ponomarev & Lubar, 2005, Lisitsyn, Ivankin & Neklyudov, 2002, Kates, 1972).

2. Materials and methods

2.1. Animals and sampling

The objects of study represented samples of *M. longissimus dorsi* with the weight of (5.0 ± 0.5) g taken from the adult female sheep, pigs, cows, turkeys, horses and chickens by the age of 12 months, and pheasant as well as from boar and wild boar. Feeding of animals was carried out using standard feeds, mainly grains, used in the southern regions of Russia. The average sample was selected from the meat samples of 10 domestic animals or 2 wild animals. The chemical composition of muscle tissue samples was (%): water 67.0 – 71.0, protein 18.0 – 22.0, ash 1.0 – 1.1, basic carbohydrates 2.5 – 4.5, fat 1.0 – 4.0. Moisture, ash, and protein contents were determined as described by AOAC (1990). Carbohydrates were determined by spectrophotometry with anthrone (Lisitsyn, Ivankin & Neklyudov, 2002).

Lipids were extracted from muscle tissues by the method described by Folch, Lees, and Stanley (1957). Meat samples (5.0 ± 0.1) g were homogenized with 50 ml of chloroform-methanol (1:1, v/v) solution for 2 hours. After blending, 30 ml of chloroform and 30 ml of deionized water HPLC were added, and the mixture was homogenized. Then, NaCl aqueous solution at 1.0 % (m/v) was added to the homogenate to separate the lipid-containing chloroform layer from the methanol-water phase. The lipid extract was transferred to a 200-ml flask and the solvent was evaporated under nitrogen stream. The lipid content was then gravimetrically determined. For comparison with milk lipids, (20.0 ± 0.1) ml of cow milk were mixed with 50 ml of chloroform-methanol (1:1, v / v) and then extracted as described above.

2.2. Saponification of fatty acid and analysis

To ensure the entire determination of all fatty acids contained in the lipid fraction by the gas-chromatographic analysis, the samples of isolated lipids were subjected to methylation by the modified method of ISO 5509 (1978).

To do so, 0.01 g of lipids in a mixture with 3 ml of 15% acetyl chloride solution in methanol were boiled at 100°C for 2 hours with subsequent neutralization of the reaction mixture by adding 1.25 ml of KOH saturated solution in CH_3OH to achieve pH 5.0–6.0. Then 3 ml of saturated aqueous NaCl solution and 3 ml of hexane were added in the mixture, stirred and defecated for 30 minutes. After that 0.2 µl of solution from clear hexane layer containing fatty acid methyl esters (FAME) was taken for analysis.

Fatty acid methyl esters (FAME) were analyzed using a HP6890 Hewlett-Packard (USA) gas chromatograph equipped with FID flame ionization detector and silica capillary column HP-Innowax 30mx0,32mmx0,5mkm, and nitrogen was used as a carrier gas. Column temperature was programmed from 100 to 260°C at 10 $^{o}C \cdot min^{-1}$.The injection port and detector were maintained at 250 and 300°C, respectively. Hydrogen at 35 $ml \cdot min^{-1}$ was used as a carrier gas and nitrogen at 20 $ml \cdot min^{-1}$ was used as the make up gas in split mode 1:100. Identification of normal fatty acids was carried out comparing sample FAME peak relative retention times with those obtained for Supelco Cat. № 47885U (USA) standards. The peak areas were determined by Winpeak integrated program (Germany). Identification and quantification were determined against external standard C_6 – C_{24} fatty acids. Data were calculated as normalized area percentages of fatty acids. Chromatographic peaks were identified by comparison of the retention times with those of Supelco (USA) reference standards and quantified using the internal standard after adjusting for the response according to the reference standards. Fatty acids exceeding 0.01% of total fatty acids amount were identified. All samples were analyzed in duplicate.

Statistical evaluation was carried out with MS Excel software for Windows XP on the mean values of the duplicate samples.

3. Results and discussions

Up to 34 basic fatty acids were determined in the studied samples. The data show significant qualitative and quantitative differences in the lipid composition of pork, beef, ovine, horse, and turkey meat. Tridecanoic acid [$CH_3(CH_2)_{11}COOH$] was obligatory for the lipids of sheep and cattle. According to Table 1, its content in beef is 3.7 times higher than in ovine and 15 times higher than in pork and turkey meat. The absence or trace amounts of tridecanoic fatty acid in the sample may indicate the absence of beef and ovine in it. For pork trace amounts of pentadecanoic acid with a branched skeleton are typical, while in ovine its presence is obligatory. According to our data, the content of C15:0 acids in ovine is up to 0.6% of the total lipids. High content of lauric (C 12:0) acid is typical for beef. Its amount in beef is up to 1.7%, while in pork, ovine, horse, and turkey it does not exceed 0.3%, 0.7%, 1%, and 1%, respectively. In general, beef is rich in fatty acids with medium molecular weight (from C 8 to C 13) – on an average of 2.56%. This value is two times higher than that in horse, two and a half times higher than in ovine (1.06%), three times higher than in pork or turkey (0.68 – 0.77%). It was revealed that turkey meat is characterized by almost complete absence of fatty acids with 17 carbon atoms (heptadecanoic acid, heptadecenoic acid, and branched heptadecanoic acid), which can be a specific indicator for turkey meat. It wass noted that the lipids of pork contain small amounts of fatty acids with an odd number of carbon atoms in the chain (C 11, C 13, C 15, and C 17). The content of these fatty acids in pork is 0.59% against 3% in beef and horse meat, 4% in turkey and more than 5% in ovine. Lipids of pork do not contain at all or contain negligible amounts of C 19 and C 21 fatty acids. Horse meat contains much higher (1.2%) pentaenoic fatty acids than the lipids of other samples. In pork, ovine, and turkey meat, these acids range from 0.05% to 0.07%, in beef – ten times more (0.7%). An important indicator of quality and functionality is studying of the essential fatty acid content in raw meat material from different animal species. Essential fatty acids are compounds of general formula $CH_3(CH_2)_x(CH{=}CHCH_2)_y(CH_2)_zCOOH$, where x = 1,4,5,7, y = 1–6, z = 0–7 with the total number of C atoms between 18 and 24 and cis-configuration. Initially, this group included only linoleic and α-linolenic acids, which are not synthesized by animals and the lack of which causes symptoms of fatty acids deficiency. Then all compounds with this formula were attributed to the essential fatty acids, even those that are synthesized in the animal organism, and are not essential in the strict sense, but are able to eliminate the symptoms of fatty acids deficiency. All of them are metabolites of linoleic and α-linolenic acids. Thus, in our studies, we determined that the total content of linoleic, α-linolenic, arachidonic, 8,11,14-eicosatrienoic, and 5,8,11,14,17-eicosapentaenoic acids (Table 2). The minimum content of such acids was found in ovine and beef, which is almost 4 times lower than in horse meat.

The total content of n3 and n6 fatty acids is the highest in horse meat (more than 18%). Mainly it is linoleic acid, while the content of arachidonic acid in horse meat does not exceed 0.7%.

Table 1
Composition of fatty acid lipid fraction, % of the total fatty acids t (n=10).

Fatty acids	Ovine	Pork	Beef	Turkey	Horse
Capronic Acid C 6:0	0.060	0.070	0.075	0.065	0.055
Caprylic Acid C 8:0	0.015	0.250	0.060	0.440	0.040
Capric Acid C10:0	0.125	0.140	0.130	0.080	0.040
Decenoic Acid C 10:1	0.250	0.040	0.090	0.025	0.035
Lauric Acid C12:0	0.480	0.255	1.185	0.085	0.075
Tridecanoic Acid C13:0	0.175	0.040	0.655	0.045	0.610
Myristic Acid C14:0	2.710	1.100	3.275	0.950	0.155
Myristoleic Acid C 14:1	0.455	0.050	0.200	0.025	0.515
Pentadecanoic Acid C15:0	0.515	0.055	0.090	0.135	0.520
cis-10-Pentadecenoic Acid C15:1	0.585	0.03	0.11	1.45	0.115
Palmitic Acid C16:0	24.015	26.88	25.465	23.5	12.255
Palmitoleic Acid C16:1	3.405	2.400	2.950	4.970	4.310
Heptadecanoic Acid C17:0	1.955	0.280	0.510	0.205	1.303
cis-10-Heptadecenoic Acid C17:1	0.755	0.140	1.000	0.050	1.150
Stearic Acid C18:0	19.145	13.215	21.070	14.360	24.420
Oleic Acid C18:1	14.150	29.940	22.400	21.805	17.320
Elaidic Acid C18:1 (trans-9-octadecenoic acid)	3.2	2.63	3.1	-	-
Linoleic Acid C18:2 n6	3.750	7.80	3.460	11.330	13.010
γ-Linolenic Acid (cis-6,9,12-octadecatrienoic) C18:3 n6	0.350	1.035	0.420	0.050	4.565
α-Linolenic Acid (cis-9,12,15-octadecatrienoic) C18:3 n3	0.545	0.595	0.295	0.060	1.50
Nonadecanoic Acid C19:0	1.195	-	0.80	0.02	2.99
cis-11-Eicosenoic Acid C20:1 n9	0.550	0.475	0.650	0.165	1.030
Eicosanic Acid C20:0	0.220	0.255	0.190	0.110	2.900
cis-11,14-Eicosadienoic Acid C20:2	0.075	0.215	0.085	0.04	0.090
cis-8,11,14-Eicosatrienoic acid C20:3n6	0.090	-	0.205	0.015	0.170
cis-11,14,17-Eicosatrienoic Acid C20:3n3	0.020	-	0.115	0.195	-
Arachidonic Acid C20:4 n6	1.55	0.9	1.69	0.355	0.635
cis-5,8,11,14,17-Eicosapentaenoic Acid C20:5 n3	0.050	0.050	0.710	0.050	1.160
Heneicosanoic Acid C21:0	0.035	-	0.02	0.05	-
Behenic Acid 22:0	0.300	-	-	0.030	0.205
Erucic Acid C22:1n9t	0.200	0.880	0.050	0.135	-
cis-5,8,11,14,17-Eicosapentaenoic Acid C22:5n3	0.010	0.020	0.020	-	1.160
cis-4,7,10,13,16,19-Docosahexaenoic C22:6n3	0.31	0.240	0.250	0.150	0.355
Lignoceric Acid C24:0	1.05	1.000	4.600	0.325	1.150

Animal fats are characterized by high content of arachidonic acid. Arachidonic acid is the precursor of prostaglandins. Many researchers demonstrated that the essential fatty acids from n6 group reduce the coagulating properties of blood, prevent the development of atherosclerosis, and regulate blood pressure, so the presence of these acids in sufficient quantities is extremely important. Arachidonic acid is 10 times more active in the reversal of these disorders than linoleic acid.

With the increase in the amount of myristic and palmitic fatty acids product atherogenicity increases too. Our results showed that the amount of C14:0 and C16:0 acids is most favorable in horse meat (12.8%), followed by turkey with an almost twofold increase, while pork, beef, and ovine were not significantly different (values range from 26.7% to 28.7%).

Table 2
Total fatty acid content in samples, % of the total fatty acids.

	Ovine	Pork	Beef	Turkey	Horse
∑ SFA	51.995	43.54	58.125	40.40	43.77
∑ UFA	30.3	47.44	37.80	40.91	45.83
∑ MUFA	23.55	36.585	30.55	28.625	22.97
∑ PUFA	6.75	10.855	7.25	12.245	22.17
SFA/UFA	1.72	0.92	1.54	0.99	0.96
Arachidonic Acid	1.55	0.9	1.69	0.355	0.66
∑ n3	0.935	0.905	1.39	0.455	4.07
∑ n6	5.74	9.735	5.775	11.75	18.10
n6/n3	6.1	10.8	4.15	25.8	4.4

Comparative studies showed that the fatty acid composition of meat material can be an indicator for the prospects of its use as a functional food. It was found that atherogenicity and/or thrombogenicity of meat is mainly influenced by qualitative composition of fat rather than the amount of fat in a meat product (Lisitsyn et al., 2004).

Based on these results we can conclude that the fatty acid composition of pork and horse meat has a higher nutritional value compared to other studied species, because they are richer sources of polyunsaturated fatty acids. Horse meat in terms of healthy nutrition and prevention of cardiovascular diseases is the most preferred type of meat.

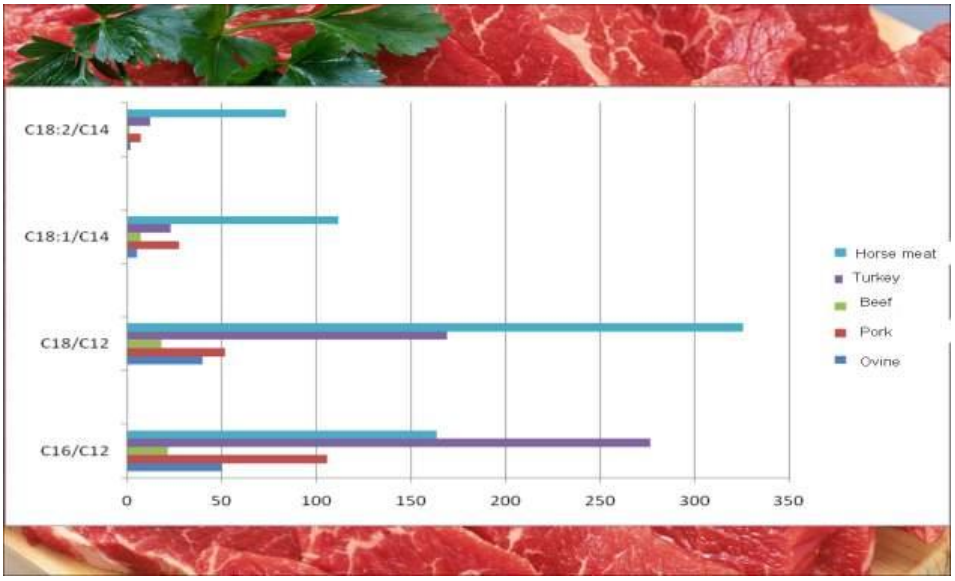

Fig. 1. Specific ratios of fatty acids in fats from different animal species.

Distinctive characteristic of the horse meat is a high proportion of fatty acids with 18 carbon atoms, mainly oleic, linoleic, and linolenic acids. Specific fatty acids ratio for turkey may be the ratio of C16:0 to C12:0. Distinctive characteristics of beef and ovine are the minimum ratio of C18:1 to C12:0. After analyzing the data in Fig. 1, we can point to significant differences in the ratios of individual fatty acids in pork, horse, and turkey.

Our studies showed differences in the composition of fatty acids in allied wild and domestic animals.

Typical fatty acid composition of pork fat in *M. longissimus dorsi* taken from castrated boars is (n = 10, %): ∑ FA – 96.3; SFA – 42.8, including: C4:0 (butiric) < 0.2 (0.1–1), C6:0 (caproic) < 0.1 (0.05–0.1), C8:0 (caprylic) < 0.2 (0.1–1), C10:0 (capric) – 0.14 (0.1–1), C12:0 (lauric) – 0.2 (0.2–2.0), C14:0 (myristic) – 1.5 (0.8–1.6), C15:0 (pentadecanoic) – 0.06 (0.04–1), C16:0 (palmitic) – 25.1 (25–29), C17:0 (heptadecanoic) – 0.25 (0.1–1), C18:0 (stearic) – 13.8 (13–18), C19:0 (nondecanoic) – 1.0 (0.1–2), C20:0 (eicosanoic) – 0.3 (0.1–0.4), C22:0 (behenic) – 0.55; MUFA – 41.9, including: C14:1 (myristoleic) – 0.08 (0.01–0.5), C15 : 1 (cis-10-pentadecenoic) – 0.3 (0.1–2), C16 : 1 (palmitoleic) – 2.32 (1.7–2.5), C17:1 (cis-10-heptadecenoic) – 1.2 (0.5–3), C18:1 n9c (cis-9-oleic) – 34 (30–44), C18:1n9t (trans-9-elaidic) – 2.7 (1.1–4), C20:1 (cis-11-eicosenoic) – 0.5 (0.5–1.5), C22:1n9 (erucic) – 0.8 (0.1–1.5); PUFA – 11.6, including: C18:2n6c (linoleic) – 7.8 (7–9), C18:3n6 (γ-linolenic) – 0.8 (0.5–2.0), C18:3n3 (α-linolenic) – 0.6 (0.5–1.5), C20:2 (cis-11,14-eicosadienoic) – 0.2 (0.1–1), C20:3n6 (cis-8,11,14-eicosatrienoic) – 0.4 (0.1–2), C20:4 (arachidonic) – 1.2 (0.5–2.0), C22:2 (cis-13,16,17-docosadienoic) – 0.4 (0.1–2), C22:6 (cis-4,7,10,13,16,19-docosahexaenoic) – 0.2 (0.1–1). In brackets you can see the most common range of individual acids content for this type of raw material.

Typical fatty acid composition of lipids in *M. longissimus dorsi* taken from wild boars is (n = 3, %): ∑ FA – 94.3, SFA – 48.0, including: C4:0 <0.1, C6:0 – 0.04, C8:0 – 0.1, C10:0 – 0.27, C12:0 – 0.4, C14:0 – 5.6, C15:0 – 0.3, C16:0 – 18.5, C17:0 – 1.0, C18:0 – 20.9, C19:0 – 0.2, C20:0 – 0.3, C22:0 – 0.4, MUFA – 35.6, including: C14:1 – 0.08, C15:1 – 0.3, C16:1 – 0.4, C17:1 – 0.05, C18:1n9c – 33.3, C18:1n9t – 0.4, C20:1 – 0.8, C22:1n9 – 0.3, PUFA – 10.7, including: C18:2n6c – 6.3, C18:3n6 – 1.1, C18:3n3 – 1.4, C20:2 – 0.55, C20:3n6 – 0.3, C20:4 – 0.1, C22:2 – 0.6, C22:6 – 0.4.

Analysis of the data indicates differences in the content of saturated and unsaturated fatty acids in lipids of wild and domestic animals. It is interesting to note that these differences are more significant compared to vegetable lipids. Thus, animal fats (beef, pork, ovine) are characterized by a high content of C16:0 palmitic acid (25-30%) and C18:0 stearic acid (15-30%). For vegetable oils these contents are 1-10% (GOST R 30623, 1998). Animal fats are characterized by the presence of prostaglandin precursor, C20:4ω6 arachidonic acid (1-4%), whilein plant products it is 5-10 times less. All fats are characterized by the high content of oleic acid.

The content of basic fatty acids in chicken fat differs somehow from those of pheasant. Brisket fat of laying hens (n = 15, %): ∑ FA – 95.8, SAF – 36.9, including: C4:0 < 0.1, C6:0 < 0.1, C8:0 < 0.02, C10:0 – 0.1, C12:0 – 0.3, C14:0 – 1.3 (0.8–1.7), C15:0 – 0.3, C16:0 – 22.1 (20–26), C17:0 < 0.5, C18:0 – 8.5 (4–9), C19:0 – 0.1, C20:0 – 3.2, C22:0 – 0.3, MUFA – 46.4, including: C14:1 – 0.7, C15:1 – 0.7, C16:1 – 5.1 (3–9), C17:1 – 1.2, C18:1n9c – 36.9 (30–45), C18:1n9t – 1.4, C20:1 – 0.3, C22:1n9 – 0.1, PUFA – 12.5, including: C18:2n6c – 9.3 (9–20), C18:3n6 – 0.6, C18:3n3 – 0.5, C20:2 – 0.1, C20:3n6 – 0.1, C20:4 – 0.4, C22:2 – 0.3, C22:6 – 1.2. Brisket fat of female pheasants (n = 4, %): C 8:0 – 0.1–0.2, C 10:0 – 0.1–0.5, C12:0 – 0.1–0.2, C 14:0 – 1.8–3.0, C 14:1 – 0.2–0.3, C15:0 – 0.4–0.5 , C15:1 – 0.3–0.5, C16:0 – 23.5–25.6, C16:1 – 1.7–3.0, C17:0 – 0.4–0.5, C 18:0 – 11.9–14.5, C18:1 – 39.3–42.4, C18:2 ω6 – 1.3–2.7, C18:3ω3 – 0.1–0.2, C 19:0 – 0.3–0.5, C20:0 – 0.4–0.7.

A comparison of fat composition from domestic and wild animals, such as pig and wild boar, chicken and pheasant, shows that wild animals are characterized by a higher content of saturated fatty acids, which is obviously due to the high mobility of the animals in wild nature (Ivankin, 2007).

It is interesting to compare fat composition from meat material with that of cow milk fat, analyzed under comparable conditions (%): ∑ FA – 97.2, SFA – 61.0 (50–70), including: C4:0 – 2.9 (2.0–4.3), C6:0 – 2.3 (1.5–3.5), C8:0 – 1.1(1.0–2.5), C10:0 – 2.4 (2.0–3.8), C12:0 –2.7 (2.0–4.0), C14:0 – 12.4 (8.0–12.0), C15:0 – 4.7 (4.0–6.5), C16:0 – 15.3 (15.0–31.0), C17:0 – 4.4 (3.5–6.5), C18:0 – 6.0 (6.0–13.0), C19:0 – 4.0 (2.0–6.0), C20:0 –1.1(0.3–1.5), C22:0 – 1.7 (0.1–2.0), MUFA – 26.9 (25–45), including: C14:1 – 1.5 (0.5–1.5), C15:1 – 0.7 (0.1–1.0), C16:1 – 2.6 (0.5–3.5), C17:1 – 0.5 (0.1–1.5), C18:1n9c – 21.1 (20.0–32.5), C18:1n9t – 0.2, C20:1 – 0.2, C22:1n9 – 0.1, PUFA – 9.3, including: C18:2n6c – 3.4 (3.0–5.5), C18:3n6 – 1.4 (0.1–2.0), C18:3n3 – 0.8 (0.1–1.5), C20:2 – 0.3, C20:3n6 – 0.2, C20:4n6 – 2.5 (0.1–4.0), C22:2 – 0.5, C22:6n3 – 0.2 (0.1–1.5).

Milk fat contains a large proportion of lower and middle C4-8 fatty acids (5–7% of total fatty acids), while animal fats or vegetable oils usually contain less amounts not exceeding 1–2%. Milk fat, as the most balanced natural product for humans, can be used as a reference product for lipid composition of new foods containing fats of different origin.

ratios of individual groups of unsaturated fatty acids are important (see Table 2). In connection with the intensive work associated with high significance of individual polyunsaturated fatty acids for a long and healthy life, many scientists conduct researches related to the assessment of n6: n3 fatty acids ratio. The group of n6 family includes first of all linoleic acid C18:2, γ-linolenic acid (cis-6,9,12-octadecatrienoic acid) C18:3, arachidonic

acid (cis-5,8,14- eicosatetraenoic acid) C20:4. The ω3 family includes alpha-linolenic acid (cis-9,12,15-octadecatrienoic acid) C18:3, cis-5,8,11,14,17-eicosapentaenoic acid C20:5 as well as cis-4,8,12,15,21-docosapentaenoic acid C22:5 and cis-4,7,10,13,16,19-docosahexaenoic C22:6 acid whose chemical analysis is complicated. A growing proportion of n3 fatty acids in foods and special dietary compositions can be regarded as a favorable and even curative factor (ICoMST 46–53, 1999 – 2007). The ratio of n6/n3 fatty acids is an important indicator. It is recognized that this ratio should be 4:1 or better 2.5:1, but really for the most of animal fats n6/n3 ratio is more than (6–14):1. That means that proportion of «n3 fatty acids which are beneficial in preventing age-related diseases» compared to other unsaturated fatty acids should be as high as possible. Differences in n6/n3 ratio serve the basis of various diets with animal, vegetable or even marine fats and oils. Our studies show that differences in the fatty acid content are determined by animal species, and obviously depend on the composition and nature of applied feeds, and vary depending on the chromatographic identification method (see Table 2, Fig. 1). It should be noted that the comparison of our experimental data with results of other researchers should be performed properly with regard to the number of identified fatty acids. Since usually the so-called fatty acid composition of isolated lipid fraction is listed, the correct comparison requires the match or, at least, approximation of general list of identified fatty acids. Mass fraction of individual components can vary significantly depending on the number of identified peaks.

4. Conclusion

Thus, we can state that the main indicator of biological and consequently the nutrition value of fats is the composition of fatty acids and especially unsaturated acids of ω3 (n3) family. Their ratio, as it comes with food, may affect the subsequent condition of a human being. Up to 34 basic fatty acids could be isolated from the samples of meat lipids from different animal species. The list, obviously, can be extended by using more sensitive methods of detection. It was revealed that turkey meat is characterized by almost complete absence of fatty acids with 17 carbon atoms (heptadecanoic acid, heptadecenoic acid, and branched heptadecanoic acid), which may be a specific indicator for turkey meat. It was shown that tridecanoic acid is obligatory for the lipids of sheep and cattle. It was noted that ovine lipids contain large quantities of fatty acids with an odd number of carbon atoms in the chain (C11, C13, C15, and C17). Ovine contains more than 5% of these fatty acids, while pork, beef, horse and turkey meat contain 0.59%, 3%, 3%, and 4%, respectively. Pork is characterized by a very low content of lauric (C 12:0) acid and trace amounts of pentadecanoic acid. With the increase in the amount of myristic and palmitic fatty acids, product atherogenicity increases too. Our results showed that the amount of C14:0 and C16:0 acids is the most favorable in horse meat (12.8%), followed by turkey meat with an almost twofold increase, while pork, beef, and ovine were not significantly different (values range from 26.7% to 28.7%). The data obtained can be used to develop and manufacture meat products with beneficial functional properties allowing not only to vary their nutritional value, but also regulate fatty acid balance.

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