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A comparative study regarding fatty acids in pork and beef

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Abstract. Meat is an important food in the human diet. The chemical composition of meat is influenced by many factors. An important factor is represented by species. In this study was analyzed for protein content, water, minerals and fatty acids in pork and beef. Minerals ranged from 0.95 ± 0.02 (%) in pig meat and 1.12 ± 0.02 (%) in beef. The protein varied between: 19.20 ± 0.14 (%) in pork and 20.31 ± 0.25 (%) in beef. The highest average values are for the following fatty acids: C16: 0 (palmitic), C18: 0 (stearic acid) and C18: 1 (oleic acid) in both pork and beef.
Key Words: Fatty acids, swine, meat, pork, beef, protein, minerals.

Introduction. The content of fatty acids in meat is influenced by factors such as the species from which the meat comes (Ponnampalam et al 2014) and feed used (Sinclair 2007). There is now increasing concern to use different nutritional supplements rich in polyunsaturated fatty acids (PUFA) in feed, in order to obtain high quality meat. Of particular interest to consumers is to eat healthy meat with a high content of PUFA (Wood et al 2003). PUFA levels in fat and muscle tissue is influenced by the feed used, which has influence on products quality (Wood et al 2008). Currently the main concerns are related to the production of meat with high nutritional value, for human benefit, with a high content of fatty acids, particularly omega 3 (Morel et al 2013). Factors that influence meat quality are the genetics and exploitation system (Pugliese & Sirtori 2012). Pork is a food with high nutrient values, rich in protein, carbohydrate, vitamins, minerals, long chain polyunsaturated fatty acids and essential amino acids. Consumption of pork at high levels due to the high content of cholesterol and saturated fatty acids can lead to adverse effects on humans (Hamill & Botineştean 2016; Reig et al 2013). Consumer requirements are mainly to reduce the fat content of meat, but also reduce the content of saturated fatty acids (Averette Gatlin 2002). Forages influence the content of fatty acids in pork, as the use of flaxseed in the diet of animals, increase levels of PUFA. Pork is a source of vitamins, minerals and a rich source of conjugated linoleic acid with antioxidant properties (Nistor et al 2012). At present, a number of studies are made in order to modify the nutrient profile, for example, increase the content of PUFA by use in animal feed of natural components with antioxidant potential, in order to reduce oxidation of lipids meat. The lipid content influences the quality and nutritional value of meat (Nieto & Ros 2012; Wood et al 2003). Currently the focus is very much on food intake, which has great influence on health. We tried different variations in order to find the optimal alternative to meat and meat products get a good balance on the lipid content of the human body needs, especially linoleic acid-rich products (Juárez et al 2009; Swinburn 2009; Pariza et al 2001). The content of fatty acids influences the final characteristics of meat flavor, juiciness and tenderness. The process of oxidation and discoloration of meat are greatly influenced by the level of unsaturated fatty acids and mainly fatty acids with double bonds (Enser 1984; Wood et al 2003). In the study conducted by Araujo de

Vizcarrondo et al (1998) on pig meat noticed a higher level for linoleic acid and lower levels of stearic acid, compared with beef (Araujo de Vizcarrondo et al 1998). Enser et al 1996, report a higher level of PUFA in beef, C20 and C22 mainly n-3 compared to pork. Through the use of food supplements rich in linoleic acid, leads to enhanced levels of linoleic acid in meat (Enser et al 2000).

Several studies were conducted on meat fatty acids profile. On omega 3 fatty acids study in lamb (Ponnampalam et al 2014), on breed and gender influence upon quality of pork and the content of fatty acids (Alonso et al 2015), modifying the content of fatty acids in pork under the influence of improved nutrition with natural additives to increase the nutritional value (Inserra et al 2015), Ros-Freixedes & Estany (2014) studied the fatty acid composition of pork, Raes et al (2004) reported increase in acid levels CLA in meat by using dietary fish oil and fishmeal or feed rich in linoleic acid, the influence of genotype on the content of fatty acids and cholesterol in pork (Parunovic 2015). Using oleic acid enriched food to improve meat quality and level of fatty acids in pork and ham housing was reported by Mas et al (2011), and influence of the processing upon volatile compounds in pork products (Rivas-Cañedo et al 2015). Sánchez-Muniz et al (2012) studied the reduction of lipid oxidation using a Hypericum extract. Feeding corn and vitamin E increased the quality of the meat, fatty acid content of ɑ-tocopherol content in plasma, liver, muscle and adipose tissue and increased the shelf life of pork (Wang et al 2012).

The purpose of this study is to perform a comparative analyze of proteins, water, minerals and fatty acids in pork and beef.

Material and Method. It was used a total of 5 samples of pork and beef, and also 5 samples for fatty acid and for physical and chemical parameters analysis. The samples were frozen at -4°C until analysis. Samples were collected from a meat processing unit from Satu-Mare County. For fatty acid analysis was used the method described by Folch et al (1957). Gas chromatography method was used for determination of the fatty acid. Physico-chemical composition was analyzed by Soxhlet. Statistical analyses were performed with StatSoft Statistica version 10 (http://www.statsoft.com).

Results and Discussion. Table 1 illustrates the mean and variability of water, protein and minerals content from pork and beef. Water content in pork was found 65.72±0.44%, in comparison with beef where the water content was found 67.32±0.64%. Protein levels vary as follows: 19.20±0.14% in pork and 20.31±0.25% in beef. Mineral substances, just like the water and protein content, has the highest content in beef. Data for pork and beef are consistent with those reported by Bulancea & Râpeanu (2009) regarding the chemical composition depending on species and animal fat cover. The water content in pork ranges between 49.1-72.6%, protein content between 15.1-20.1% and minerals between 0.8-1%. Water content in beef was found 62.5-74.0% protein 19.2-21.1%, minerals 1.0-1.2% (Bulancea & Râpeanu 2009). Figure 1 shows the comparative mean values for water, protein and minerals for pork and beef.

Table 1

Average values and variability for protein, water and mineral substances in pork and beef

Species	*Water %*		*Proteins %*		*Minerals %*	
	X ± sx	*V%*	*X ±sx*	*V%*	*X ± sx*	*V%*
Pork	65.72±0.44	1.51	19.20±0.14	1.61	0.95±0.02	4.53
Beef	67.32±0.64	2.13	20.31±0.25	2.76	1.12±0.02	4.85

n = 5; V - variability.

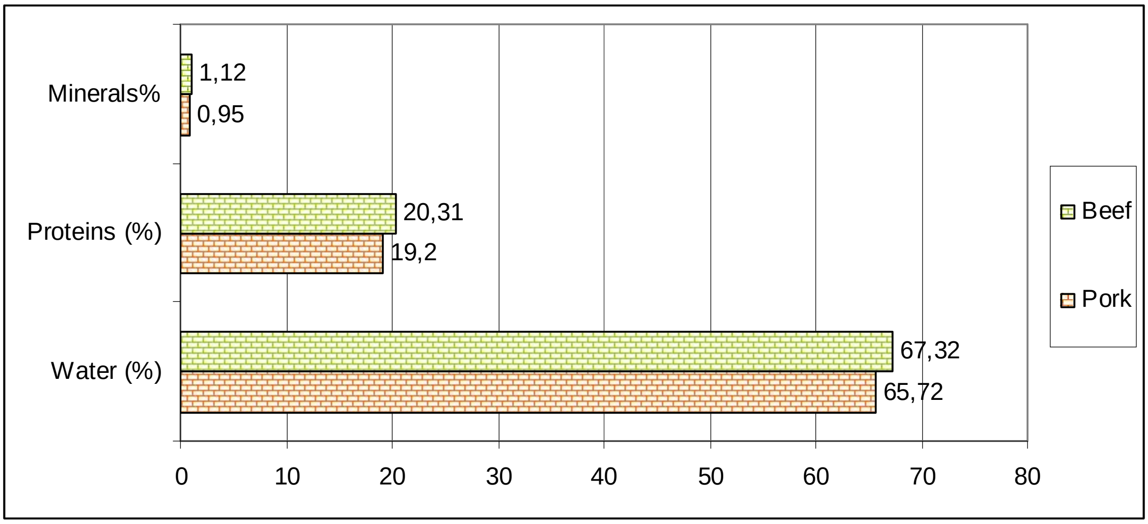

Figure 1. Comparative analysis for water, protein and minerals in pork and beef.

Table 2

Average values and variability of fatty acids in pork and beef (mg/100 g)

Fatty acid	*Pork*		*Beef*	
	X±sx	*V%*	*X±sx*	*V%*
C12:0 (lauric)	2.75±0.06	5.15	3.04±0.06	4.50
C14:0 (myristic)	38.40±1.21	7.04	94.20±1.56	3.71
C16:0 (palmitic)	494.40±4.50	2.04	870.6±4.28	1.10
C18:0 (stearic)	265.2±2.79	2.35	452.40±5.43	2.68
C18:1 (oleic)	663.4±3.26	1.10	1276.8±1.80	0.32

n = 5, V – variability.

Table 2 shows the detected mean values and variability of fatty acids in pork and beef. The lauric acid (C12:0) content was found 2.75±0.06 mg/100 g in pork and 3.04 ± 0.06 mg/100 g in beef. The found values are higher than those reported by Enser et al (1996), for both species. Myrisitic acid (C14:0) level was detected at 38.40±1.21 mg/100 g in pork and 94.20±1.56 mg/100 g in beef. Our findings regarding C14:0 in pork showed higher values compared to values found by Enser et al (1996) and lower in beef. The measured palmitic acid (C16:0) was 494.40±4.50 mg/100 g in pork and 870.6±4.28 mg/100 g in beef. Our findings regarding C16:0, for both species, highlighted lower values comparing with those reported by Enser et al (1996). Stearic acid (C18:0) and oleic acid (C18:1) showed average values below those reported by Enser et al (1996) for both, beef and pork samples. Enser et al (1996) obtained the following values for fatty acids in pork: 12:0 2.6 mg/100 g, C14:0 30 mg/100 g, C16:0 526 mg/100 g, C18 :0 278 mg/100 g, C18:1 (759 mg/100 g); for beef: C12:0 2.9 mg/100 g, C14:0 103 mg/100 g, C16:0 962 mg/100 g, C18:0 507 mg/100 g, C18:1 1395 mg/100 g. Figure 2 display the comparative average values for fatty acids in pork and beef.

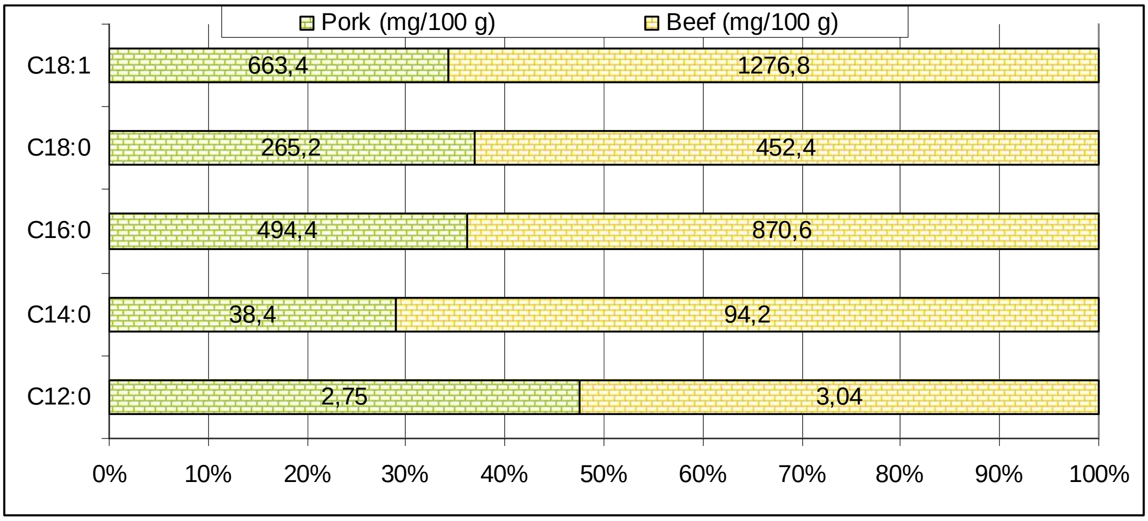

Figure 2. The average content of fatty acids in pork and beef meat (mg/100 g).

Conclusions. The fatty acid content (C12:0, C14:0, C16:0, C18:0, C18:1) found in beef are higher in beef than in pork. The water content was lower in pork than in beef. The results also highlighted higher protein and mineral salt content of the beef meat comparing to the pork. The analyzed parameters average values are in agreement with data reported in the literature.

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