THE DIFFERENCE IN THE NUTRITIONAL COMPOSITION OF PORK AND FAT OF BARROWS, BOARS AND GILTS OF FINISHING PIGS

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Abstract

The experiment was realized in the experimental facility of Animal Production Research Center in Nitra. There were 21 hybrid fattening pigs included in this experiment. The pigs were divided into three groups of 7 pieces (7 barrows, 7 gilts and 7 boars). All pigs were fed during the experiment one feed mixture.The fattening was realized up to 105 kilograms of live weight of pigs. The samples for the analysis of the chemical indicators were taken from *longissimus dorsi* muscle and fat from belly during dissection of the right half/carcase hold in storage for 24 hours *post mortem* at the temperature 3-4 ^{o}C. The sample from muscle and fat (50 g) was hold in storage and dates separately for 30 days at the temperature -19±0,5^{o}C before the analysis was carried out.We analyzed the total amount of proteins in g/100 g, intramuscular fat in g/100 g, total amount of water in g/100 g, composition of fatty acids in the muscle and fat and composition of selected amino acids in the muscle. Based on the results analysis of chemical composition of pork we can state that in the meat of barrows it was found the highest proportion of intramuscular fat in comparison to boars and gilts. We found the lowest content of total protein (23.72%) in the group of barrows in comparison to the group of gilts where we measured 24,15 %. In the case of total water indicator [%] it was found the lowest value 74,03 % in group of barrows in comparison to the group of boars where we found value of 74,69 %. There was recorded the lowest proportion of saturated fatty acids in the MLT in the group of boars 40.1 g.100^{-1} FAME in comparison with the group of barrows where we found the value of 40.75 g.100^{-1} FAME. Regardless of significant effect of castration on sensory and organoleptic characteristics of pork in conclusion we scan state that the meat of boars in our experiment contained lower amount of intramuscular fat in comparison with barrows and simultaneously higher amount of total protein and total water. The content of cholesterol in MLT was also lower in the group of boars in comparison with the group of borrows. Chemical composition of intramuscular fat in MLT and belly identified in the group of boars showed optimal composition of individual fatty acids groups. From a nutritional point of view, meat of boars was characterized by a higher amount of ω3 and ω6 fatty acids and a lower amount of saturated fatty acids in the MLT and the belly.

Key Words: Pig, castration, nutritional composition, pork

The castration is a procedure that is practiced in animal husbandry for a long time. The main reason for castration is elimination of so-called boar taint, by which the meat of boars is characterized after reaching sexual maturity. However the theme of castration became controversial in the last few years. The reason for this is the fact that the castration might be in contradiction to so called good living conditions (EFSA, 2004), animals´ health condition and furthermore in contradiction to production of pork meat with better quality. The negative effects of castration are also in a lower intensity of growth and in a worse feed conversion in comparison to boars that are fed intensively as stated in ČUBOŇ (2006), PRUNIER et al. (2006) a BABOL (1995). Boars are used for the production of pork more often due to lower content of fat and a favourable fatty acids composition (Wood et al., 2004). DOSTÁLOVÁ (2008) found lower values of intramuscular fat in the group of boars in comparison to the group of barrows. Boar meat was characterised with a lower drip loss and lower content of dry matter in chosen parameters of technological quality and nutrition value. NADEJE et al. (2000), LATORRE et al. (2003), BATOREK et al. (2012) and TEYE (2009) came to the similar conclusions in their studies. Lower values of intramuscular fat of boars were also found in the previous studies of NEWELL a BOWLAND (1972), KNUDSON et al. (1985) a SQUIRES et al. (1993). NADĚJE et al. (2000) also stated that the group of boars was characterized by higher content of proteins in comparison to the values found in the group of barrows and it was also proved in the studies by FORTIN et al. (1983) a PEINADO et al. (2008). More favourable content of proteins was found in meat of boars as stated in LUNDSTRÖM et al. (2008). Meat of boars is characterised by higher rate of unsaturated fatty acids and excellent results in the case of sensory evaluation (NADĚJE et al., 2000) but also higher content of water (BONEAU, 2000) in comparison to

meat of barrows. Higher content of water as well as higher content of proteins in meat of boars are also stated in XUE et al. (1997). In the case of fatty acid composition PAULY et al. (2009), JATURASITHA et al. (2006) and Bolero et al. (2011) noted higher values of saturated fatty acids in a group of barrows. The values of monounsaturated and polyunsaturated fatty acids were higher in the group of boars and moreover the authors mentioned above proved lower values of intramuscular far in castrated boars as well as GISPERT et al. (2010). SERRANO et al. (2009) noted higher content of saturated fatty acids in the group of barrows.The results of monounsaturated and polyunsaturated fatty acids composition were not statistically proved. His results are in agreement with GRELA et al. (2013) who noted lower values of saturated fatty acids in the group of boars whereas the group of castrated boars showed statistically higher values of monounsaturated fatty acids but lower values of polyunsaturated fatty acids. GRELA et al. (2013) noted more favourable ratio of PUFA: SFA in the group of boars.

Materials and Methods

Animal and sample preparations

The experiment was realized in the experimental facility of Animal Production Research Center in Nitra. There were 21 hybrid fattening pigs included in this experiment. The pigs were divided into three groups of 7 pieces (7 pieces of barrows, 7 pieces of gilts and 7 pieces of boars). All pigs were fed during the experiment one feed mixture with the following parameters of nutrition value: dry matter - 899.19 g / kg, crude protein 149.81, fibre - 47.67, fat - 23.47, ash - 41.71, nitrogen free extract - 636 , 54, organic matter - 857.48, lysine in the dry matter - 7.03, methionine - 2.62, cysteine - 2.72. The fattening was realized up to 105 kilograms of live weight of pigs. The slaughter and dissection of pig carcasses were realized at the slaughterhouse of Animal Production Research Center in Nitra. The dissection of carcasses was performed according to the methodology STN 466164. The samples for the analysis of the chemical indicators were taken from *longissimus dorsi* muscle and fat from belly during dissection of the right half/ carcase hold in storage for 24 hours *post mortem* at the temperature 3-4 ^{o}C. The sample from muscle and fat (50 g) was hold in storage and dates separately for 30 days at the temperature -19±0,5^{o}C before the analysis was carried out.

Analysis of chemical indicators

The indicators of chemical composition of pork muscle in thoracic saddle and belly fat were identified from the muscular homogenate sample (50g) by the FT IR method using the device Nicolet 6700.

We analyzed the total amount of proteins in g/100 g, intramuscular fat in g/100 g, total amount of water in g/100 g, composition of fatty acids in the muscle and fat and composition of selected amino acids in the muscle. The analysis of infra-red spectrum of the muscular homogenate was carried out by the method of molecular spectroscopy. The principle of this method is the absorption of the infra-red spectrum during the sample transition where there is a change of the rotary vibrating energetic conditions of the molecule depending on the changes of the dipole momentum molecule. The analytical output is the infra-red spectrum which is a graphic representation of the function dependence of the energy, mostly given in transmittance percentage (T) or absorbance units (A) on wave-length of the incident emission. The transmittance is defined as a ratio of the intensity of the emission which has passed the sample (I) and the intensity of the emission emitted by the source (Io). The absorbance is defined as a decimal logarithm 1/T. The dependence of the energy on the wave-length is logarithmic, so a repetency - defined as a reciprocal of the wave-length – is used therefore the presented dependence of the energy on the repetency is linear function.

Results and Discussion

Based on the results analysis of chemical composition of pork (Table 1) in accordance with NADĚJE et al. (2000), LATORRE et al. (2003), BATOREK et al. (2012) and TEYE (2009) we can state that in the meat of barrows it was found the highest proportion of intramuscular fat in comparison to boars and gilts. We found the lowest content of total protein (23.72%) in the group of barrows in comparison to the group of gilts where we measured 24,15 % which is in accordance with the experiment carried out by LUNDSTRÖM et al. (2008). In the case of total water indicator [%] it was found the lowest value 74,03 % in group of barrows in comparison to the group of boars where we found value of 74,69 % which is in accordance with the results XUE et al. (1997).

There was recorded the lowest proportion of saturated fatty acids in the MLT in the group of boars 40.1 g.100^{-1} FAME in comparison with the group of barrows where we found the value of 40.75 g.100^{-1} FAME. These results are consistent with the statement of PAULY et al. (2009), JATURASITHA et al. (2006) and BOLER et al. (2011).

The highest content of monounsaturated fatty acids in the MLT was also found in the group of boars 55,84 g.100^{-1} FAME and the lowest proportion of monounsaturated fatty acids was observed in the group of barrows 50.08 g.100^{-1} FAME. In the individual parameters of the composition of fatty acids in MLT between the experimental groups it was not found statistically significant difference (Table 2).

Table 1. Chemical composition of longissimus dorsi muscle (n=21)

Trait	Gilts (n=7) mean±sd	Boars (n=7) mean±sd	Barrows (n=7) mean±sd
Total water, %	74.544 ± 0.555	74.689 ± 0.375[a]	74.033 ± 0.528[b]
Protein, %	24.151 ± 0.279[a]	23.774 ± 0.500	23.716 ± 0.350[b]
Intramuscular fat, %	1.193 ± 0.353[a]	1.297 ± 0.392[a]	1.739 ± 0.441[b]
Cholesterol (g.kg^{-1})	0.180 ± 0.067[a]	0.259 ± 0.081	0.277 ± 0.079[b]

[a] Different letters denote significant differences between groups at P≤0.05
[b] Different letters denote significant differences between groups at P≤0.05

In the composition of individual amino acids in pork (Table 3) was a statistically significant difference only in threonine and valine. Higher content of threonine was recorded in the group of boars 1,18 g.100 g^{-1} in comparison with group of barrows 1,09 g.100 g^{-1} and higher content of valine was also found in the group of boars 1,06 g.100 g^{-1} while in the group of barrows was found value of 1,00 g.100 g^{-1}.

Based on the analysis of pork belly fat (Table 4) we can state that fat of boars contains a lower proportion of saturated fatty acids that was statistically recorded in the content of palmitic acid. The lower content of palmitic acid was measured in group of boars 25.19 g.100 g^{-1} FAME in comparison with the group of barrows where we measured value of 26.19 g.100 g^{-1} FAME. Statistically significant difference in favor of the nutritional value of meat of boars was recorded in values of linoleic acid and alpha-linoleic acid which is consistent with the arguments of Gispert et al. (2010), SERRANO et al. (2009) and GRELA et al. (2013).

Table 2. Fatty acids in intramuscular fat of longissimus dorsi muscle (g.100g^{-1} FAME) (n=21)

Trait	Gilts (n=7) mean±sd	Boars (n=7) mean±sd	Barrows (n=7) mean±sd
Monounsaturated fatty acids	55.821 ± 0.956	55.844 ± 1.877	55.084 ± 1.711
Polyunsaturated fatty acids	5.959 ± 0,826	6.300 ± 1.432	6.553 ± 1.478
Saturated fatty acids	40.750 ± 0.904	40.019 ± 1.148	40.749 ± 2.319
ω3 polyunsaturated fatty acids	0.467 ± 0.068	0.494 ± 0.072	0.486 ± 0.037
ω6 polyunsaturated fatty acids	5.233 ± 0.714	5.621 ± 1.684	5.831 ± 1.717

Table 3. Amino acids in protein of longissimus dorsi muscle (g.100g^{-1}) (n=21)

Trait	Gilts (n=7) mean±sd	Boars (n=7) mean±sd	Barrows (n=7) mean±sd
Arginine	1.502 ± 0.044	1.576 ± 0.099	1.494 ± 0.117
Cysteine	0.364 ± 0.014	0.376 ± 0.019	0.358 ± 0.017
Phenylalanine	0.997 ± 0.028	1.040 ± 0.065	0.989 ± 0.071
Histidine	1.095 ± 0.035	1.146 ± 0.084	1.091 ± 0.088
Isoleucine	0.882 ± 0.024	0.936 ± 0.061	0.883 ± 0.076
Leucine	1.941 ± 0.046	2.028 ± 0.120	1.919 ± 0.142
Lysine	2.010 ± 0.063	2.112 ± 0.139	2.002 ± 0.158
Methionine	0.697 ± 0.032	0.733 ± 0,051	0.711 ± 0.052
Threonine	1.126 ± 0,055	1.180 ± 0.066[a]	1.097 ± 0.072[b]
Valine	1.019 ± 0.016	1.064 ± 0.062[a]	1.006 ± 0.060[b]

[a] Different letters denote significant differences between groups at P≤0.05
[b] Different letters denote significant differences between groups at P≤0.05

Table 4. Fatty acids in fat of pork belly (g.100g^{-1} FAME) (n=21)

Trait	Gilts (n=7) mean±sd	Boars (n=7) mean±sd	Barrows (n=7) mean±sd
Myristic acid C14:0	1.390 ± 0.051	1.420 ± 0.065	1.406 ± 0.068
Palmitic acid C16:0	26.257 ± 0.793[a]	25.194 ± 1.220[b]	26.194 ± 0.763
Stearic acid C18:0	15.617 ± 1.164	15.093 ± 1.862	15.824 ± 1.178
Oleic acid 9c-C18:1	36.640 ± 1.348	36.051 ± 1.779	36.240 ± 1.402
Linoleic acid C18:2 n-6	9.374 ± 0.634[A]	10.850 ± 0.959[B]	9.457 ± 0.479[A]
Alpha-linolenic acid C18:3 n-3	0.587 ± 0.039[A]	0.699 ± 0.069[B]	0.593 ± 0,039[A]
Monounsaturated fatty acids	43.284 ± 1.641	42.933 ± 2.082	43.019 ± 1.719
Polyunsaturated fatty acids	11.049 ± 0.808[a]	12.783 ± 1.251[b]	11.064 ± 0.556[a]
Saturated fatty acids	44.834 ±1.796	43.177 ± 2.993	45.074 ± 1.742
ω6 polyunsaturated fatty acids	9.831 ± 0.655[A]	11.364 ± 1.057[B]	9.817 ± 0.504[A]
ω3 polyunsaturated fatty acids	0.707 ± 0.046[A]	0.827 ± 0.080[B]	0.710 ± 0.035[A]

[a] Different letters denote significant differences between groups at P≤0.05
[b] Different letters denote significant differences between groups at P≤0.05
[A] Different letters denote significant differences between groups at P≤0.01
[B] Different letters denote significant differences between groups at P≤0.01

Conclusion

Regardless of significant effect of castration on sensory and organoleptic characteristics of pork in conclusion we scan state that the meat of boars in our experiment contained lower amount of intramuscular fat in comparison with barrows and simultaneously higher amount of total protein and total water. The content of cholesterol in MLT was also lower in the group of boars in comparison with the group of borrows. Chemical composition of intramuscular fat in MLT and belly identified in the group of boars showed optimal composition of individual fatty acids groups. From a nutritional point of view, meat of boars was characterized by a higher amount of ω3 and ω6 fatty acids and a lower amount of saturated fatty acids in the MLT and the belly.

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