EFFECT OF NUTRITION ON FATTY ACID PROFILE AND QUALITY OF PORK IN TWO GENOTYPES

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Introduction

Modern society is concerned about the importance of meat in the diet, and the consequences of consuming pork fat in human health. High levels of fat consumption and particularly of saturated fatty acids have been associated with increased serum LDL-cholesterol, and increased risk of coronary heart disease in humans (Department of Health, 1994). The trend in human nutrition is towards a higher intake of polyunsaturated fatty acids, especially n-3 fatty acids. However, greater contents of highly unsaturated fatty acids in pork fat may cause reduced storage stability, rancidity, off-flavours, and poor processing properties. Miller *et al.* (1990) showed that diets with high levels of monounsaturated fatty acids increased the amount of oleic acid in adipose tissues without adversely affecting carcass quality. Vitamin C has been used in different ways to enhance lean colour stability of meat during display. The aim of this study was to evaluate the effect of feeding a diet rich in oleic acid and supplementation with antioxidants (Biocitro®) on the fatty acid profile of intramuscular and subcutaneous fat and pork quality in two genotypes.

Materials and Methods

One hundred sixty eight pigs from 2 sexes (barrows and gilts) and 2 genotypes were fed one of three finishing diets: 1) grain and soy diet (CONTROL); 2) grain and soy plus 3.83 % high oleic acid supplement (HO); and 3) grain and soy plus 3.83% HO plus 200 ppm Biocitro® (HO-ANTX). Animals (60 kg live weight) were fed CONTROL (n=53) and HO (n=115) diets until they reached 90 kg live weight. During the finishing period animals were fed the 3 diets (CONTROL n=53, HO n=55, and HO-ANTX n=60) until slaughter. Diets had similar nutrient content and diet composition is shown in Table 1. Genotypes were crosses of Landrace(LD)*Large White(LW) with Pietrain (negative for the halothane gene, NN) or Large White and were slaughtered at 115 (fresh pork market) and 130 kg (processed ham market), respectively. The high oleic acid supplement is a natural byproduct of the olive industry composed of a mixture of Ca-salts rich in oleic acid. Biocitro® is a natural byproduct of the citric juice industry and a rich source of vitamin C and flavonoids. Muscle samples of *longissimus thoracis* and subcutaneous fat from *semimembranosus* muscle were taken at 24 h postmortem. Lipids were extracted following the chloroform-methanol procedure of Folch *et al.* (1957), and converted to fatty acid methyl esters following the method of ISO 5509-1978 (E) and analyzed using GC (BP70-SGE, USA). Colour and lipid stability were evaluated on *longissimus* chops packaged in MAP (70%O_2, 30%CO_2) and displayed for 10 days at 4°C in a lighted cooler using a Minolta chromameter (CR-400, Osaka, Japan) and TBARS procedure (Kornbrust and Mavis, 1980), respectively. There were no interactions (P>0,05) between sex and diet, and results are presented as main effects.

Table 1: Diet composition.

Composition, %	CONTROL	HO	HO-ANTX
Corn	25.0	5.0	5.0
Barley	26.9	47.2	47.2
Wheat	20.0	20,0	20.0
Soy	22.3	20.3	20.3
Fat	2.90	1.39	1.39
High oleic acid supplement	-	3.83	3.83
Biocitro®	-	-	0.02
Lysine	0.24	0.27	0.27

Results and Discussion

There were no differences (P>0.05) in the fatty acid profile of intramuscular and subcutaneous fat between HO and HO-ANTX for Pietrain and Large White crosses. CONTROL muscle from Pietrain animals had lower percent of C16:0, C18:1 and MUFA, greater percent of C18:2 and PUFA, and higher PUFA:SFA and n-6:n-3 ratios compared with *longissimus* from HO and HO-ANTX fed animals. Intramuscular fatty acid profile from Large White animals showed similar pattern to Pietrain, but only C18:0 percent was lower and n-6:n-3 ratio was higher (P<0.05) for CONTROL compared with HO and HO-ANTX. Values for PUFA:SFA are above the recommended ratio of 0.45 (Department of Health, 1994). However, n6:n3 ratios are well above the recommended value of 4.0, being lower (P<0.05) for animals

fed HO compared with CONTROL. Subcutaneous fat was more unsaturated than intramuscular fat for all diets and both genotypes. CONTROL subcutaneous fat from Pietrain pigs had lower percent of C18:1 and MUFA, greater percent of C18:0, C18:2, SFA, and higher n-6:n-3 ratio than HO and HO-ANTX fed pigs. Subcutaneous fat from Large White CONTROL animals had lower percent of C18:1 and MUFA, greater percent of C16:0, C18:2, SFA, PUFA and higher n-6:n-3 ratio than HO and HO-ANTX. Although the n-6:n-3 ratio is lower for subcutaneous compared with intramuscular fat, values are higher than 4.0 and lower for HO and HO-ANTX compared with CONTROL. Minolta and TBARS results (data not shown) indicated that animal supplementation with Biocitro® did not offer advantages in improving colour and lipid stability of pork chops displayed during 10 days at 4°C.

Table 2: Fatty acid composition of *longissimus thoracis* intramuscular fat and *semimembranosus* subcutaneous fat from CONTROL, HO and HO-ANTX in two genotypes.

Fatty Acid, %	(LD*LW) * Pietrain				(LD*LW)*Large White			
Intramuscular fat (LT)*	CONTROL	HO	HO-ANTX	RMSE†	CONTROL	HO	HO-ANTX	RMSE†
16:0, *palmitic*	22.31^{a}	23.02^{ab}	23.55^{b}	1.283	22.37	22.75	23.09	2.118
18:0, *estearic*	12.88	12.79	12.92	0.841	12.63^{a}	12.93^{ab}	13.58^{b}	1.118
18:1, *n-9 oleic*	32.62^{a}	36.72^{b}	36.44^{b}	4.287	31.61	34.46	35.38	5.262
18:2, *n-6 linoleic*	16.97^{b}	13.29^{a}	13.35^{a}	4.091	17.32	14.38	13.99	5.615
18:3, *n-3 linolenic*	0.47	0.46	0.44	0.083	0.43	0.45	0.44	0.126
SFA	36.77^{a}	37.45^{ab}	38.13^{b}	1.958	36.46	37.20	38.10	3.174
MUFA	40.05^{a}	44.69^{b}	44.42^{b}	4.776	39.16	42.05	42.57	5.842
PUFA	23.23^{b}	17.85^{a}	17.50^{a}	5.977	24.38	20.70	19.33	8.735
PUFA:SFA	0.64^{b}	0.49^{a}	0.46^{a}	0.184	0.69	0.59	0.53	0.282
n-6:n-3	21.79^{b}	18.89^{a}	19.29^{a}	3.733	23.32^{b}	19.77^{a}	19.25^{a}	2.983
Subcutaneous fat (SM)*								
16:0, *palmitic*	19.83	19.38	19.50	0.900	21.23^{b}	20.09^{a}	20.89	1.128
18:0, *estearic*	10.17^{b}	9.08^{a}	9.35^{a}	1.073	11.10	10.52	11.36	1.284
18:1, *n-9 oleic*	41.21^{a}	44.46^{c}	43.19^{b}	1.735	41.58^{a}	44.78^{b}	43.94^{b}	1.261
18:2, *n-6 linoleic*	16.93^{b}	15.12^{a}	16.04^{ab}	1.747	14.70^{b}	13.31^{a}	13.20^{a}	1.628
18:3, *n-3 linolenic*	1.30	1.31	1.36	0.197	1.04	1.10	1.08	0.163
SFA**	32.00^{b}	30.45^{a}	30.87^{a}	1.594	34.39^{b}	32.46^{a}	34.15	1.985
MUFA**	47.95^{a}	51.41^{c}	50.02^{b}	1.907	48.30^{a}	51.64^{b}	50.25^{b}	1.616
PUFA**	20.05^{b}	18.14^{a}	19.11^{ab}	2.045	17.38^{b}	15.90^{a}	15.60^{a}	1.884
PUFA:SFA	0.63	0.60	0.63	0.089	0.51	0.49	0.46	0.082
n-6:n-3	11.31^{c}	9.83^{a}	10.61^{b}	0.942	12.05^{b}	10.78^{a}	10.76^{a}	0.593

†RMSE: root mean-square error, *LT: *longissimus thoracis*, SM: *semimembranosus*; **SFA: saturated, MUFA: monounsaturated, PUFA: polyunsaturated fatty acids. Means within the same row with different letters differ P<0.05

Conclusions

Dietary supplementation with 3.83% of high oleic acid supplement was effective in increasing oleic acid and MUFA percent of intramuscular and subcutaneous fat in finishing Pietrain and Large White crossed pigs offering the consumer a healthier product. Treated animals showed a more favourable n-6:n-3 ratio than control, but higher than current nutritional recommendations. Supplementation with 200 ppm Biocitro® did not improve colour and lipid stability of fresh pork.

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