EFFECT OF DIETARY FATTY ACID PROFILE ON PORK CARCASS FAT CONTENT AND DISTRIBUTION

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Introduction

The pork industry has made significant efforts to decrease total amount of fat deposited in pigs through genetics, nutrition and management. There is also a trend in human nutrition towards a higher intake of polyunsaturated fatty acids (PUFAs). It is well known that the amount and fatty acid composition of the diet in monogastric species such as chickens and pigs influences carcass fat quality. Previous research has shown that diets rich in PUFAs reduce abdominal fat in broilers compared with saturated or monounsaturated fats (Crespo and Esteve-Garcia, 2002). In addition, Shimomura *et al.*, (1990) reported less body fat accumulation in rats fed a safflower oil diet than in rats fed a beef tallow diet. The aim of this study was to evaluate the effect of dietary fatty acid profile on pork carcass fat content and distribution.

Materials and Methods

Sixty crossbred (Duroc x Landrace) gilts (61 kg average live weight) were fed a basal diet (barley and soybean meal) supplemented with 10% of the following fats and oils: 1) tallow (T); 2) high oleic sunflower oil (HOSF); 3) sunflower oil (SFO); 4) linseed oil (LO); 5) fat blend: 55% tallow, 35% sunflower oil, 10% linseed oil (FB); or 6) fish oil blend: 40% fish oil, 60% linseed oil (FO). Diets had similar nutrient content differing in the fatty acid (FA) profile (Table 1). Feed lipids were extracted following the procedure of Folch *et al.*, (1957), converted to fatty acid methyl esters using BF_3 and methanolic KOH (Morrison and Smith, 1964) and analyzed using GC (Agilent 6890N, Wilmington, DE, USA). Gilts were slaughtered (97 kg average live weight) using CO_2 stunning and carcass and flare fat weights were recorded within 1 h postmortem. Fat and muscle depths were measured using the Fat-O-Meat'er probe and carcass lean percentage estimated according to Gispert and Diestre (1994). The left side of each carcass was cut and the loin and belly dissected into lean, fat and bone following the procedure of Walstra and Merkus (1995). The right side of each carcass was reduced into small pieces, frozen, ground (Grinder Cato-PA160, Spain), homogenized and subsamples (500 g) collected. Fat content of the ground carcass was determined following the ether extraction method 960.39 (AOAC, 1990). Intramuscular fat of *longissimus thoracis* (LT) and *semimembranosus* (SM) muscles was determined by Near Infrared Transmittance (NIT-Infratec 1265).

Table 1: Fat content and fatty acid composition of the experimental diets (g/kg feed).

	T	HOSF	SFO	LO	FB	FO
Fat content	124.5	134.2	130.2	113.9	120.9	115.6
Fatty acids						
Palmitic	28.7	7.87	11.2	8.21	20.0	13.0
Stearic	22.9	4.6	5.6	3.6	12.8	4.1
Oleic	34.8	86.8	32.5	20.7	29.5	19.0
Linoleic	14.2	21.5	73.3	26.2	26.0	21.5
Linolenic	1.9	1.3	1.3	47.1	18.9	31.2
Long chain PUFAs	2.5	3.2	9.9	13.5	8.0	19.7
Sum PUFAs	16.4	22.8	74.5	73.4	45.3	71.0

T=tallow; HOSF= high oleic sunflower oil; SFO= sunflower oil; LO=linseed oil; FB= fat blend; FO=fish oil blend

Results and Discussion

Dietary fat sources differed in the fatty acid profile showing higher values of PUFAs for SFO, LO and FO followed by FB, with lower values for HOSF and T (Table 1). Although fat content of ground carcass and intramuscular fat of LT and SM muscles were numerically lower for LO compared with other diets, values did not differ ($P>0.05$) among dietary treatments (Table 2). Diets SFO and LO showed lowest values of fat content of ground carcass and SM intramuscular fat, while HOSF showed highest values for carcass and SM fat percentage. There were no differences ($P>0.05$) among treatments in carcass characteristics with the exception of estimated carcass lean percentage which was higher ($P<0.05$) for T than HOSF and SFO (Table 3). There were no differences ($P>0.05$) among treatments in ham and shoulder percentage. Dietary SFO fed animals showed higher ($P<0.05$) percentage of loin compared with FB, and higher ($P<0.05$) percentage of belly than T. Results from primal dissections showed no differences ($P>0.05$) in lean, fat and bone percentages of the loin among treatments (Table 4). Lean percentage of the belly was higher ($P<0.05$) and fat percentage was lower ($P<0.05$) for T and LO compared with HOSF.

Table 2: Fat content of ground carcass and intramuscular fat of *longissimus thoracis*, and *semimembranosus* muscles.

Fat content, %	T	HOSF	SFO	LO	FB	FO	RMSE
Carcass	23.7	24.4	21.5	21.2	23.1	23.7	2.803
Longissimus thoracis	1.53	1.65	1.51	1.37	1.46	1.64	0.418
Semimembranosus	2.85	3.29	2.60	2.56	2.73	2.64	1.100

RMSE: root mean-square error

Table 3: Carcass characteristics and percentage of major primal cuts.

Carcass characteristics	T	HOSF	SFO	LO	FB	FO	RMSE
Carcass weight, kg	77.9	78.7	76.3	74.8	79.1	73.5	6.798
Flare fat %	1.50	1.85	1.83	1.61	1.63	1.69	0.300
Last rib fat depth, mm	13.5	15.8	15.8	14.3	14.1	14.8	2.071
Estimated lean %	56.2[b]	53.4[a]	53.6[a]	55.3[ab]	55.4[ab]	54.7[ab]	1.947
Major primal cuts, % of carcass							
Ham	24.5	24.4	24.2	24.7	24.6	24.3	0.815
Loin	18.3[ab]	17.7[ab]	18.4[b]	17.9[ab]	17.3[a]	18.0[ab]	0.891
Shoulder	13.9	13.7	13.6	13.6	13.8	13.9	0.536
Belly	9.07[a]	9.83[ab]	9.87[b]	9.48[ab]	9.82[ab]	9.47[ab]	0.659

Means within the same row with different letters differ $P<0.05$
RMSE: root mean-square error

Table 4: Dissection of loin and belly into lean, fat and bone.

Loin dissection, %	T	HOSF	SFO	LO	FB	FO	RMSE
Lean	54.7	51.4	51.0	54.2	53.8	52.0	3.197
Fat*	34.3	37.8	38.4	34.9	34.8	36.6	3.567
Bone	11.1	10.9	10.6	11.0	11.4	11.5	0.998
Belly dissection, %							
Lean	49.0[b]	44.9[a]	47.2[ab]	49.3[b]	48.3[ab]	47.9[ab]	2.798
Fat*	42.9[a]	47.3[b]	44.7[ab]	42.6[a]	43.9[ab]	43.9[ab]	3.172
Bone	8.15	7.85	8.12	8.06	7.75	8.17	1.094

*Skin-on
RMSE: root mean-square error

Conclusions

Dietary supplementation with fat sources differing in the fatty acid profile showed minor changes in pork carcass fat content and distribution. Preliminary results from this study suggest that diets rich in polyunsaturated fatty acids may affect lipid content differently in swine compared to other monogastric species such as chickens.

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