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RESEARCH ARTICLE

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Differential response of Iberian and lean pig crossbreeds to dietary linoleic acid administration

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Abstract

We aimed to determine whether the response of linoleic acid (C18:2 n-6) tissue concentration to dietary C18:2 n-6 administration, in the finishing period, is done in a different way in Iberian pig compared with a lean genotype. Therefore, 48 pigs, 24 of a lean genotype (Large White × Great York) and 24 of a fat genotype (Iberian × Duroc) were offered three commercial diets, for each genetic type, in order to provide three levels of C18:2 n-6, but maintaining constant the concentration of saturated and linolenic fatty acids (FA) in each genotype. Samples from adipose tissue (subcutaneous backfat and intramuscular fat (IMF) from *Longissimus dorsi* muscle) were taken. Six pigs of each genotype (two per each C18:2 n-6 level) were slaughtered at the start of the trial to estimate initial fatty acids composition. The C18:2 n-6 proportions at slaughter were higher in the subcutaneous backfat outer layer than in subcutaneous backfat inner layer for both genetic types. In both backfat layers, as the dietary C18:2 n-6 increased, the C18:2 n-6 proportions also increased in both genotypes. In IMF, the concentration of C18:2 n-6 was also altered in lean genotype according to dietary treatment, but no response was observed in Iberian pigs. Linoleic acid concentrations was higher in lean pig genotypes than in the Iberian pig, both in subcutaneous and IMF throughout the whole range of dietary linoleic acid concentration used in this experiment. These results indicate the resistance of Iberian pig to modify the proportion of linoleic in their tissues, particularly in the IMF.

Additional key words: genetic type; metabolism; swine.

Introduction

It is generally believed that nutrition is the main factor through which the lipids and fatty acids (FA) deposition in pigs may be altered (Kloareg *et al.*, 2007). Body fat accumulation may be considered the net result of the balance among dietary absorbed fat, endogenous fat synthesis (lipogenesis) and fat catabolism through beta-oxidation (lipolysis) (Sanz *et al.*, 2000).

The Iberian (IB) breed is the most important Mediterranean pig type, both in population size and in economic importance. IB pigs are characterized by early maturity, dark coat and reduced lean deposition (Nieto *et al.*, 2002). In order to improve productivity, IB pigs are frequently crossed with Duroc. As a result, the hybrids have better productive variables, without a serious reduction of the adaptability to the environment and on the quality of the dry-cured-meat products (López-Bote, 1998). The levels of linoleic acid (C18:2 n-6) in pig fatty tissues is of importance, particularly in meats used for the production of quality meat products, since it is negatively associated with meat quality characteristics, such as consistency, appearance, susceptibility to rancidity and off-flavour and impaired water migration (López-Bote, 1998).

Although numerous studies have been carried out to study the relationship between nutrition and tissue FA

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Abbreviations used: FA (fatty acids); IB (Iberian); IB*D (Iberian × Duroc); IMF (intramuscular fat); LW*GY (Large White × Great York); MUFA (monounsaturated fatty acids); PUFA (polyunsaturated fatty acids); SEM (standard error of mean); SFA (saturated fatty acids).

composition (Wiseman & Agunbiade, 1998; Ostrowska *et al.*, 2003), these relations are often limited to a single genetic type. Serra *et al.* (1998) and Morales *et al.* (2003) and found that fat depots form IB pigs had higher MUFA (monounsaturated fatty acids) and lower PUFA (polyunsaturated fatty acids) proportions than those in a lean genotype (Landrace pigs), and attributed these differences to the higher lipogenesis of IB adipose tissues. Barea *et al*. (2013) reported that genetic variation in de novo lipid synthesis and pattern of FA unsaturation might contribute to explain differences in back-fat FA profile of IB and Landrac × Large White pigs under nutritional management.

The minimum C18:2 n-6 requirements proposed by the National Research Council (NRC, 2012) for pigs up to 30 kg are 1.5% of digestible energy from 30 to 90 kg. This amount of C18:2 n-6 is easily achievable with concentrated fed ingredients of common use in swine nutrition. It has been reported a lineal relationship between dietary intake of C18:2 n-6 and subcutaneous fat accumulation within a wide range of dietary intake (López-Bote *et al*., 1999; Wood *et al*., 2008). Studies from Ellis & Isbell (1926) showed the implication of dietary C18:2 n-6 as critical in determining carcass fat quality. Values above 150 mg C18:2 n-6 g^{-1} FA in body fat are commonly observed when the dietary fat concentration exceeds approximately 40 g kg^{-1} (Wood *et al.*, 1978). This concentration in pig fat determines a low fat consistency and rancidity problems (Holman, 1998).

Linoleic acid is an essential FA that comes directly from the dietary absorbed fat. It has been proposed that the concentration of C18:2 n-6 in pig fat is directly proportional to the amount consumed (Wood, 1984). However, results from Shimomura *et al.* (1990) in rats and Sanz *et al.* (1999) in broiler chickens, based on respiratory quotient data and carcass fat proportion, indicate that there is a metabolic regulation of C18:2 n-6 accumulation and mobilization, and this may be affected not only by the amount of C18:2 n-6 included in the diet but to some other genetic or metabolic factors, such as membrane fluidity (Pan & Storlien, 1993).

The aim of this study was to investigate the C18:2 n-6 concentration in Iberian × Duroc (IB*D) crossbreeds and in Large White × Great York (LW*GY) pigs submitted to a wide range of dietary C18:2 n-6 concentrations normally used in formulated feeds for these genotypes.

Material and methods

Twenty four LW*GY females with an average weight of 54.2 ± 1.92 kg (mean ± SEM) and another twenty four IB*D females with an average weight of 102.8 ± 2.1 kg, which are the normal weights to start the finishing period for each genotype, were randomly distributed and located in individual cages and given three experimental diets. The IB*D pigs were 10 months old and the LW*GY pigs were 6 months old.

Diets were provided *ad libitum* during 42 and 56 days for LW*GY and IB*D pigs, respectively. The diets were formulated to contain a wide range of C18:2 n-6 in each genetic type, but maintaining constant the concentration of saturated and linolenic FA. The average daily intake was of 2.60 ± 0.28 kg and 3.50 ± 0.31 kg for LW*GY and IB*D pigs, respectively. Ingredients, chemical composition and main FA of experimental diets are shown in Table 1. Dietary treatments were formulated to contain similar nutrient and energy concentration, and to meet the nutritional requirements of the finishing diets at these ages as recommended by FEDNA (2006). Six pigs of each genotype (two per each C18:2 n-6 level) were slaughtered at the start of the trial to estimate initial FA composition.

Dietary FA were extracted and quantified by the one-step procedure as described by Sukhija & Palmquist (1988) in lyophilized samples. Pentadecanoic acid (C15:0) (Sigma, Alcobendas, Madrid, Spain) was used as internal standard. Previously methylated FA samples were identified by gas chromatography as described elsewhere (López-Bote *et al.*, 1997) using a 6890 Hewlett Packard gas chromatograph and a 30 × 0.32 mm × 0.25 µm cross-linked polyethylene glycol capillary column. A temperature program of 170 to 245°C was used. The injector and detector were maintained at 250°C. The carrier gas (helium) flow rate was 2 mL min^{-1}.

The LW*GY and IB*D pigs were slaughtered at a local slaughterhouse at 42 and 56 days after the beginning of experimental period with an average weight of 97.3 and 151.7 kg, respectively, which is within the normal range of slaughter weight for each genotype. A piece of backfat from over the last rib was removed and separated into inner and outer layers which were independently analysed for FA composition at the beginning and at the end of the experiment. Also, a sample of the *Longissimus dorsi* muscle at the level of the last rib was taken for the FA analysis at slaughter. Lipids from subcutaneous backfat were extracted by the

Table 1. Ingredients, calculated composition and analyzed fatty acid composition of the experimental diets (g kg^{-1} as fresh matter basis)

Dietary C18:2 n-6	(LW*GY) diet[1]			(IB*D) diet[2]		
	13.1	**16.2**	**19.2**	**8.7**	**13.5**	**16.7**
Ingredients						
Barley	591.0	591.0	591.0	500.0	500.0	500.0
Wheat	159.0	159.0	159.0	381.0	381.0	381.0
Soyabean meal, 44% CP[3]	183.0	183.0	183.0	41.2	41.2	41.2
Added fat						
Lard	22.0	22.0				
Iberian pig lard				15.4	18.7	22.0
Olive oil	8.0			24.6	12.3	
Sunflower oil		8.0	22.0		9.0	18.0
Hydrogenated fat			8.0			
Sodium chloride	4.0	4.0	4.0	4.0	4.0	4.0
Calcium carbonate	7.0	7.0	7.0	9.9	9.9	9.9
Bicalcium phosphate	13.0	13.0	13.0	20.0	20.0	20.0
Lysine (50%)	8.0	8.0	8.0	1.4	4.1	1.4
Vitamin and mineral premix	5	5	5	2.5	2.5	2.5
Calculated composition of nutrients[4]						
Net energy (kcal kg^{-1})	2,371.8	2,373.5	2,367.5	2,483.4	2,484.5	2,485.7
Dry matter (g kg^{-1})	916.3	916.3	916.3	890.8	890.8	890.8
Crude protein (g kg^{-1})	171.8	171.8	171.8	124.9	124.9	124.9
Crude fibre (g kg^{-1})	42.0	42.0	42.0	36.0	36.0	36.0
Analysed major fatty acids						
Total fatty acids	46.2	44.3	43.3	43.7	44.2	45.8
C16:0	9.7	8.9	7.5	9.0	9.1	9.0
C18:0	3.0	3.2	4.9	2.8	2.7	2.7
C18:1 n-9	15.4	12.4	8.1	19.0	14.5	12.6
C18:2 n-6	13.1	16.2	19.2	8.7	13.5	16.7
C18:3 n-3	1.0	1.0	0.9	1.2	1.2	1.2
Σ SFA[5]	13.8	13.5	13.8	12.3	12.5	12.5
Σ MUFA[6]	17.4	13.5	8.2	20.6	16.4	14.3
Σ PUFA[7]	14.9	17.4	21.3	10.9	15.3	19.1

[1] LW*GY: Large White × Great York genotype. [2] IB*D : Iberian × Duroc genotype. [3] CP: crude protein. [4] According to FEDNA (2010). [5,6,7] SFA: saturated fatty acids; MUFA: monounsaturated fatty acids; PUFA: polyunsaturated fatty acids.

procedure proposed by Bligh & Dyer (1959), and intramuscular fat (IMF) from *Longissimus dorsi* muscle was obtained according to the method developed by Marmer & Maxwell (1981). Fat extracts were methylated in the presence of sulphuric acid and analysed as described above.

Statistical analysis

The effects of dietary C18:2 n-6 on FA composition from backfat outer and inner layers and IMF were analysed with the GLM procedure of SAS (2010). The C18:2 n-6 level was considered as main effect in each experimental period for both genotypes. LSD test was applied to compare the mean values within the different diets.

Results

The FA composition of subcutaneous backfat outer and inner layers from LW*GY according to experimental diets is shown in Table 2 and from IB*D is shown in Table 3. No significant differences were found in FA composition at the beginning of the experiment.

Table 2. Fatty acid composition (g/100 g of total fatty acids) from subcutaneous inner and outer backfat layers in lean pig crossbreed at the beginning and at the end of a seven weeks experimental administration of diets with different C18:2 n-6 concentration

Sampling time	Layer	Dietary C18:2 n-6 (g kg^{-1})	C16:0	C18:0	C18:1 n-9	C18:2 n-6	C18:3 n-3	SFA[1]	MUFA[2]	PUFA[3]
Initial	Inner	13.1	25.12	17.55	38.44	10.64	0.47	44.42	44.12	11.46
	Inner	16.2	25.52	18.24	37.83	10.30	0.40	45.57	43.40	11.03
	Inner	19.2	25.92	18.10	37.79	9.98	0.41	45.87	43.40	10.73
		RMSE[4]	1.53	0.74	1.89	0.62	0.17	1.83	1.95	0.74
		p-value[5]	ns	ns	ns	ns	ns	ns	ns	ns
Final	Inner	13.1	23.40	16.53	42.25^{a}	9.80^{b}	0.64	42.05	47.05^{a}	10.90^{b}
	Inner	16.2	21.74	16.38	40.64^{a}	13.44^{a}	0.73	40.21	45.21^{ab}	14.58^{a}
	Inner	19.2	22.08	16.29	38.47^{b}	14.99^{a}	0.67	40.53	43.32^{b}	16.15^{a}
		RMSE	1.862	1.354	1.615	1.998	0.147	2.763	1.898	2.244
		p-value	ns	ns	< 0.001	< 0.001	ns	ns	< 0.01	< 0.001
Initial	Outer	13.1	25.38	14.57	39.48	10.08	0.63	41.69	45.64	12.66
	Outer	16.2	26.74	14.96	39.18	10.22	0.42	43.56	45.09	11.35
	Outer	19.2	26.58	15.34	38.87	10.38	0.35	43.78	44.81	11.41
		RMSE	1.16	0.47	0.51	0.77	0.20	1.65	0.61	1.13
		p-value	ns	ns	ns	ns	ns	ns	ns	ns
Final	Outer	13.1	22.74	12.69	42.25	12.52	0.80	37.05	48.45	14.50
	Outer	16.2	22.11	12.51	41.56	14.14	0.84	36.19	47.56	16.25
	Outer	19.2	21.71	12.84	41.66	14.70	0.74	36.10	47.26	16.64
		RMSE	0.59	1.17	1.20	1.55	0.07	2.02	1.45	1.67
		p-value	ns	ns	ns	ns	ns	ns	ns	ns

[1] SFA: saturated fatty acids. [2] MUFA: monounsaturated fatty acids. [3] PUFA: polyunsaturated fatty acids. [4] RMSE: root mean square error. [5] *p*-value: significance of genotype effect; ns: not significant; different letters in the same column indicate significant statistical differences ($p < 0.05$).

After 42 days, the LW*GY pigs showed significant differences for C18:1 n-9, C18:2 n-6, MUFA and PUFA in the inner layer, while in the IB*D pigs, after 56 days, we found a higher concentration of C18:2 n-6 in both, inner and outer, layers in the pigs fed the highest level of dietary C18:2 n-6 (18.8 g kg^{-1}). Also the C18:0 concentration in the inner layer was higher in IB*D pigs fed 13.5 g kg^{-1} and 16.7 g kg^{-1} than in those fed with 8.7 g kg^{-1} of C18:2 n-6.

The most marked effect induced by dietary treatment was observed for C18:1 n-9 and C18:2 n-6 concentration in the inner and outer backfat layers. This was expected because diets were formulated to provide a marked range in the concentration of these two FA. Backfat C18:2 n-6 concentration increased in both layers from LW*GY genotype but remained almost constant in the IB*D genotype. The average daily feed intake in dry matter was 2.60 ± 0.28 kg and 3.50 ± 0.31 kg for LW*GY and IB*D pigs, respectively, whereas C18:2 n-6 concentration of backfat in the outer layer was lower in IB*D than in LW*GY pigs. In addition the C18:2 n-6 concentration of intramuscular lipids exhibited a similar response to C18:2 n-6 dietary intake (g kg^{-1}) in both genetic types (Table 4), although in this tissue the relationship between C18:2 n-6 consumption and proportion in IB*D genotype, did not show any response (Fig. 1). The IMF was higher in LW*GY pigs fed the lowest level of linoleic acid but we did not find any differences in the IB*D genotype.

Discussion

Linoleic acid is an essential FA that cannot be synthesised by pigs and therefore, accumulation in pig tissues depends on dietary intake (Wood, 1984). Moreover we must consider that breed and sex also affect fat quality and it is important to know whether these effects are independent from the amount of body fat or there are interactions with other dietary constituents (Wood *et al*., 2008).

Table 3. Fatty acid composition (g/100 g of total fatty acids) from subcutaneous inner and outer backfat layers from IB*D pigs at the beginning and the end of a eight weeks experimental administration of diets with different C18:2 n-6 concentration

Sampling time	Layer	Dietary C18:2 n-6 (g kg^{-1})	C16:0	C18:0	C18:1 n-9	C18:2 n-6	C18:3 n-3	SFA[1]	MUFA[2]	PUFA[3]
Initial	Inner	8.7	25.94	15.24	38.79	9.98	0.50	42.97	45.51	11.51
	Inner	13.5	25.34	14.84	39.26	10.20	0.50	41.94	46.26	11.81
	Inner	16.7	25.50	15.68	39.20	10.07	0.48	42.87	45.47	11.66
		RMSE[4]	0.53	0.65	0.50	0.42	0.05	1.74	0.64	0.50
		p-value[5]	ns	ns	ns	ns	ns	ns	ns	ns
Final	Inner	8.7	25.53	15.59^{b}	41.70^{a}	7.81^{b}	0.46	42.78	48.06^{a}	9.19^{b}
	Inner	13.5	26.16	17.60^{a}	39.16^{b}	8.09^{b}	0.44	45.45	45.06^{b}	9.52^{b}
	Inner	16.7	25.51	17.52^{a}	39.14^{b}	9.19^{a}	0.42	44.67	44.69^{b}	10.64^{a}
		RMSE	1.30	1.30	1.68	0.58	0.03	2.10	1.81	0.66
		p-value	ns	< 0.01	< 0.01	< 0.001	ns	ns	< 0.01	< 0.01
Initial	Outer	8.7	25.37	13.93	40.41	9.28	0.43	41.23	48.48	10.87
	Outer	13.5	25.82	13.83	40.18	9.21	0.50	41.50	48.18	10.95
	Outer	16.7	25.31	14.01	40.46	9.55	0.54	41.16	48.10	11.45
		RMSE	0.56	0.30	0.24	0.78	0.06	0.74	0.38	0.97
		p-value	ns	ns	ns	ns	ns	ns	ns	ns
Final	Outer	8.7	22.31	13.71	44.37^{a}	8.83^{b}	0.45^{b}	37.59	52.52^{a}	10.69^{b}
	Outer	13.5	23.75	14.59	41.56^{b}	9.07^{b}	0.63^{a}	40.07	49.49^{b}	11.50^{a}
	Outer	16.7	23.40	14.18	41.41^{b}	10.59^{a}	0.48^{b}	39.29	49.02^{b}	12.51^{a}
		RMSE	1.782	1.167	2.274	0.8814	0.076	2.66	2.49	1.027
		p-value	ns	ns	< 0.05	< 0.001	< 0.05	ns	< 0.05	< 0.01

[1] SFA: saturated fatty acids. [2] MUFA: monounsaturated fatty acids. [3] PUFA: polyunsaturated fatty acids. [4] RMSE: root mean square error. [5] *p*-value: significance of genotype effect; ns: not significant; different letters in the same column indicate significant statistical differences ($p < 0.05$).

The evolution of subcutaneous FA composition in the present experiment showed a marked effect of diet in C18:2 n-6 concentration in LW*GY. The average value in both layers at the beginning and at the end of the experiment was 102.6 mg kg^{-1} and 132.6 mg kg^{-1}, respectively, whereas that for IB*D was 97.2 mg kg^{-1} at the beginning and 89.3 mg kg^{-1} at slaughter. The C18:2 n-6 proportion in the inner layer from LW*GY pigs fed with 19.2 g kg^{-1} reached a value of 149.9 mg g^{-1} which is close to the recommended limits to prevent consistency problems on carcasses (Wood, 1984). However, in IB*D pigs, the inclusion of 16.7 g kg^{-1} of C18:2 n-6 in the diet reached the highest value in the outer layer (105.9 mg g^{-1}), far from problematic standards.

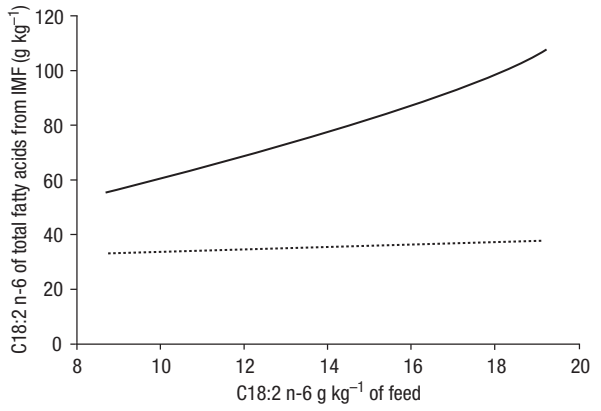

Figure 1. Effect of dietary C18:2 n-6 concentration (g kg^{-1}) on C18:2 n-6 (g kg^{-1} of total fatty acids) in intramuscular fat (IMF) in LW*GY (continuous line) and IB*D (dotted line) pigs at slaughter.

The C18:2 n-6 proportions in pig adipose tissue declines as fat deposition proceeds and it is considered an index of fatness (Wood *et al*., 2008). Kouba *et al*. (2003) found a decrease of 45% of C18:2 n-6 after 100 days with pigs of 40 kg fed a control diet with 10.25 g of linoleic acid kg^{-1} diet. However, higher dietary C18:2 n-6 concentrations are frequently used in the commercial setting, since most vegetable oils contains high concentration (> 50%) of this FA and the increase of C18:2 n-6 in the adipose tissue can be a technological problem related with meat quality. In our ex-

Table 4. Effect of genotype and dietary linoleic acid content on the fatty acid profile (g/100 g of total fatty acids) of intramuscular fat (IMF) at the end of experimental period

Dietary C18:2 n-6 (g kg^{-1})	IMF (%)	C16:0	C18:0	C18:1 n-9	C18:2 n-6	C18:3 n-3	SFA[1]	MUFA[2]	PUFA[3]
*Genotype LW*GY*[4]									
13.1	3.89	21.95	13.29	45.44^{a}	7.38^{b}	0.38^{b}	36.57	53.63^{a}	9.74^{b}
16.2	2.29	22.19	13.11	44.46^{ab}	8.68^{b}	0.34^{b}	36.57	52.94^{ab}	10.49^{b}
19.2	1.31	21.66	13.09	43.42^{b}	10.78^{a}	0.61^{a}	36.03	50.93^{b}	13.03^{a}
RMSE[5]	1.01	1.01	1.46	1.96	1.74	0.17	1.73	2.44	2.29
p-value[6]	< 0.05	ns	ns	< 0.05	< 0.001	< 0.01	ns	< 0.05	< 0.01
*IB*D*[7]									
8.7	5.8	24.75	12.0^{b}	44.87	3.27	0.66^{a}	39.18	54.77	6.05^{a}
13.5	5.3	25.61	11.79^{b}	44.51	3.53	0.50^{a}	39.48	54.56	5.96^{a}
16.7	6.5	25.85	12.91^{a}	45.38	3.59	0.27^{b}	40.47	54.75	4.74^{b}
RMSE	1.96	1.74	1.10	1.77	0.51	0.26	2.73	2.18	1.06
p-value	ns	ns	< 0.05	ns	ns	< 0.01	ns	ns	< 0.01

[1] SFA: saturated fatty acids. [2] MUFA: monounsaturated fatty acids. [3] PUFA: polyunsaturated fatty acids. [4] LW*GY: Large White × Great York. [5] RMSE: root mean square error. [6] *p*-value: significance of genotype effect; ns: not significant; different letters in the same column indicate significant statistical differences ($p < 0.05$). [7] IB*D: Iberian × Duroc.

periment the highest dietary linoleic content was 19.2 g kg^{-1} and 16.7 g kg^{-1} for the LW*GY and IB*D pigs, respectively. Moreover LW*GY pigs were six months old at slaughter while IB*D pigs were ten months old, which may possibly be one of the factors that could explain the differences in C18:2 n-6 concentration found in the present trial. However, the daily linoleic intake was in the range from 34.1 to 49.9 g for the LW*GY and from 30.5 to 58.5 g per day for the IB*D pigs, this fact means that the range of total linoleic intake in fresh matter was 1.8 times higher for IB*D than for LW*GY pigs, well above the amounts referenced in previous studies (Serra *et al*., 1998; Barea *et al*., 2013).

The results of the present experiment agree with previous studies, where the proportion of C18:2 n-6 in subcutaneous fat increases linearly as the dietary intake increases (Wood, 1984) in lean genotypes but is consistent with the idea that C18:2 n-6 concentration in subcutaneous and intramuscular tissues is metabolically regulated and therefore the response depends also on the genetic type and probably some other factors. Wood *et al.* (2008) and Chang *et al*. (2003) showed that a variety of factors, such as the proportion of phospholipids in total lipid and the muscle fibre type profile can affect C18:2 n-6 accumulation.

Interestingly, IMF showed even a more marked difference in the response to dietary C18:2 n-6 administration depending on the pig genotype: lean genotype pigs showed a marked C18:2 n-6 proportion in IMF, while IB*D ones are completely reflective to dietary C18:2 n-6 level. It is noteworthy that LW*GY pigs consumed less C18:2 n-6 FA and were slaughtered with a lower weight than IB*D pigs. In spite of that, LW*GY pigs have more concentration of C18:2 n-6 than IB*D pigs during the finishing period. IB pigs and IB crosses with Duroc have a high proportion of red muscular fibres (Andres *et al.*, 1999), which are characterized by a high concentration of mitochondria. It may be speculated that IB pigs and their crosses have a greater capacity for beta oxidation of C18:2 n-6 than lean genotypes, thus maintaining a very low concentration of C18:2 n-6 in intramuscular lipids regardless dietary inclusion level.

In previous studies, the lower essential PUFA and higher SFA contents in obese pigs have been always related to their higher feed intake capacity, resulting in increased lipid deposition, as compared to lean-type pigs (Morales *et al*., 2003), whereas the data from the present experiment suggest that, apart from the dilution effect of the novo synthesis, some other factors could be also involved. A number of experiments have also found different metabolization of C18:2 under distinct productive circumstances. Sanz *et al*. (2000) showed that dietary fat type affects fat accumulation in broiler chickens and Shimomura *et al.* (1990) reported a higher post-pandrial lipoprotein lipase activity in heart and *soleus* muscle or rats fed a diet containing a high concentration of C18:2 n-6 than in those fed on a tallow-enriched diet, suggesting different uptake by tissues.

Bray *et al*. (2002) in clinical studies showed that exercise can enhance the rate of adaptation to a high fat diet by increasing the rate of beta-oxidation. Also, different breeds of rats have different metabolic responses to dietary unsaturated FA (Shan-Ching & Ching-Jang, 2006).

The IMF content was higher in the lean pigs fed the diet with less C18:2 n-6; this result agrees with the studies from Sanz *et al.* (1999), that showed a negative relation between unsaturation index and IMF in broiler chickens. Moreover, the different dietary FA composition could have different effects depending on the genotype (Olivares *et al*., 2009).

In our study, the dietary CP supply was fixed to meet the current recommendations for finishing IB and lean pigs (FEDNA, 2006). In a recent study, Barea *et al*. (2013) showed that lean pigs fed a diet with 17% crude protein presented higher proportions of C18:2 n-6 and PUFA at 38 and 50 kg of body weight in the outer layer than when offered a low protein content diet (13%). In our experiment, we used the same level of crude protein in each genotype.

The results of this experiment indicate that the fate of dietary C18:2 n-6 in swine is largely dependent on anatomical location and on swine genotype. This is of importance because C18:2 n-6 concentration is negatively associated with meat quality characteristics, suggesting that some pig genotypes are refractory to suffer fat quality problems regardless the dietary C18:2 n-6 concentration. This finding also suggests a possible genotype effect on metabolic C18:2 n-6 beta-oxidation, which may have many practical implications in swine nutrition. However, a detailed study is required to clarify the mechanisms that regulate pig C18:2 n-6 deposition in relation to the genetic type.

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