NUTRIGENETIC RESPONSE OF DIETARY LINSEED INCLUSION ON PORK FATTY ACID COMPOSITION IN HALOTHANE GENE CARRIERS

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Abstract – This study assessed whether dietary inclusion of extruded linseed (5%) during the last month of finishing enriched pork n-3 fatty acids, regardless of *RYR1* gene. A total of 88 crossbred pigs were used. At slaughter, fatty acid composition was analysed in caudal loin samples. Linseed increased n-3 PUFA and reduced the pork n-6/n-3 ratio, regardless of gender and *RYR1* genotype (NN *vs.* Nn). However, the halothane carriers fed on linseed showed greater intramuscular fat and MUFA deposition and lower n-6 PUFA content compared to control-fed halothane carriers.

Key Words – health, intramuscular fat, omega-3.

I. INTRODUCTION

Feeding n-3 PUFA to pigs, using linseed, improves pork nutritional quality [1]. However, whether this response is uniform according to gender and genetic background remains unclear. The aim of this study was to evaluate if a 5% dietary inclusion of extruded linseed during the last month of finishing enriched pork n-3 fatty acids, irrespectively of gender (gilts *vs.* barrows) and *RYR1* genotypes (free or NN *vs.* carriers or Nn).

II. MATERIALS AND METHODS

A total of 88 crossbred pigs were allocated into 8 pens (11 pigs each). When the pigs reached 150 days of age (standard deviation, SD = 2 days), half of the pens were provided an enriched n-3 feed (linseed) and the rest were fed a commercial feed (control) during the last 32 days of finishing period (mean initial BW = 88.6 kg, SD = 5.8 kg). The pigs (22 males and 26 females) were the progeny of Pietrain sires and Landrace x Large-White dams. The barrows had been surgery castrated at 5 days of age (SD = 2 days). The pigs were split in pens by sex but were mixed by *RYR1* genotype (halothane free, NN vs. halothane carriers, Nn). The control diet was formulated at the least cost while the experimental diet included 5% of extruded linseed (Valomega 160, Valorex, Pinallet, Spain), which reduced dietary n-6/n-3 ratio from 7.3 to 1.2. Both diets were iso-nutritive (2390 kcal of net energy/kg, 1.05% of total lysine, 16.6% of crude protein, 30 mg/kg vitamin E). At 182 days of age, when average BW was 112.7 kg (SD = 7.6 kg), all the animals were slaughtered at a commercial abattoir (MAFRICA, Barcelona, Spain) 30 km away, where they were kept in lairage for 3 h with full access to water but not to feed (feed withdrawal for 12 h before slaughter). The pigs were stunned by CO_2 using a dip lift system, exsanguinated, scalded, skinned, eviscerated according to standard commercial procedures and split down the midline. A total of 48 pigs were used for meat quality measurements (4-6 replicates per pen, randomly chosen based on frequency of appearance of *RYR1* genotype). Hot carcass weight was recorded before the carcass sides were refrigerated in line processing at 2 ºC. At approximately 45 min postmortem, the loins were excised and trimmed from the carcass. Individual *L. lumborum* samples (400 g) were sliced from the caudal half left loin, packaged in polyethylene bags and stored at 4°C in darkness overnight. Muscle pH was measured in the *L. lumborum* samples of each carcass at 45 min and 24 h post-mortem. IMF content was determined using a NIR meat analyser (XDS NIR Rapid Content Analyser, Foss, Hillerød, Denmark) between 400 and 2200 nm. Muscle fat was extracted in chloroform methanol and butylated hydroxytoluene was used as antioxidant. Fatty acid methyl esters (FAMES) were analysed by GC (Agilent Technologies 6890, Santa Clara, CA) equipped with a FID. Separation was carried out in an Omegawax 320 capillary column (30 m x 0.32 mm i.d., 0.25 mm film thickness) with polyethylene glycol as the stationary phase (Supelco, Bellefonte, USA). GC conditions were: oven temperature 200 ºC held for 60 min with helium as carrier gas (flow rate 1.3 mL/min), injector and detector temperatures were 260 ºC. Individual FAMES were identified by comparing their retention times with those from a known standard Supelco® 37 Component FAME Mix (Supelco, Bellefonte, PA, USA) [2]. The data were analysed with a standard least squares model including as fixed effects linseed, gender and halothane gene and their single interactions. Differences ($P<0.05$) between least square means were assessed using a Tukey test.

III. RESULTS AND DISCUSSION

The average daily gain of the pigs was not affected by diet, sex or *RYR1* (not shown; P>0.05). The loin pH at 45 min and 24 h post-mortem was not affected by diet or sex (not shown; P>0.05), but it was higher in NN than in Nn at 45 min post-mortem (6.48 vs. 6.23±0.07; P<0.05), although no differences were observed at 24 h post-mortem (5.73 vs. 5.76±0.02, respectively; P>0.05). Intramuscular fat (IMF), MUFA and PUFA n-6 contents responded differently to diet according to genotype (P<0.05). No differences were observed between dietary treatments in NN pigs (n=16 for control and n=14 for linseed) but in Nn pigs, the IMF and MUFA contents were lower and the n-6 PUFA was higher in control (n=9) than in linseed (n=9) (Figure 1). Dietary linseed did not affect the pork SFA content but increased n-3 PUFA, regardless of gender and halothane genotype (Table 1). Hence, the pork n-6/n-3 ratio was reduced close to dietary recommendations (5:1 to 10:1) [1].

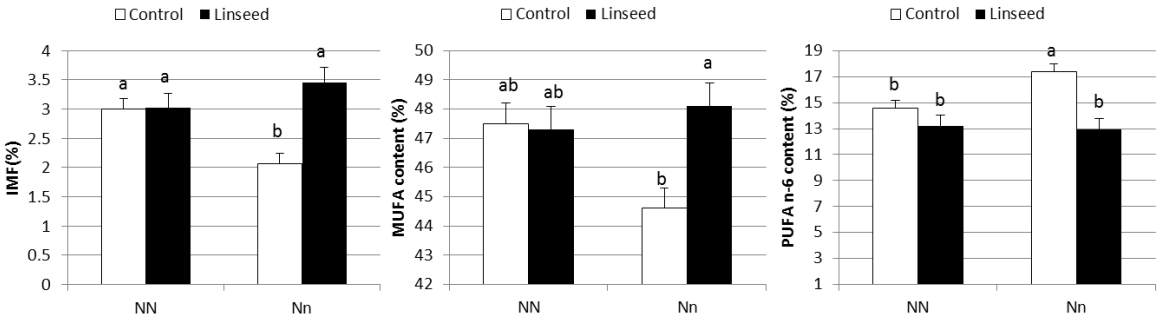

Figure 1. Interaction between dietary linseed and *RYR1* genotype on IMF, MUFA and n-6 PUFA contents (within each variable, different letter above bar indicate significant differences among groups)

Table 1. Intramuscular fat (IMF) content and fatty acid (FA) composition according to dietary linseed, sex and *RYR1* genotype

	Feed		Sex		*RYR1*		SEM	P-value			
	Control	Linseed	Gilts	Barrows	NN	Nn		Feed	Sex	*RYR1*	Interactions
n	25	23	26	22	30	18					
IMF (%)	2.53a	3.24b	2.57a	3.21b	3.02	2.76	0.15	0.003	0.007	NS	Feed x *RYR1*
∑ SFA (g/100 g FA)	36.2	36.9	35.4a	37.7b	36.8	36.4	0.3	NS	<0.001	NS	
∑ MUFA (g/100 g FA)	46.0a	47.7b	46.0a	47.7b	47.4	46.3	0.5	0.03	0.03	NS	Feed x *RYR1*
∑ PUFA n-3 (g/100 g FA)	1.21a	1.76b	1.68b	1.30a	1.41a	1.56b	0.05	<0.001	<0.001	0.02	
∑ PUFA n-6 (g/100 g FA)	15.95b	13.08a	16.29b	12.74a	13.89	15.14	0.52	<0.001	<0.001	NS	Feed x *RYR1*
n-6/n-3 ratio	13.21b	7.44a	10.21	10.43	10.54	10.10	0.16	<0.001	NS	NS	

NS=not significant (P>0.05). Within each row, different letters indicate significant differences between feeding treatment, sex or *RYR1* genotypes (P<0.05).

IV. CONCLUSION

Dietary linseed (5%) increased n-3 PUFA and reduced the pork n-6/n-3 ratio, regardless of gender and halothane genotype. However, the halothane carriers fed linseed showed greater intramuscular fat and MUFA deposition and lower n-6 PUFA content compared to control-fed halothane carriers.

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