THE EFFECT OF PIG GENOTYPE AND SEX ON RAW MATERIAL QUALITY AND TECHNOLOGICAL TRAITS OF CARSO DRY-CURED HAMS

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ABSTRACT

In the present study, crossing with Duroc was compared to usual Landrace (Lan) and Large White (LW) strains for the purpose of Carso dry-cured ham production. Crossing with Duroc at 50% resulted in higher intramuscular fat content and marbling and, though not significant, in a trend to more intermuscular fat. Hams from Duroc crosses had lower weight losses during the processing. Castrated males were fatter, had more intra and intermuscular fat and lower processing losses than females. There was a strong negative relationship between ham fatness and dehydration during the processing.

BACKGROUND AND OBJECTIVES

It has been shown that crossing with Duroc results in higher intramuscular fat content, which is generally considered to be beneficial for meat sensory quality. It is well accepted that highly muscled pig genotypes (i.e. Pietrain) are less appropriate for production of high quality dry-cured products (Russo & Nanni Costa, 1994; Buscailhon & Monin, 1994 ; Oliver et al., 1994). On the other hand, Duroc breed has been considered to present some quality advantage for Spanish dry ham production (Gou et al., 1995; Guerrero et al., 1996; Oliver et al., 1994). In Slovenia, crossing with Duroc breed, very often at 50%, is widespread. Therefore our aim was to evaluate the effect of crossing with Duroc on raw meat quality and technological parameters during the processing of Carso dry-cured hams.

MATERIAL AND METHODS

The experiment was carried out on 110 pigs (53 females, 57 castrated males) of six different genotypes, three of them including 50 or 25 % Duroc genes (see Table 1). Pigs weighed 115±0.4 kg (mean ± stderr) one week before slaughter (at the age of 204 ± 0.7 days). One day after slaughter, carcass weight, ham weight (trimmed, prepared for salting), fat thickness at the level of *m. gluteus medius (GM)*, and fat thickness of trimmed ham under *caput ossis femoris* were measured. Pictures of a cross-section (Fig.1-a and Fig.1-b) were taken in order to evaluate the area of intermuscular fat, the average subcutaneous fat thickness and the meat area % (as the ratio of meat to total area of the ham cross-section) on images using the LUCIA_M software. Marbling (scores 1-7; 1=low) and colour intensity (scores 1,2-3,4-5,6; pale-normal-dark; as proposed by Nakai, 1975) were evaluated and pH measured on *m. biceps femoris* (BF) and *m. semimembranosus* (SM). For *m.semitendinosus* (ST) only marbling was assessed. Samples of BF and SM were taken for intramuscular fat determination (extraction by Folch et al., 1957). The appearance of ham (color, firmness, 1-7 1=inappropriate) was evaluated. Hams were weighed after salting (2 weeks), resting (7 weeks), drying (28-29 weeks) and maturation (8 weeks). Data were analyzed by SAS, GLM procedure (effects of genotype, sex, genotype×sex interaction, litter) and lsmeans for genotypes and sexes were compared at the 5% probability level. Correlation analysis was made in order to assess the relationships between different ham parameters and weight losses during the processing of hams.

RESULTS

Effect of genotype (Table 1). Lan×LW crosses showed more intensive colour than others. In accordance with literature data, pigs with 50% Duroc genes exhibited higher intramuscular fat content compared to Lan and LW strains, whereas pigs with 25% od Duroc genes (Lan×Du)×LW were intermediate. Fifty percent Duroc crosses had thicker average subcutaneous fat at the level of *m. gluteus medius*. Surprisingly, 25 % Duroc crosses (Lan×Du)×LW were significantly fatter than the 50 % Duroc (Lw×Lan)×Du in the present study. Hams from Duroc crosses tended to have more intermuscular fat than others, although the difference was not significant. The highest note for the appearance of the ham was seen in the (Lan×Du)×LW pigs, which were the fattest although not significantly different. Genotype affected significantly ham weight losses during salting, resting, and drying, showing that hams from fatter genotypes lost less weight during the processing.

Effect of sex. Castrated males had fatter hams, higher intramuscular and intermuscular fat content and lower ham weight losses at salting and drying.

Correlation analysis Table 2 shows that weight loss in processing of dry-cured hams was highly related to the fatness of ham; fatter hams lost less water during the processing. On the other hand, ham weight was positively related to salting and drying losses.

CONCLUSIONS

Hams from Duroc crosses showed lower weight loss during Carso ham processing, which is economically favorable. They had also more intramuscular fat, which has been considered by some authors as beneficial to sensory quality of dry hams. However they had more cover fat and a trend to more intermuscular fat, which could be detrimental for consumer acceptability. The effects of Duroc crossing on sensory quality and consumer acceptability of Carso dry hams will be assessed in further studies.

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Table 1: Lsmeans for raw material quality and processing parameters in Carso dry-cured hams

		Pig genotype (G)						[1]Sex (S)			[2]Effects	
		Lan × Lan	(Lan×LW) × Lan	Lan × LW	Lan × **Du**	(Lan×LW) × **Du**	(Lan×**Du**) ×LW	F	C	rsd	G	S
Warm carcass weight (kg)		89	91	90	91	92	90	89	91	4	ns	†
Fat thickness (*GM* - mm)		18^{ab}	16^{a}	17^{a}	20^{bc}	18^{ab}	22^{c}	17	20	4	**	***
Trimmed ham weight (kg)		9.0	9.1	8.9	8.9	9.0	9.0	9.1	8.9	0.4	ns	*
Trimmed ham fat thickness (mm)		19	18	16	19	20	20	18	20	4	ns	*
Appearance of ham (1-7)		5.8	5.6	5.8	5.8	5.9	6.5	6.2	5.7	0.9	ns	*
Ham cross-section												
intermuscular fat area (cm^2)		2.5	2.7	2.7	3.4	2.7	2.9	2.5	3.1	1.3	ns	†
Av. thickness of fat (mm)		10^{b}	9^{a}	9^{a}	10^{b}	10^{b}	12^{c}	10	11	2	**	*
meat area on ham (%)		81.4^{b}	83.1^{b}	83.0^{b}	81.0^{ab}	82.2^{b}	78.4^{a}	82.7	80.3	3.0	*	**
pH 24 h p.m.	BF	5.88	5.96	5.99	5.79	5.97	5.76	5.89	5.89	0.27	ns	ns
	SM	5.92^{ab}	6.01^{b}	6.08^{b}	5.82^{ab}	5.99^{ab}	5.7^{a}	5.94	5.90	0.27	†	ns
Color (1-6)	BF	4.3^{a}	4.2^{a}	4.8^{b}	4.4^{a}	4.4^{a}	4.0^{a}	4.5	4.3	0.5	*	ns
	SM	4.3^{ab}	4.2^{a}	4.7^{b}	4.3^{ab}	4.6^{b}	3.8^{a}	4.4	4.2	0.6	*	ns
Marbling (1-7)	BF	1.8^{ab}	1.7^{a}	1.6^{a}	2.5^{c}	2.1^{b}	1.5^{a}	1.6	2.1	0.5	***	***
	SM	1.4^{a}	1.3^{a}	1.5^{ab}	1.9^{b}	1.6^{b}	1.2^{a}	1.4	1.6	0.4	***	*
	ST	2.8^{a}	2.3^{a}	2.4^{a}	3.5^{b}	2.7^{a}	2.7^{a}	2.4	3.0	0.9	**	*
[3]IM fat %	BF	2.2^{bc}	1.9^{ab}	1.8^{a}	3.4^{e}	2.5^{d}	2.4^{cd}	2.1	2.6	0.5	***	***
	SM	1.6^{a}	1.6^{a}	1.6^{a}	2.4^{c}	2.0^{b}	1.8^{ab}	1.7	2.0	0.4	***	*
Processing: Salting loss (%)		4.4^{bc}	5.1^{d}	5.0^{cd}	4.2^{ab}	4.4^{bc}	3.5^{a}	4.9	4.0	0.9	**	***
Resting loss (%)		16.1^{b}	15.9^{b}	16.0^{b}	15.1^{a}	15.8^{b}	15.6^{ab}	15.9	15.6	0.8	*	ns
Drying loss (%)		15.6^{b}	15.9^{c}	16.2^{c}	14.4^{a}	15.0^{b}	13.5^{a}	15.5	14.7	1.1	***	**
Maturation loss (%)		7.2	7.3	7.3	6.8	7.2	6.8	7.0	7.2	0.6	ns	ns
Total dehydration loss (%)		37.5^{bc}	38.2^{c}	38.3^{c}	35.4^{a}	36.9^{b}	34.7^{a}	37.5	36.2	1.5	***	**

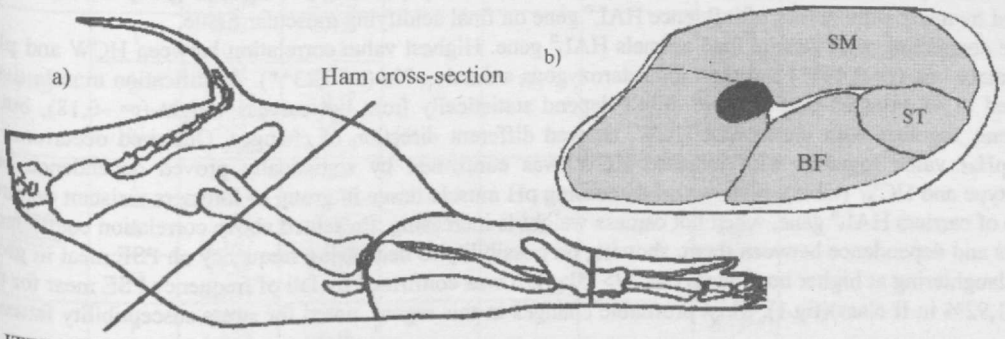
[1]F: female; C: castrated male; [2]ns: not significant; † P<0.10; * P<0.05; **P<0.01; *** P<0.001; [3]intramuscular fat

Table 2: Relationship between ham parameters and weight loss in different stages of processing of Carso dry-cured ham

N=110	Fat thickness at *GM*	Fat thickness average at cross-section of ham	Fat thickness under femur	Fat area inter-muscular	Ham meat area (%)	% intramuscular fat *BF*	% intramuscular fat *SM*	Trimmed ham weight (kg)
Salting loss (%)	-0.56***	-0.62***	-0.60***	-0.21*	0.60***	-0.29**	-0.32***	0.35***
Resting loss (%)	-0.37***	-0.31***	-0.32***	-0.31***	0.37***	-0.49***	-0.35***	0.02
Drying loss (%)	-0.63***	-0.65***	-0.63***	-0.27**	0.64***	-0.48***	-0.44***	0.47***
Maturation loss (%)	-0.22*	-0.29**	-0.13 ns	-0.17 ns	0.28**	-0.20*	-0.16 ns	-0.33***
Total dehydration loss (%)	-0.65***	-0.69***	-0.62***	-0.34***	0.70***	-0.55***	-0.50***	0.31***

ns: not significant; † P<0.10; * P<0.05; **P<0.01; *** P<0.001

Fig.1: Schematic presentation of ham cross section



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