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Chemical and physical characteristics of meat from Cinta Senese, Large White and related cross pigs reared indoors

O. Franci*, C. Pugliese*, A. Acciaioli*, G. Campodoni*, R. Bozzi* and G. Gandini**

*Dipartimento di Scienze Zootecniche, Via delle Cascine 5, 50144 Firenze, Italy

**Istituto di Zootecnica, Via Celoria 10, 20133 Milano, Italy

SUMMARY - Twenty-nine Cinta Senese (CS), 12 Large White (LW) and 29 Large White x Cinta Senese (LWxCS) pigs were reared under intensive conditions and slaughtered at an average weight of 140 kg and an average age of 312 d (CS), 273 d (LWxCS) and 259 d (LW). The colour of the fat was measured on the side. pH, colour, chemical composition, water loss and shear force were determined on the *Longissimus lumborum* muscle. The CS animals had fat with lower values of L*, b* and hue, and higher values of a* and chroma. Pork from CS was more acceptable in colour (lower hue values) and was like LWxCS in being more highly coloured because of the contribution of red. pH_u was higher in CS than in the other two genotypes (5.78 compared with 5.66 and 5.51). Fat content was higher in CS (3.19% on wet basis) than in LWxCS (2.25%) or LW (0.88%) but moisture was lower in CS than in the other genotypes. Water holding capacity was higher in CS than in LW. Meat from CS had a greater shear force when raw, but tenderness similar to that of the other genotypes after cooking.

Key words: Autochthonous pig, Cinta Senese, chemical traits, physical traits, meat quality.

RESUME - "Caractéristiques physico-chimiques de la viande de porcs Cinta Senese, Large White et croisements relatifs élevés en box". On a utilisé 29 porcs Cinta Senese (CS), 12 Large White (LW) et 29 Large White x Cinta Senese (LWxCS) élevés en système intensif et abattus au poids moyen de 140 kg et à l'âge de 312 j (CS), 273 j (LWxCS) et 259 j (LW). La couleur de la graisse a été mesurée sur la demi-carcasse, en trois localisations. Sur le muscle *Longissimus lumborum* des caractéristiques physico-chimiques (pH, couleur, composition chimique, pouvoir de rétention d'eau et effort de cisaillement) ont été déterminées. Les CS ont présenté la graisse avec les valeurs de L*, b* et teinte les plus basses et les valeurs de a* et de chroma les plus élevées. La viande des CS a présenté la couleur la plus agréable (avec les valeurs de teinte les plus basses) et, avec la viande des LWxCS, elle a été la plus colorée à cause de la contribution du rouge. Le pH après 24 heures s'est montré plus élevé chez les CS que chez les autres génotypes (5,78 vs 5,66 et 5,51). Le contenu en graisse a été plus élevé chez les CS (3,19%) que chez les LWxCS (2,25%) et les LW (0,88%), tandis que l'humidité a été plus basse chez les CS que chez les autres génotypes. Le pouvoir de rétention d'eau a été plus élevé chez les CS par rapport aux LW alors que les métis ont occupé une place intermédiaire. La viande des CS a présenté l'effort de cisaillement à cru le plus grand, mais la tendreté après cuisson a été analogue aux autres génotypes.

Mots-clés : Race locale, Cinta Senese, caractéristiques chimiques, caractéristiques physiques, qualité de la viande.

Introduction

In the middle of the present century the Cinta Senese was the main Tuscan pig breed, but the use of genetically improved imported breeds reduced its numbers to a few dozen animals in the 1960s. Having survived thanks to the affection of some pig breeders, and steps taken by public authorities to safeguard the germoplasm of an autochthonous breed, Cinta Senese pig has of late undergone a strong increase in numbers as there has been a renewed interest in types of breeding with a low environmental impact and in niche products. The high homozygosity of the breed is currently the most urgent problem requiring solution (Gandini *et al.*, 1998), but almost equally important seems the determination of the productive traits of both pure-bred and crossbred animals. As part of a wider study of the productive capacity of Cinta Senese under intensive and extensive rearing, some preliminary results of which have already been published (Campodoni *et al.*, 1998; Franci *et al.*, 1998) in this note we compare the chemical and physical characteristics of fresh pork from Cinta Senese, Large White and their crossbreeds under intensive rearing.

Materials and methods

Seven Cinta Senese and two Large White sows were mated with two Cinta Senese and three Large White boars to produce Cinta Senese (CS), Large White (LW) and Large White x Cinta Senese (LWxCS) progeny. The test animals were reared intensively with the usual commercial feed mixes. Males and females were castrated. Twenty-nine CS, 29 LWxCS and 12 LW were slaughtered when they reached the appropriate weight for medium/heavy pigs. Average weight and age at slaughter (\pm s.d.) were: CS 136.1 ± 6.8 kg and 312 ± 15 d; LWxCS 139.4 ± 6.2 kg and 273 ± 17 d; LW 154.2 ± 8.3 kg and 259 ± 7 d. On the side the colour (CIE L^* , a^* , b^*) of backfat was measured in three localizations. *Longissimus lumborum* muscle (LL) was tested for: (i) colour (CIE L^* , a^* , b^*); (ii) pH at 45 min (pH_{45}) and 24 h (pH_u) after slaughter; (iii) chemical composition (AOAC); (iv) water loss by pressure on filter paper, by dripping, after cooking in a water bath and baking in the oven; and (v) shear force (Warner Bratzler, Instron) on raw meat and after cooking. Data were processed with ANOVA taking account of genotype and sex.

Results and discussion

Sex was never a significant effect. Table 1 shows the colour parameters for fat and meat of the three genotypes. Compared with LW and LWxCS, the fat of CS had lower L^* , hue and chroma values, and so it was more translucent and more coloured. CS and LWxCS meat was more intensely coloured than LW meat because of the greater red contribution. The lower hue values for CS made meat from this local Tuscan breed more acceptable than that of the crosses or LW. Similar results showing a local breed to have a better meat colour were reported by Oliver *et al.* (1997) on Iberian compared with Landrace pig.

Table 1. Colour of backfat and of *Longissimus lumborum* muscle

	Genetic type		
	Cinta senese (CS)	LWxCS	Large white (LW)
Backfat colour			
L^*	60.32 ± 0.34^a	63.33 ± 0.34^b	65.43 ± 0.54^c
a^*	6.17 ± 0.24^a	5.03 ± 0.25^b	5.44 ± 0.38^{ab}
b^*	5.03 ± 0.14^a	5.01 ± 0.14^a	5.58 ± 0.22^b
chroma	8.0 ± 0.26^a	7.14 ± 0.27^b	7.84 ± 0.41^{ab}
hue	0.711 ± 0.012^a	0.798 ± 0.013^b	0.823 ± 0.02^b
LL muscle colour			
L^*	49.67 ± 0.8	51.66 ± 0.82	51.28 ± 1.28
a^*	11.40 ± 0.33^a	11.29 ± 0.34^a	9.1 ± 0.53^b
b^*	4.62 ± 0.26	5.22 ± 0.26	4.44 ± 0.41
chroma	12.36 ± 0.38^a	12.5 ± 0.38^a	10.17 ± 0.60^b
hue	0.381 ± 0.016^a	0.432 ± 0.016^b	0.443 ± 0.025^b

a,b,c: Means with different letters differ ($P < 0.05$)

The chemical characteristics of LL are shown in Table 2. The pH_{45} was similar in all three genotypes but pH_u was higher in CS than in LWxCS and LW, in that order. Oliver *et al.* (1997) obtained similar results for Iberian pig compared with Landrace and postulated a higher water holding capacity of the local breed as a consequence. Legault *et al.* (1996) on the other hand found no difference in pH_u when comparing Gascon and Limousin pigs with Large White x Landrace crossbreeds. The chemical composition data showed greater intramuscular fat levels and lower moisture of CS meat compared with LW meat, with the crossbreeds always somewhere in between, in line with results obtained for other Mediterranean local breeds (Simon *et al.*, 1996; Oliver *et al.*, 1997). It should be noted that the intramuscular fat of the crossbreeds and CS in this study falls within, or only slightly exceeds, the 2-3% range considered optimal for pork quality (Molénat *et al.*, 1992).

Table 2. Chemical characteristics of *Longissimus lomborum* muscle

	Genetic type		
	Cinta senese (CS)	LWxCS	Large white (LW)
pH 45'	6.22±0.04	6.26±0.04	6.31±0.07
pH 24 h	5.78±0.04 ^a	5.66±0.04 ^b	5.51±0.06 ^c
On wet basis (%)			
Moisture	73.23±0.16 ^a	73.91±0.16 ^b	74.27±0.25 ^b
Protein	22.80±0.15 ^a	22.88±0.15 ^a	23.91±0.23 ^b
Ether extract	3.19±0.13 ^a	2.25±0.13 ^b	0.88±0.2 ^c
Ash	1.08±0.01 ^a	1.07±0.01 ^a	1.13±0.02 ^b

a,b,c: Means with different letters differ ($P<0.05$)

As regards the physical characteristics (Table 3), CS meat showed a better water holding capacity with at least three of the four testing methods employed. The crossbreeds were as a rule in an intermediate position with a performance that was alternately more similar to that of the paternal or the maternal breed. This result is therefore consistent with the positive link between water retention and pH_u postulated by Oliver *et al.* (1997). Meat from CS had a greater shear force than LW meat when raw, but was significantly more tender when cooked.

Table 3. Physical characteristics of *Longissimus lomborum* muscle

	Genetic type		
	Cinta senese (CS)	LWxCS	Large white (LW)
Water losses			
Drip (%)	2.04±0.14 ^{ab}	1.47±0.14 ^a	2.51±0.22 ^b
In water-bath (%)	26.05±0.78 ^a	28.49±0.8 ^b	33.25±1.24 ^c
In oven (%)	31.07±0.71 ^a	34.93±0.73 ^b	33.65±1.13 ^b
Pressure (cm ²)	99.7±3.5 ^a	104.2±3.6 ^a	117.5±5.6 ^b
Warner bratzler (kg)			
On raw meat	9.803±0.4 ^a	8.932±0.401 ^{ab}	8.06±0.637 ^b
In water-bath	10.59±0.397	10.684±0.405	10.411±0.631
In oven	9.631±0.33 ^a	10.489±0.365 ^{ab}	12.237±1.281 ^b

a,b,c: Means with different letters differ ($P<0.05$)

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