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Characterization of "lardo" from Cinta Senese pigs: Differences between seasoning techniques and starch sources

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SUMMARY – The trial was carried out to investigate the effect of the fattening diet (maize vs barley) and the seasoning technique ("dry" vs "Colonnata") on fatty acid composition of seasoned backfat ("lardo") from Cinta Senese pigs. Forty pigs were fattened with maize (20) or barley as main feed. Backfat from right side was seasoned according to the "Colonnata" technique placing the backfat in a marble vessel for a period of six months. Backfat from the left side was seasoned following the "dry" technique, adding salt and pepper, and then cured for three months in controlled conditions. The following analysis were carried out on "lardo" : moisture, total lipids, fatty acids and malonaldehyde (MDA) content. Few differences were found between diets. Lardo obtained with the technique showed higher MUFA (45.5 vs 44.9%) and lower PUFA percentage (16.8 vs 17.6%) and MDA content dry (0.49 vs 0.60 mg/kg lard) than that obtained with the "Colonnata".

Keywords: Pig, Cinta Senese, fatty acid, seasoning technique, starch source.

RESUME – "Caractérisation du lard de porcs Cinta Senese: différences selon les techniques d'élaboration et les sources d'amidon". Une expérimentation a été effectuée pour évaluer l'effet du régime d'engraissement (maïs vs orge) et de la technique d'élaboration sur la composition chimique du lard de porcs Cinta Senese. Quarante porcs ont été engraisés avec du maïs ou de l'orge comme aliment principal. Le lard provenant de la demi-carcasse droite a été élaboré selon la technique "Colonnata", en saumure en bacs de marbre pendant 6 mois; le lard de la demi-carcasse gauche a été élaboré à sec pendant trois mois en conditions contrôlées. A la fin de l'affinage, les analyses suivantes ont été effectuées sur le lard: humidité, lipides totaux, composition en acides gras et teneur en malonaldéhyde (MDA). Les différences entre régimes ont été peu nombreuses et modestes. La technique d'élaboration à sec a produit un pourcentage plus élevé de MUFA (45,5 vs 44,9%) et une teneur plus basse en PUFA (16,8 vs 17,6) et en MDA (0,49 vs 0,60 mg/kg de lard).

Mots-clés : Porc, Cinta Senese, acides gras, technique d'élaboration, sources amylacées.

Introduction

Quality of cured products is strictly connected with quality of raw matter and with biochemical reactions that occurred during handling and seasoning period (Buscailhon and Monin, 1994; Toldra and Flores, 1998). On the other hand the quality of raw matter is linked with other important factors such as rearing system and feed sources. Originally, curing was a way of preserving derived from salting, although nowadays this is not as important as it was because of refrigeration techniques, and it has acquired a new dimension as a method for obtaining a variety of sensorial characteristics from an extensive range of products (Flores, 1997). The marketing strategies of meat products are now based on a quality image for a select market, demanding high quality products for special occasions, and willing to pay a high price (Bosi *et al.*, 2000; Lopez-Bote, 1998).

"Lardo" is the subcutaneous fatty connective tissue lying between the retro-occipital and backbone regions, from which the jowl and belly have been removed. With industrial modernisation "lardo" fell out of favour and received little consideration because of its high caloric content and triglycerides and saturated fatty acids composition. However, in Italy "lardo" is now back in vogue as a gourmet product (e.g. lard of Colonnata) (Palèari *et al.*, 2004).

A renewed attention is nowadays showed for Cinta Senese, a local breed of pig original of the area around Siena (Tuscany, Italy) reared in extensive system. It is a rural breed, at risk of extinction in seventies (Franci, 2004), that lead to the production of typical products of high value from the qualitative point of view. The aim of this trial was to investigate the effect of fattening diet and of seasoning technique on chemical composition of cured lard of Cinta Senese pig.

Material and methods

Fourty Cinta Senese pigs, castrated males and females, of 280 days of age and 109 kg of live weight, were separated in two homogeneous groups balanced by weight and sex. During fattening the groups were fed two diets containing different starch sources: barley and maize (Table 1).

Table 1. Composition of diets

	Diet	
	Maize	Barley
Ingredient (%)		
Barley	0	77
Maize	57	0
Field bean	20	10
Wheat bran	16	6
Premix	5	5
Molasses	2	2
Chemical composition (% DM)		
Crude protein	12.4	12.6
Crude fiber	5.1	5.7
Ether extract	2.6	1.7
Ash	6.7	6.8
N-free extract	73.2	73.2
Digestible energy kcal/kg DM	3013	2875

Diets were supplied on a basis of 2.5 kg/pig/d for three months. At slaughtering, occurred at 140 kg of live weight, backfat of the two sides was submitted to two different seasoning techniques: "Colonnata" and "Dry". The "Colonnata" technique was carried out placing the backfat in a tub dug in a marble block, which contained natural marine salt, milled black pepper, fresh garlic, rosemary and sage (Villano *et al.*, 2000). The tub was covered with a marble slab and the seasoning period lasted six months. In the "dry" technique the backfat was added with salt and pepper, then was cured for three months at controlled conditions. On seasoned backfat ("lardo") the following analysis were carried out: moisture, total lipids (Folch *et al.*, 1957), fatty acids profile (Morrison and Smith, 1964) and malonaldehyde content (MDA) (Pikul *et al.*, 1983). Atherogenic and thrombogenic indexes were also calculated according to Ulbricht and Southgate (1991). Data were analysed by ANCOVA using the GLM procedure (SAS, 2003) following this model: $Y_{ijklm} = m + D_i + L_j + S_k + T_l + b(X_{ijklm}) + E_{ijklm}$ where D, L, S, T and X were diet, layer, sex, seasoning technique and live weight, respectively.

Results and discussion

As shown in Table 2, the different starch sources did not affect the slaughter weight and, consequently, the growth rate of pigs. Moreover, pigs of the two diets had the same carcass fatness, measured as backfat thickness.

In Table 3 chemical composition of "lardo" is reported, as influenced by diet, seasoning technique and layer. Sex effect was not tabulated, for brevity, because it did not give significant differences. No differences between diets were found for moisture and lipid content, whereas pigs fattened with maize showed lower percentage of C14:0, C16:0 and C18:3. However, such differences were minimal in absolute value so that neither SFA, nor MUFA and PUFA contents are influenced by diet. The higher content of oleic and linoleic acid of maize respect to barley (Martillotti *et al.*, 1989) had limited effect on fatty acidic composition of lard and, consequently, on oxidation of its lipid, as the values of MDA content show. Statistical small differences between diets were found for atherogenic index that was lower in maize than in barley.

Table 2. Growth performances of pig fed diets based on maize or barley

	Diet		Sex		RSD
	Maize	Barley	Barrows	Gilts	
Initial weight	108	110	108	110	13.9
Slaughter age (d)	359	361	360	361	9.6
Slaughter weight (kg)	140	139	138	141	10.3
ADG in trial (g)	426	385	411	400	89.6
Subcutaneous fat thickness (mm)	36	35	36	35	5.5

Table 3. Influence of diet, seasoning technique and layer on chemical composition of "lardo"

	Diet		Seasoning technique		Layer		RSD
	Maize	Barley	Dry	Colonnata	Outer	Inner	
Moisture%	5.61	5.64	6.39 ^a	4.85 ^b	5.42	5.82	1.44
Total lipids%	77.17	77.53	76.18 ^a	78.52 ^b	79.03 ^a	75.67 ^b	3.36
Fatty acid%							
C14:0	1.16 ^a	1.21 ^b	1.17 ^a	1.20 ^b	1.15 ^a	1.22 ^b	0.09
C16:0	23.02 ^a	23.29 ^b	23.21	23.10	22.12 ^a	24.19 ^b	0.84
C16:1	1.65	1.70	1.65	1.70	1.70	1.65	0.20
C18:0	12.89	13.05	13.06	12.88	11.84 ^a	14.10 ^b	1.04
C18:1	42.84	42.74	43.11 ^a	42.47 ^b	43.53 ^a	42.05 ^b	1.35
C18:2	15.50	15.02	14.99 ^a	15.54 ^b	16.52 ^a	14.00 ^b	1.62
C18:3	1.11 ^a	1.21 ^b	1.10 ^a	1.22 ^b	1.27 ^a	1.06 ^b	0.22
SFA	37.33	37.82	37.67	37.48	35.37 ^a	39.78 ^b	1.74
MUFA	45.25	45.18	45.51 ^a	44.91 ^b	45.96 ^a	44.47 ^b	1.40
PUFA	17.42	17.00	16.82 ^a	17.61 ^b	18.67 ^a	15.75 ^b	1.86
PUFA/SFA	0.47	0.46	0.45	0.47	0.53 ^a	0.40 ^b	0.07
A.I.1	0.44 ^a	0.46 ^b	0.45	0.45	0.41 ^a	0.49 ^b	0.03
T.I.2	1.09	1.10	1.11	1.08	0.99 ^a	1.21 ^b	0.09
MDA (mg/kg lard)	0.52	0.57	0.49 ^a	0.60 ^b	0.50 ^a	0.59 ^b	0.25

a, b within criterion means different (P<0.05).

† Atherogenic index = [C12:0+(4*C14:0)+C16:0]/[(n-3+n-6)+MUFA].

†† Thrombogenic index = (C14:0+ C16:0+C18:0)/[(0.5*MUFA)+(0.5*n-6)+(3*n-3)+(n-3/n-6)].

In comparison with "Colonnata", "lardo" seasoned with "dry" technique showed lower content of lipids and higher moisture; moreover the latter had higher percentage of C18:1 and, consequently, of MUFA and lower percentage of C18:2 and PUFA. MDA content was higher in lard seasoned with "Colonnata" technique probably due to the seasoning period, three months longer. There is a lack of investigation regard to characterization of "lardo", particularly on evolution of oxidative phenomena. Paleari *et al.* (2004) on "lardo" cured with spices and aromatic herbs found significant differences in MDA content between fresh lard and lard of 40 days of seasoning. Vestergaard and Parolari (1999) on subcutaneous fat of cured ham found level of MDA higher (2-2.5 mg MDA/kg lipids) than values registered in this trial (0.71 mg MDA/kg lipids). It's probable that the longer period of seasoning of cured ham than the cured lard promotes oxidations.

The well known differences between the two layers are here confirmed: the outer layer showed higher content of lipids, MUFA and PUFA than the inner one. This confirms other results (Geri *et al.*, 1988) that indicated an higher level of insaturation in outer layer of fresh subcutaneous fat. Outer layer showed the best dietetic and technological properties due to lower atherogenic and thrombogenic indexes and lower MDA content. This last result are in contrast with Martin *et al.* (1999) which found higher percentage of PUFA in inner than in outer layer of cured ham. It's probable that the lower percentage of PUFA registered in inner layer of lard in this trial was due to the higher effect of oxidation occurred because of the exposition to oxidation conditions.

Conclusion

The employment of maize or barley as main starch source during the fattening period (three months) in Cinta Senese pig did not influence in particular manner the composition of cured backfat, being the few statistical differences minimal in absolute value. The technological treatment during the curing period of lardo had, on the contrary, more marked effect. The typical curing technique "Colonnata", that preserves the lard in pickle in marble vessel for a long period (generally more than six months), produced higher content of linoleic and lower of oleic acid than the classical "dry" system, and, as consequence of the longer curing period, higher MDA content. More investigation is necessary to study the biochemical transformation during the seasoning period of this typical Italian pig product, with the aim to obtain the right balance among dietetic and organoleptic properties, considering the importance that the seasoned products could have in the valorisation of local genotypes as Cinta Senese pig.

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