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Nero Siciliano pigs proposed as a traditional quality product: Comparison between salami made from black pig's meat and white pig's meat

G. Madonia*, C. Diaferia*, V.M. Moretti*, S. Margiotta*, E. Manganelli**, V. Pruiti****, F. Caprino*** and A. D'Amico***

*Istituto Sperimentale Zootecnico per la Sicilia, Via Roccazzo 85, 90136 Palermo, Italy
**Stazione Sperimentale Industrie Conserve Alimentari, Viale Tanara 31/A, 43100 Parma, Italy
***Dipartimento di Scienze e Tecnologie Veterinarie per la Sicurezza Alimentare, Università di Milano, via Trentacoste 2, 20134, Milano, Italy
****Servizio di Assistenza Tecnica della Regione Siciliana, 98070 Castell'Umberto (Messina), Italy

SUMMARY – Products made from native pig meat are arousing an ever increasing and renewed interest in customers. They are typical products best characterised by describing their features. The experiment involved a comparison between salami made from meat from Nero Siciliano pigs and salami made from white pigs. The quantity of salt used was lower compared to traditional varieties and no antioxidants or preservatives were added. In particular the comparison aimed to test certain intrinsic characteristics of a traditional product and, at the same time, to verify that these characteristics met the quality standards required. The salami were seasoned for 70 days and the results of the chemical, microbiological and sensorial analyses verify the suitability of the meat from black pigs to obtain quality salami maintaining the typical characteristics that distinguish niche products.

Keywords: Salami, Nero Siciliano pig, autochthonous genetic type, technology transformation.

RESUME – *"Les porcs Nero Siciliano proposés comme produit traditionnel de qualité : Comparaison entre le salami fait à partir de viande de porc noir et celui de porc blanc". Les produits faits à partir de porcs de race indigène suscitent un intérêt croissant et renouvelé de la part des consommateurs. L'expérience a consisté à comparer des salamis faits à partir de viande de porcs Nero Siciliano et de porcs blancs. La quantité de sel utilisée était inférieure aux quantités traditionnelles et ni conservateurs ni antioxydants ne furent ajoutés. En particulier la comparaison avait pour but de tester certaines caractéristiques intrinsèques de ce produit traditionnel et en même temps de vérifier que ces caractéristiques satisfaisaient aux standards de qualité requis. Les salamis étaient maturés pendant 70 jours et les résultats des analyses chimiques, microbiologiques et sensorielles témoignent de l'aptitude de la viande de porcs noirs pour l'obtention de salamis de qualité et conservant les caractéristiques de typicité qui distinguent les produits de niche.*

Mots-clés : *Salami, porcins Nero Siciliano, type génétique autochtone, technologie de transformation.*

Introduction

In Sicily, in the Nebrodi Mountains, which are characterised by extensive and luxuriant woods, nearly all the Nero Siciliano pigs are reared and their meat is used both for fresh consumption and to make excellent sausages (Moretti *et al*., 2004). These subjects, like many other native pigs distinguished by their "slow growth", a modest yield in lean cuts and a marked adiposity (Pugliese *et al.,* 2003,) have been banished in the last decades to a marginal role in the production field based exclusively on highly productive non native races.

The production of sausages in the Nebrodi area, and salami in particular, presents a traditional family craft of which the main differences are found in the quantities of the ingredients (salt, pepper, seasoning) added to the meat, cut into small pieces "*a punta di coltello*". (Diaferia *et al*., 2003). Over the last few years, products made from meat from native pigs reared by extensive breeding methods and yet bio-sustainable, are provoking an ever increasing and renewed interest in customers. They are certainly niche products that, although the fruit of consolidated tradition (Madonia *et al*., 2001), are in most cases "new" and yet to conquer their share of the market.

The preservation of the peculiarities of the typical products can be pursued through the identification and qualification of the chemical, microbiological and sensorial properties, which best describe the

characteristics of these products (Baldini *et al*., 2000). Therefore a fundamental step for their success is the characterization and typicality of the products. The experiment involved a comparison between salami made from meat from Nero Siciliano pigs (salami from black pigs SN) and salami made from animal meat LW (salami from white pigs SB), reducing the quantity of salt used compared to traditional quantities and not adding antioxidants or preservatives. In particular we wanted to check certain intrinsic characteristics of a traditional product that at the same time conforms to quality standards.

Materials and methods

Three black pigs of an average weight of around 94 kg and 2 LW not of pure race of an average weight of around 117 kg were used. During the finishing period the subjects were fed a mix made up of mainly about 80% barley and 20% broad beans. At slaughter a weight of 272.2 kg was recorded for the black pigs and 228 kg for the white. After 24 hours the weight was 2673 kg for the black pigs and 220.5 kg for the white ones, with a respective weight loss of 1.8% and 3.3%.

The preparation of the salami took place at a sausage maker in the region of Piraino (Messina) in the Nebrodi Mountains using typical methods and techniques from the region. From the dissection of the carcasses and the cleaning of various cuts the following were obtained (Table 1):

Table 1. Cuts obtained from the dissection of the carcasses

	White		Black	
	kg	%	kg	%
Lean meat	117.7	53.29	99	37.04
Fat	15.5	7.30	54.3	20.31
Discard	87.5	39.68	114	42.65

All the cuts of pork were used (shoulder, ham, bacon trimming, neck, minced throat, fillet, lardon) and according to the tradition of the Nebrodi, the meat was cut into small pieces using a lardon cut which reproduces "chunks of meat" traditionally obtained with the "*a punta di coltello*" cut

For the preparation of the mixture, considering that the meat from black pigs showed more streaking and therefore was richer in intramuscular fat, 1.5 kg of fat were added to the lean meat while for the mixture for salami with white pigs, in order to obtain a balanced lean/fat ratio 12 kg of fat were added to the meat. In both cases bacon fat was used. For the curing of the meat, sea salt (2.7%), black pepper, half ground and half crushed about 0.3% and sugar 0.15% were used. No preservatives or antioxidants were used (Table 2). To combine the seasoning a mixer was used. The mixtures, once prepared, were put into stainless steel containers and left to rest for a few hours in a cold store at a temperature of about 1 degree (Table 2).

Table 2. Composition of the mixture

Mixture	White sausages		Black sausages	
	kg	%	kg	%
Lean meat	117.7	87.90	99	95.38
Fat added	12.0	8.96	1.5	1.45
Salt	3.625	2.71	2.84	2.74
Pepper	0.388	0.29	0.300	0.29
Sugar	0.195	0.15	0.152	0.15
Total	133.91	100	103.79	100

The dry sausages was made by means of a mechanical pressured sausage making machine, using soft pork intestines. Overall 168 salami from black pigs meat (SN) about 104 kg in total, and 216 salami from white pigs meat (SB) about 134 kg in total, were obtained. The salami, weighing an average of about 0.600 kg, was hung on stainless steel racks and put in temperature-controlled rooms for the drying and seasoning phases. We proceeded with the weighing of the dry sausages at the end of the drying phase and then at intervals of 15 days until the end of the seasoning phase, which lasted for 70 days. During the whole period the temperature and humidity parameters were monitored at 20-minute intervals with "data logger Escort" portable registers.

The analyses for determining proximate composition were carried out on samples of fresh mixture and on the salami at the end of the seasoning phase according to the method AOAC (AOAC, 1990).

Moreover the pH was measured by directly inserting an electrode into to the mixture using a pH meter HANNA Instruments HI 9024.

The extraction of total lipids was performed according to Bligh and Dyer (1959) and the preparation of fatty acid methyl esters was carried out according to Christie (1992). Fatty acids analysis was performed on a Perkin Elmer gas-chromatograph (Model 8700) fitted with an automatic sampler (Model AS 2000B) and FID detector. The conditions used were the following: Omegawax fused silica capillary column (30 m x 0.25 mm I.D.) (Supelco Inc., Bellafonte, PA), temperature programmed from 150 to 250℃ at 2.5℃/min., held for 3 min. Carrier gas was helium at 1.0 ml/min, inlet pressure 12 psi.

The microbiological analyses and the water activity (A_w) were carried out on samples of the fresh mixture, at the end of the drying phase and on the 30^{th} and 45^{th} day of seasoning using the following method: total microbic amount Tryptone soya agar (Oxoid) at 30℃ for 72 hours; Enterobacteria Violet red bile glucose agar (Oxoid) at 37℃ for 24 hours Micrococcus Mannitol salt agar (Oxoid) at 30℃ for 72 hours; Lactic acid bacteria MRS agar at 30℃ for 72 hours; Yeast Malt extract agar (Oxoid) with 0.2% of a citric acid solution of 50% at 30℃ for 72-120 hours; (A_w) measured with hygrometer Novasina mod. EEJA-3.

Sensorial analyses

At the end of the seasoning phase a group of 14 people evaluated the various sensorial characteristics of the salami being tested, to which commercial salami produced in the region of S.Angelo di Brolo was added. The parameters tested were: the presentation of the slice (ease of removal of the casing, lean/fat ratio, colour of the fat, colour of the meat, greasiness, cohesion of the slice, smell (seasoning, acidity), taste (saltiness, pepper, acidity, spiciness and rancidity), chewiness (hardness, presence of connective tissue). A score from 0 to 6 was given to each characteristic.

Statistical analyses

Data are reported as mean values and standard deviation. Comparison among means was performed by one-way ANOVA according to test LSD. Significance was accepted at probabilities of 0.05 or less.

Results and discussion

Table 3 and 4 show the mean weights and the weight loss of the dry sausages from the moment it was put into sausage skins to the end of the seasoning phase. The dry sausages from black pigs displayed a significantly lower weight loss. The minimum value of the weight difference between the 2 productions was found at the end of the drying phase (1.42%) while the maximum halfway through the seasoning phase (3.62%).

At the end of the seasoning phase the SN lost in total 41.44% against 44.52% for the SB (Table 4). The higher capacity of water retention of the rustic race in comparison to the improved version has been confirmed by various authors, both on fresh meat and transformed products. (Franci *et al.,* 2000), Physico-chemical analyses were carried out both on the fresh mixture and at the end of the seasoning phase, the results are shown in Table 5, while the determination of the acidic composition of the fat was carried out on the salami at the end of the seasoning phase and are shown in Table 6.

Table 3. Mean weight in grammes (mean ± standard error) of the salami

	Mixture	6 days	21 days	37 days	51 days	70 days
SB	618 ± 0.056ns	532 ± 0.051ns	442 ± 0.047ns	389 ± 0.044a	363 ± 0.040a	343 ± 0.037a
SN	620 ± 0.063ns	540 ± 0.058ns	460 ± 0.054ns	410 ± 0.049b	380 ± 0.046b	365 ± 0.042b

Different letters in the column correspond to significant differences P<0.05.

Table 4. Weight loss of the salami in% (mean ± standard error)

Seasoning in days	6	21	37	51	70
SB	14.03A ± 0.19	16.90A ± 0.20	37.15A ± 0.32	41.42A ± 0.30	44.52A ± 0.24
SN	12.61B ± 0.21	15.07B ± 0.24	33.57B ± 0.37	38.27B ± 0.34	41.44B ± 0.28
Difference	1.42	1.83	3.62	3.15	3.08

In columns A, B = P<0.01.

Table 5. Physico parameters (mean ± standard error)

	pH	Moisture%	Protein%	Fats%	Ash%	NaCl%
Mixture						
SB	5.85 ± 0.1	58.3 ± 1.4	16.3 ± 0.3	21.9 ± 0.5	3.5 ± 0.07	
SN	5.80 ± 0.1	58.9 ± 1.2	16.7 ± 0.4	20.9 ± 0.6	3.5 ± 0.08	
Salami						
SB	5.77 ± 0.1	28.3 ± 0.8	28.2 ± 0.7	36.9 ± 0.6	6.6 ± 0.1	5.5 ± 0.1
SN	5.91 ± 0.1	27.8 ± 0.8	27.6 ± 0.8	38.5 ± 0.7	6.1 ± 0.2	5.0 ± 0.1

Table 6. Fatty acid composition (weight% mean ± standard error)

	SN	SB
C14:0	1.12 ± 0.03[a]	1.19 ± 0.01[b]
C16:0	20.99 ± 0.14	22.52 ± 0.94
C16:1n-7	2.37 ± 0.01	2.02 ± 0.11
C18:0	11.27 ± 0.13[a]	14.00 ± 0.73[b]
C18:1n-9	47.19 ± 0.40	42.46 ± 1.36
C18:1n-7	3.73 ± 0.01[a]	2.94 ± 0.22[b]
C18:2n-6	11.83 ± 0.07[a]	13.36 ± 0.15[b]
C18:3n-3	0.66 ± 0.01[a]	0.77 ± 0.01[b]
C18:4n-3	0.11 ± 0.00[b]	0.07 ± 0.01[a]
C20:4n-6	0.73 ± 0.03	0.67 ± 0.11
SFA	33.39 ± 0.28[a]	37.71 ± 1.66[b]
MUFA	53.29 ± 0.39[b]	47.42 ± 1.69
PUFA	13.33 ± 0.11[a]	14.87 ± 0.03[b]
TOT N-6	12.56 ± 0.11[a]	14.02 ± 0.04[b]
T0T N-3	0.77 ± 0.01[a]	0.84 ± 0.01[b]
N-3/N-6	0.02 ± 0.00	0.02 ± 0.00
IA[†]	0.38 ± 0.00	0.44 ± 0.03
IT[†]	0.95 ± 0.01	1.14 ± 0.08

[†] Different letters on the line correspond to significant differences P<0.05.

The salami made from black pigs displayed a higher percentage content of oleic acid and a lower content of linoleic acid compared to white pigs. The latter, instead, contained a higher quantity of palmitic acid and stearic acid. This leads to a higher total content of saturated fatty acids in salami made from white pigs and a higher content of monounsaturated fatty acids in salami made from black pigs. This could have an important nutritional implication. In fact the aterogenic index (IA) and the trombogenic index (IT) were calculated on the basis of the acidic composition using equations proposed by Ulbricht and Southgate (1991). These indexes, which resulted lower in salami from black pigs compared to white pigs, take into account the different effects that single acid fats can have on our health and in particular the probability of pathological phenomenon such as the formation of aterome and/or thrombosis.

Figure 1 shows the course of the microbiological parameters. The total microbial amount, the Micrococcus and the lactic bacteria after the drying phase (7 days) remain almost constant for the whole seasoning phase. The Enterobacteria increase during the drying phase 10^5–10^6 cfu/g and decrease at the end of the seasoning phase 10 e 10^2 cfu/g, following a correct production technique and according to what is quoted by Diaferia *et al.,* (2000).

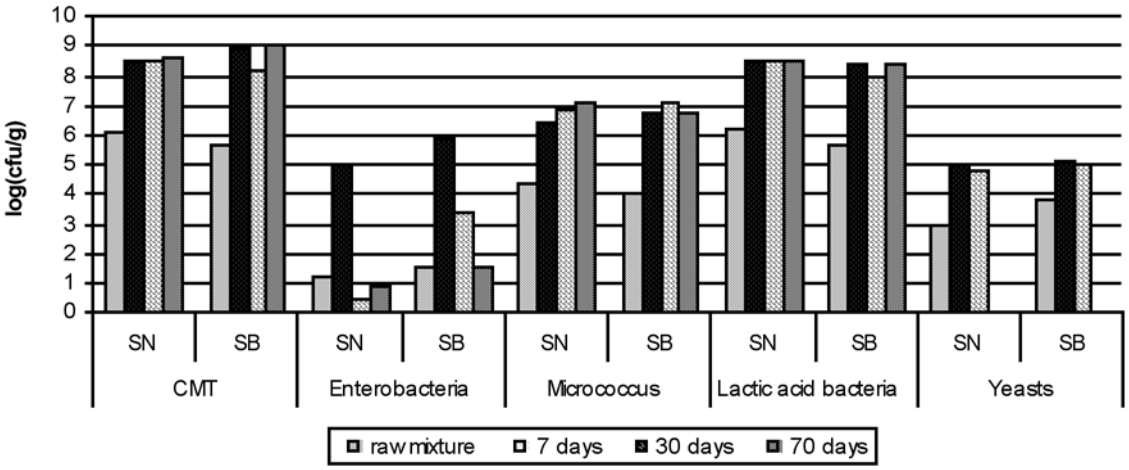

Fig. 1. Microbiological analysis of a raw mixture at 7, 30 and 70 days.

The values of the water activity (Aw), initially very similar, differed at the end of the seasoning phase with a variation from 0.96 at time of making the mixture to 0.83 at the end of the seasoning phase.

At the end of the seasoning phase a sensorial evaluation was carried out on samples of salami being tested, to which commercial salami produced by the same producer was added. The results are shown in Table 7.

The results of the Table highlight how the characteristics of the meat from black pigs affected the sensorial parameters. In fact salami from black pigs stood out significantly from salami made from white pigs and from commercial salami for a higher greasiness (4.428 against 3.214 and 2.857), for the more intense colour of the lean meat tending towards red (4.678 against 4.071 and 3.857), for a more accentuated smell of seasoning (4.821 against 4.321 and 3.428) and finally for satisfaction (5.00 against 4.285 and 3.75).

Conclusion

The quality of the meat from Nero Siciliano pigs characterises and highlights a product typical of the Nebrodi region and family tradition. The experiment sought to highlight some of the peculiarities of salami made from meat from SN compared to those from SB. Moreover, with the quality of the product we wanted to test the efficiency of the production system in order to obtain a product with a reduced amount of salt compared to local customs and without adding antioxidants and preservatives.

The results of the chemical, microbiological and sensorial analyses testify the suitability of the meat from black pigs to obtain quality salami maintaining the typical characteristics that distinguish traditional products.

Table 7. Sensorial parameters (mean ± stand. dev.)

Sensorial parameters	SB	SN	COM
Presentation of the slice			
Easiness of casing removal	4.28 (± 1.34)	4.393 (± 1)	4.321 (± 1.03)
Amount of fat	3.5 (± 1.02)	3.214 (± 0.58)	3.178 (± 0.82)
Colour of fat	4.5 (± 0.85)	4.285(± 0.85)	4.285 (± 0.99)
Greasiness	3.214 (± 1.25)^{B}	4.428 (± 1.03)^{BB}	2.821 (± 1.15)^{A}
Colour of lean meat	4.071 (± 1.07)^{ab}	4.678 (± 0.91)^{a}	3.857 (± 0.93)^{b}
Lean/fat	3.428 (± 0.75)	3.642 (± 1.08)	3.857 (± 1.04)
Cohesiveness	3.393 (± 1.04)^{B}	4.5 (± 0.85)^{B}	5.036 (± 0.66)^{B}
Incrustation	0.643 (± 0.84)	0.678 (± 1.13)	0.286 (± 0.47)
Smell			
Seasoning	4.321 (± 0.77)^{AaB}	4.821 (± 0.60)^{Aab}	3.428 (± 0.78)^{Bb}
Acid	0.428 (± 0.75)	0.643 (± 1)	0.5 (± 0.94)
Taste			
Salt	3.678 (± 1.03)	3.286 (± 0.67)	3.643 (± 0.77)
Pepper	3.5 (± 1.34)	3.178 (± 1.06)	3.285 (± 0.75)
Acidity	0.857 (± 1.29)	0.75 (± 1.37)	0.643 (± 1.15)
Spiciness	1.571 (± 1.45)	1.714 (± 1.32)	2.035 (± 1.52)
Rancidity	0.214 (± 0.42)	0.286 (± 0.47)	0.214 (± 0.42)
Chewiness			
Hardness	3.571 (± 0.65)	3.571 (± 0.75)	3.357 (± 1.21)
Connective tissue	0.643 (± 1.08)	0.857 (± 0.46)	0.714 (± 0.61)
Overall acceptability	4.285 (± 0.70)^{Aa}	5.00 (± 0.62)^{Bab}	3.75 (± 0.87)^{ABb}

On line: A, B = P<0.01; a, b = P<0.05.

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