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"Napoli-type" salami processing from various, indigenous genetics lines of pigs. III. Chemical-physical and microbiological characteristics

C. Diaferia*, L. La Pietra*, M. Longo*, V. Magliano*, G. Pirone* and M. Rocco**

*Stazione Sperimentale per l'Industria delle Conserve Alimentari, Anagni (SA), Italy

**Consorzio per la Sperimentazione, Divulgazione e Applicazione di Biotecnologie Innovative, Azienda Casaldianni (Circello), Benevento, Italy

SUMMARY - Salami processing suitability of pork meat belonging to various native genetic lines: Calabrese (CA), Siciliana (SI), Cinta Casaldianni (CC), Cinta Senese (CS) was evaluated. Salami were dried and seasoned in cells with controlled temperature and humidity. Chemical, physical-chemical and microbiological analyses were performed. The request and usual growing of LAB during drying and its persistence at high number during seasoning, was observed. *Enterobacteriaceae* level reduced during all processing period. A_w values lowering was continue and homogeneous; pH values, in most cases, lowered in drying and subsequently increased. The analytical results show that these kinds of meat are quite qualified to salami processing.

Key words: Napoli-type, salami, genetic lines, technology, analysis.

RESUME - "Emploi de la viande de certains types génétiques de porcs autochtones pour la production du Saucisson Napoli. III. Caractéristiques physico-chimiques et microbiologiques". On a évalué l'aptitude à la transformation en saucissons de la viande de porc de 4 lignées génétiques autochtones italiennes : Calabrese (CA), Siciliana (SI), Cinta Casaldianni (CC) et Cinta Senese (CS). Les saucissons ont été séchés et mûris en cellules à température et hygrométrie contrôlée. On a fait les analyses chimiques, physico-chimiques et microbiologiques. Durant le séchage on a observé une augmentation normale des bactéries lactiques qui sont restées à des valeurs élevées pendant toute la maturation. Les entérobactéries ont baissé pendant la maturation et le *Micrococcaceae* a augmenté d'une façon régulière pendant le séchage et la maturation. L' A_w a suivi une baisse continue et homogène ; le pH, en général, a atteint les valeurs les plus faibles à la fin du séchage et est remonté pendant la maturation. L'ensemble des données analytiques a montré que les viandes des porcs des races autochtones sont parfaitement adaptées pour la préparation des saucissons secs traditionnels italiens.

Mots-clés : Type Napoli, saucissons, lignées génétiques, technologie, analyse.

Introduction

Mix preparation technology (raw beef, lean cuts/fat cuts ratio, sodium chloride concentration, kind of sugars) and drying-seasoning procedures (Diaferia and Pirone, 1992) are very important aspects in seasoned raw salami processing.

Salami processing suitability of pork meat belonging to various native genetics lines was evaluated in this research work.

The genetic lines (Diaferia *et al.*, 1996) are typical of Mediterranean habitat and their genetic characteristics are controlled and protected.

Materials and methods

Chemical, physical-chemical and microbiological analysis were carried out on mix, at the end of drying (5 days) and seasoning (45 days).

The following microorganisms were enumerated: TMC, *Enterobacteriaceae*, total Gram negative bacteria, enterococci, *Micrococcaceae*, *S. aureus*, lactic acid bacteria, yeast and moulds.

Salami were dried and seasoned in controlled temperature and humidity ambient (Table 1).

Table 1. Processing thermo-hygrometric parameters

Step	Temperature (°C)		Humidity (%)		Operating time
	Min	Max	Min	Max	
Heating	23	24			1 hour
Dripping	23	24	88	90	2 hours
Drying	20	22	62	67	24 hours
Drying	18	20	62	67	24 hours
Drying	16	18	65	70	24 hours
Drying	16	18	65	70	24 hours
Ripening	12	14	80	90	41 days

Results and discussion

In Table 2 are reported initial and final percent quantity of moisture and fats.

Regarding on microbiological analysis, no significant difference were observed between genetics lines either in mix or in final product.

Table 2. Moisture and fat variation %

TGA	Initial moisture (%)			Final moisture (%)			Initial fat (%)			Final fat (%)		
	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max
CA	63.80	66.05	68.50	38.22	39.31	40.95	12.61	13.28	14.36	15.88	24.08	30.12
SI	61.89	65.24	68.26	36.02	40.22	45.68	10.32	12.72	15.62	14.05	18.89	28.32
CS	65.59	67.22	68.76	31.11	35.91	41.88	10.90	12.68	14.01	14.79	22.52	30.01
CC	-	62.58	-	-	37.71	-	-	-	-	-	26.69	-

CA: Calabrese; SI: Siciliana; CS: Cinta Senese; CC: Cinta Casaldianni

In all experimental works, a rapid increase of lactic acid bacteria was observed during drying; this was observed, also, in mix with a low level of these kinds of bacteria. In most cases, a further growing was observed during ripening (Table 3). In finished product, lactic acid bacteria were comprised between 7.35×10^6 and 4.59×10^8 cfu/g.

In most cases, a significant reduction of *Enterobacteriaceae* was found at the end of ripening; a usual increase was observed during drying (Table 4).

Table 3. Variation of lactic acid bacteria counts (cfu/g) in function of processing steps

LAB	Mix			Drying end			Ripening end		
	Min	Average	Max	Min	Average	Max	Min	Average	Max
CA	1.95E02	3.29E03	1.44E04	2.40E05	6.99E07	2.73E08	2.67E07	1.09E08	2.28E08
SI	<3	1.38E03	1.77E04	3.12E03	5.75E07	3.15E08	1.02E07	2.08E08	4.86E08
CS	2.10E01	1.02E02	2.25E02	2.52E06	1.61E07	7.80E07	7.35E06	1.71E08	4.59E08
CC	9	1.35E01	1.80E01	7.80E05	9.75E05	1.17E07	1.86E07	6.48E07	1.11E08

CA: Calabrese; SI: Siciliana; CS: Cinta Senese; CC: Cinta Casaldianni

Table 4. Variation of *Enterobacteriaceae* counts (cfu/g) in function of processing steps

<i>Enterobacteriaceae</i>	Mix			Drying end			Ripening end		
	Min	Average	Max	Min	Average	Max	Min	Average	Max
CA	<3	9.81E03	6.00E04	9	3.55E05	1.56E06	<3	1.87E02	1.35E03
SI	<3	1.17E03	1.20E04	<3	5.62E04	4.17E05	<3	<3	1.80E01
CS	<3	1.63E03	8.85E03	<3	1.66E06	8.40E06	<3	9.71E03	5.55E04
CC	10	1.95E01	2.70E01	<3	6	1.20E01	<3	<3	<3

CA: Calabrese; SI: Siciliana; CS: Cinta Senese; CC: Cinta Casaldianni

Only in three processing, level of *Enterobacteriaceae* was still high in ripened salami ($>10^3$ cfu/g); corresponding mix showed more than 10^3 cfu/g of *Enterobacteriaceae*.

Micrococcaceae increased either during drying or during seasoning in all tests.

Moulds were never found; enterococci, yeast and *S. aureus* remained at initial values of concentration (Diaferia *et al.*, 1993a,b).

A_w values decreased progressively during all processing steps.

pH values trend was, instead, less homogenous; a pH increase in finished salami was observed when levels of *Enterobacteriaceae* were high at the end of seasoning.

In the other processing, pH values lowered at the end of drying and then increased; final pH was higher than 6.0 in samples analysed (Table 5).

The whole of analytical results show that these kinds of meat are perfectly qualified in salami processing, similarly to meat of feeding for industrial production of cured meats.

Table 5. Variation of pH in function of processing steps

pH	Mix			Drying end			Ripening end		
	Min	Average	Max	Min	Average	Max	Min	Average	Max
CA	5.76	5.91	6.14	5.40	5.73	5.94	6.26	6.42	6.65
SI	5.66	5.84	6.18	5.28	5.71	6.04	5.62	6.17	6.84
CS	5.77	5.80	6.02	5.66	5.86	6.08	5.92	6.13	6.46
CC	-	5.68	-	5.72	5.75	5.80	5.70	5.79	5.92

CA: Calabrese; SI: Siciliana; CS: Cinta Senese; CC: Cinta Casaldianni

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