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Production of *Napoli* salami from some swine autochthonous genetic types. II. Sensory evaluation[†]

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SUMMARY - The research was carried out on "Napoli" salami obtained using separated meat, excluding neck and ham, from castrated males and whole females belonging to Calabrese, Cinta senese and Siciliano autochthonous genetic types (AGT). The sensory characteristics were judged by a tasting panel on slices of salami seasoned in two different plants for 45 d and subsequently stored for 45 and 135 d partly in a vacuum and partly under kidney fat. The results showed that genetic type, sex, conservation time and method as well as taster are critical factors for sensory characteristics. On average: (i) salami from Cinta senese is more acceptable than that obtained from the other two AGTs due to its close texture, lower rancidity, lighter meat, lower saltiness and higher tenderness and juiciness ($P<0.05-0.001$); (ii) in comparison with castrated males, females provide meat characterized by a closer texture, less sharp taste, lower saltiness, higher tenderness and juiciness and better overall judgement ($P<0.001$); (iii) salami seasoned in the Morcone plant was judged better than that from Angri ($P<0.001$); (iv) the better overall judgement was assigned to salami at the end of seasoning (45 d); after further 45 and 135 d of storage, such judgement was significantly worse; after 135 d, salami under kidney fat was judged better compared to that stored by vacuum ($P<0.05$); and (v) some interactions among the considered factors affect panel judgements.

Key words: Pig, autochthonous genetic type, 'Napoli' salami, sensory evaluation.

RESUME - "La production de Saucisson type Napoli avec des porcins de races autochtones. II. Caractéristiques sensorielles". La recherche a été réalisée sur le saucisson Napoli préparé avec la viande détachée, sauf la 'coppa' et le jambon, de porcs mâles castrés et femelles entières appartenant aux types génétiques autochtones (TGA) Calabrese, Cinta senese et Siciliano. Le saucisson avait été séché pendant 45 jours dans deux établissements différents et successivement conservé pendant 45 et 135 jours, en partie sous vide et sous gras. La définition des caractéristiques sensorielles de saucisson a été réalisée par un jury de dégustateurs. Les résultats plus importants ont montré que, en moyenne : (i) le saucisson obtenu de la Cinta senese a été le mieux accepté par rapport à celui des autres types TGA, il présente une structure de tranche plus compacte, il est moins rance, la viande est plus 'claire', il est moins salé et plus tendre et succulent ($P<0,05-0,001$) ; (ii) la femelle entière, par rapport au mâle castré, donne un saucisson plus compact, avec un goût moins fort, moins salé, plus tendre et succulent et un meilleur jugement 'global' ($P<0,001$) ; (iii) le saucisson séché dans l'établissement de Morcone a reçu un jugement 'global' supérieur vis-à-vis de celui de Angri ($P<0,001$) ; (iv) le meilleur jugement 'global' a été donné au saucisson à la fin du séchage (45 jours) ; après encore 45 jours et 135 jours de conservation ce jugement était inférieur ($P<0,05$) ; après 45 jours de conservation sous gras le saucisson a reçu le meilleur jugement 'global' par rapport à celui conservé sous vide ($P<0,05$) : moins tendre et succulent ($P<0,05-0,01$), avec un goût moins acide et plus 'clair' ($P<0,05$) et (v) certaines interactions entre les facteurs pris en considération ont influencé le jugement exprimé par le jury.

Mots-clés : Porc, types génétiques autochtones, saucisson Napoli, caractéristiques sensorielles.

Introduction

The quality of salted pork depends on various factors, amongst which meat and fat play a critical role. The latter factors may derive from animals differing in genetic type, sex, live-weight at slaughtering, housed systems and diet, etc., this diversity may affect the qualitative

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traits of the seasoned product. Based on these considerations it becomes necessary to investigate the qualitative aspects of salami 'Napoli' obtained from autochthonous genetic types (AGT) in order to direct breeding towards productive goals, in addition to pure preservation of AGTs, which may be considered as gene banks at risk of extinction (Matassino, 1997). In two previous papers the objective quality indicators (rheology and colorimetry) of raw meat (Palazzo *et al.*, 1998) and salami 'Napoli' (Cappuccio *et al.*, 1998) were investigated; the aim of this study is to offer a contribution to the recognition of global acceptability of seasoned salami from some AGT, through the evaluation of sensory characteristics (flavour).

Material and methods

The research was carried out on salami 'Napoli' obtained with separated meat, excluding neck and ham, from castrated males and whole females belonging to Calabrese, Cinta senese and Siciliano autochthonous genetic types. Meat (85%) and belly fat (12%) were triturated using a draw-plate of 12 mm; after homogenization and addition of 2.8% NaCl and 0.2% black peppercorns, half ground, half whole, it was sacked in a natural envelope (cattle small intestine) of 50-55 mm diameter. The dripping and drying phases were performed in two cells conditioned for temperature and humidity, situated in two plants: Angri (SA) and Morcone (BN). Subsequently, the salami was transferred to a seasoned cell where it remained for 45 d. After this period, the salami was stored half in a vacuum and half under kidney fat for 135 d. Sensory analysis was performed by a tasting panel on salami seasoned in the two above cited plants at 45 d of seasoning and at 45 and 135 d of storage. Scheme 1 shows the judgement scale of panel taste.

The statistical analysis was performed by the following variance analysis model, where genetic type (α_i), sex (β_j), plant (γ_k), storing (δ_l), taster (ϕ_m), and their relative interactions were considered as fixed and the effect of each was expressed as deviation from the general average μ :

$$y_{ijklmn} = \mu + \alpha_i + \beta_j + \gamma_k + \delta_l + \phi_m + (\alpha\gamma)_{ik} + (\alpha\delta)_{il} + (\alpha\phi)_{im} + (\gamma\delta)_{kl} + (\gamma\phi)_{km} + (\delta\phi)_{lm} + e_{ijklmn}$$

The significance of difference among the estimated means was calculated using Student's *t* test.

Meat: fat rate (A) 1. Too favourable to fat 2. Moderately favourable to fat 3. Ideal 4. Moderately favourable to meat 5. Too favourable to meat		Meat colour (B) 1. Too dark 2. Moderately dark 3. Ideal 4. Moderately light 5. Very light		Fat colour (C) 1. Too unfavourable 2. Unfavourable 3. Favourable 4. Very favourable	
Different hue of meat (D) 1. Absence 2. Slight presence 3. Moderate presence 4. Accentuated presence		Structure of slice (E) 1. Too close 2. Close 3. Loose 4. Very loose		Saltiness (F) 1. Not salty enough 2. Correctly salty 3. Slightly salty 4. Very salty	
				Juiciness (G) 1. Dry 2. Not very juicy 3. Juicy 4. Very juicy	
Aroma and flavour:				Tenderness (M)	
of raw meat (H) of pepper (I) 1. Absence 2. Slight presence 3. Accentuated presence		of sharp taste (J) of acid (K) of rancid (L) 1. Absence 2. Slight presence 3. Moderate presence 4. Accentuated presence		Overall judgement (N) 1. Unfavourable 2. Favourable 3. Good 4. Excellent	
				1. Hard 2. Not very hard 3. Ideal 4. Tender 5. Very tender	

Fig. 1. Structured scale of sensory evaluation.

Results and discussion

The results evidenced that genetic type, sex, storage time and method, and panel tasters are important variation factors which affect the sensory characteristics. The analysis model explains about 30% of the total variability, attaining higher values for some indicators such as 'flavour and raw meat taste' (40.3%), 'flavour and acid taste' (36.2%), 'tenderness' (35.1%); over 50% of this variability is attributed to the taster because, as evidenced by previous research (Kramer and Twigg, 1970; Matassino *et al.*, 1991; Zullo *et al.*, 1996), the judgement varies according to the taster.

Table 1 shows that, on average:

(i) Salami from Cinta senese is more acceptable than that from the other two AGTs, due its close texture, lower rancidity, lighter meat, lower saltiness and higher tenderness and juiciness ($P<0.05-0.001$); nevertheless, this superiority is due to the seasoning plant in the sense that Cinta senese and Siciliano provided salami with better sensory characteristics when seasoned in Morcone, while Calabrese gives a better response in Angri; this indicates that the process technique (cell temperature and humidity, ventilation conditions, etc.) should be differentiated depending on genetic type employed for salami production.

(ii) In comparison with castrated males, females provide meat characterized by a closer texture, less sharp taste, lower saltiness, higher tenderness and juiciness and better overall judgement ($P<0.001$).

(iii) Salami seasoned in the Morcone plant was judged better than that from Angri ($P<0.001$); nevertheless, this occurs only for salami stored under vacuum for 45 and 135 d.

(iv) The best overall judgement was assigned to salami at the end of seasoned period (45 d); after further 45 and 135 d of storage, such judgement was significantly worse; after 135 d, salami under kidney fat was judged better compared to that stored by vacuum ($P<0.05$); indeed, it was less tender and juicy ($P<0.05-0.01$), with a lower acidity ($P<0.01$) and 'lighter' ($P<0.05$).

Table 1. Estimated mean value and significant comparisons of judgement in relation to the factors of variation

Factors	Sensory characteristic (see Fig. 1)						
	A	B	C	D	E	F	G
Genetic type							
Calabrese	3.33 ^a	2.59 ^a	2.86 ^a	1.94 ^a	2.42 ^a	2.60 ^a	2.05 ^a
Cinta senese	3.23 ^a	3.01 ^b	2.86 ^a	1.69 ^b	2.23 ^b	2.46 ^b	2.29 ^b
Siciliano	3.46 ^b	2.46 ^c	2.75 ^b	2.05 ^c	2.34 ^c	2.64 ^a	2.24 ^b
Sex							
Male	3.26 ^a	2.58 ^a	2.78 ^a	2.01 ^a	2.52 ^a	2.62 ^a	2.12 ^a
Female	3.42 ^b	2.80 ^b	2.87 ^b	1.77 ^b	2.14 ^b	2.51 ^b	2.27 ^b
Factory							
Angri	3.34	2.65	2.80	1.91	2.31	2.59	2.15 ^a
Morcone	3.35	2.72	2.84	1.88	2.35	2.55	2.24 ^b
Seasoning (45 d)	3.16 ^a	2.86 ^a	2.92 ^a	1.75 ^a	2.41 ^a	2.48 ^a	2.38 ^a
Storage							
45 d vacuum	3.48 ^b	2.59 ^b	2.80 ^b	1.90 ^b	2.32 ^b	2.83 ^b	2.11 ^b
45 d kidney fat	3.36 ^{bc}	2.65 ^{bc}	2.78 ^b	1.93 ^b	2.28 ^b	2.73 ^c	2.17 ^{bc}
135 d vacuum	3.40 ^{bc}	2.57 ^{bd}	2.78 ^b	1.98 ^b	2.32 ^{ab}	2.43 ^a	2.24 ^{cd}
135 d kidney fat	3.31 ^{ac}	2.77 ^{ac}	2.82 ^b	1.90 ^b	2.33 ^{ab}	2.37 ^a	2.07 ^b

Table 1. (cont.) Estimated mean value and significant comparisons of judgement in relation to the factors of variation

Factors	Sensory characteristic (see Fig. 1)						
	H	I	J	K	L	M	N
Genetic type							
Calabrese	1.15 ^a	1.74	1.54 ^a	1.31 ^a	1.24 ^a	2.36 ^a	2.18 ^a
Cinta senese	1.21 ^a	1.68	1.48 ^a	1.26 ^a	1.14 ^b	2.75 ^b	2.37 ^b
Siciliano	1.30 ^b	1.72	1.78 ^b	1.54 ^b	1.43 ^c	2.69 ^b	2.01 ^c
Sex							
Male	1.19 ^a	1.74	1.64 ^a	1.40	1.27	2.45 ^a	2.07 ^a
Female	1.25 ^b	1.69	1.55 ^b	1.34	1.27	2.75 ^b	2.30 ^b
Factory							
Angri	1.21	1.73	1.64 ^a	1.39	1.29	2.50 ^a	2.12 ^a
Morcone	1.23	1.70	1.56 ^b	1.35	1.25	2.70 ^b	2.25 ^b
Seasoning (45 d)	1.40 ^a	1.66 ^a	1.50 ^a	1.26 ^a	1.08 ^a	2.97 ^a	2.40 ^a
Storage							
45 d vacuum	1.26 ^b	1.74 ^b	1.71 ^b	1.39 ^{bc}	1.28 ^b	2.47 ^b	2.10 ^b
45 d kidney fat	1.26 ^{bc}	1.70 ^{ab}	1.65 ^{bc}	1.45 ^c	1.38 ^{cd}	2.55 ^b	2.11 ^{bc}
135 d vacuum	1.13 ^d	1.77 ^{bc}	1.60 ^{bc}	1.46 ^{cd}	1.34 ^{bd}	2.66 ^c	2.07 ^{bd}
135 d kidney fat	1.05 ^d	1.69 ^{ab}	1.52 ^{ac}	1.29 ^{ab}	1.27 ^{bd}	2.34 ^b	2.26 ^a

a,b,c,d: Different letters within factors indicate significance for $P < 0.05$

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