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Abstract. Production of Chato Murciano breed, a Mediterranean rustic pig, requires the development of differentiated quality meat products with high commercial value. The aim of this study was to adjust the fat content of a small-calibre Salami manufactured with pork from Chato Murciano breed (castrated, 180 kg live weight and 18 months aged). Three types of Salami with different fat level estimated by near infrared probe (High 20%, Medium 18%; and Low 16% fresh mass) were processed according standard industrial practices, using, *Pediococcus pentosaceus* and *Staphylococcus xylosus* as starter culture, and *Penicilium crysogenum* as coverage moulds. The Salami was stuffed into pig casings and then were dried for 12 days (12-14 º C and 90-75% RH). Several quality parameters were determined: proximate composition, drying-ripening rates (dehydration, acidification, fermentation, proteolysis, lipolysis and fat oxidation) and eating quality. The final content of fat was 27.7% for higher, 26.1% for medium and 24.2% for lower fat Salami. Lower fat favoured lactic fermentation and acidification (pH = 4.5), improved the reddening and intensified the proteolysis and the lipolysis. The intensity of aroma and taste of cured-fermented meat was similar in the fat range tested, since Salami showed small variations in firmness, but not in juiciness. Fat level did not affect the acceptance, so we recommend a final fat content of 24% for the Salami made with pork from Chato Murciano

Keywords: Salami – Chato Murciano – Fat.

Évaluation de la teneur en gras de la saucisse sèche du porc Chato Murciano

Résumé. *La production durable de porcs de races rustiques, comme le Chato Murciano, exige le développement de dérivés de viandes d'une qualité différenciée avec une haute valeur commerciale. L'objectif de l'étude a été d'établir le niveau en graisse idéal pour la saucisse sèche de porc de race Chato Murciano (castré, avec 180 kg de poids vif et 18 mois d'âge). Trois types de saucisses expérimentales furent élaborées avec de la viande maigre et 3 pourcentages de graisse différents estimés par proche infrarouge (élevé 20%, moyen 18% et faible 16% de masse fraîche). La saucisse fut élaborée avec un procédé industriel standard avec une culture initiatrice de* Pediococcus pentosaceus *et* Staphylococcus xylosus*, couverture de* Penicillium crysogenum*. Elle fut emboutie dans des tripes naturelles de porc et fut séchée pendant 12 jours (12-14ºC et 90-75% HR). La qualité est définie selon la composition, les indices de séchage-maturation (déshydratation, acidification, fermentation, protéolyse, lipolyse et oxydation des graisses) et l'analyse sensorielle. La teneur finale en graisse fut: 27,7% élevée, 26,1% moyenne et 24,2% faible. La faible teneur en graisse a favorisé la fermentation lactique et l'acidification correcte de la charcuterie (pH=4,5), a amélioré le rougissement et a intensifié la protéolyse et la lipolyse. L'intensité de l'arôme et de la saveur à viande séchée-fermentée fut similaire dans la frange de graisse testée, en observant de petites variations de fermeté et d'onctuosité, mais pas de jutosité. L'acceptation n'a pas été affectée par la teneur en graisse, c'est pourquoi nous recommandons 24% de graisse finale pour la saucisse de Chato Murciano.*

Mots-clés. *Saucisse – Chato Murciano – Graisse.*

I – Introduction

Chato Murciano breed is a Mediterranean rustic pig originated from Iberian trunk. In the early twentieth century this breed was of high socio-economic importance, being traditionally raised at home and in extensive systems with remnants of the orchard. Actually, Chato is being recovered by farmers of Murcia Region. Pigs were raised semi-extensively, fed a balanced diet based on special feeds and optionally local raw materials, and slaughtered around 18 months old and 180 kg live weight. Chato provides heavy carcasses and pork meat with high levels of haematic pigments, proteins, infiltration and oleic acid, being a suitable raw material for dry-cured products (Galián *et al*., 2008). The sustainable breeding of Chato Murciano would be given for the elaboration of differentiated quality meat products with high commercial value. Local companies from Murcia Region are actually developing pork sausages from Chato Murciano. An example is traditional small-calibre salami (less than 45mm diameter), ripened for 2-3 weeks, which is widely consumed in Spain. High fat infiltration of Chato pork offers the possibility to manufacture salami with no added back fat. This supposes certain technological risk, since fat strongly contributes to eating quality of salami, since fat intensifies the aroma, taste and juiciness. However, excessive fattiness can also limit the commercialization of salami, due mainly to nutritional aspects.

II – Materials and methods

Salamis were manufactured according industrial practices with pork from Chato Murciano breed. Three fat levels were tested (High 20%, Medium 18%; and Low 16% raw mass) (HF, MF and LF). Fat content was determined by near infrared (NIR) probe. The recipe (g kg^{-1}) of salami was: boned pork (880), water (44), sodium chloride (22), black and white pepper (10), dextrose, lactose and sucrose (20), dextrin (20), potassium nitrate (0.25) and sodium nitrite (0.25), sodium isoascorbate (0.5), sodium citrate (0.3) sodium glutamate (2.5) and Ponceau 4R red (0.2). Starter cultures of *Pediococcus pentosaceus*, *Staphylococcus xylosus* and *Penicilium Crysogenum* were used. The salami was stuffed into pig gut and then was dried for 12 days (12-14ºC and 90-75% RH). Several quality parameters were determined: proximate composition drying-ripening rates (dehydration, acidification, fermentation, proteolysis, lipolysis and fat oxidation) and eating quality. The effects of fat level on the quality of salami were determined by simple ANOVA.

III – Results

Table 1 shows the effects of fat level on the proximate composition and drying-ripening indices of salami. After drying, the fat content of salami reached percentages of 27.7% (high), 26.1% (medium) and 24.2% (low). Salami may contain up to 50% fat (Moretti *et al.*, 2004; Rubio *et al.,* 2008). Appropriated a_w value was reached for all three salamis, although HF had lowers moisture and a_w. Rates of ash and protein were similar in al three salamis, although the MF salami showed a slightly lower protein percentage. LF salami showed more pronounced acidification, reaching pH value of 4.5 at the end of ripening, while pH fell to 4.9 in HF and MF salamis. Reddening, proteolysis and lipolysis were more intense in LF.

Total viable and lactic acid bacteria counts were higher in LF than in MF and HF (Table 2). Low fat level also improved the lactic fermentation of Salami, due to the rate microbiological growth increase at higher a_w. Rapid acidification by LAB in LF was associated with lower counts of *Micrococaceae*.

Table 3 shows the effects of the fat level on the eating quality of Salami. Surprisingly, lean colour scoring was higher in HF and MF than in LF. The intensity of dry-cured colour may increase when Salami contains more lean meat and equal dose of curing agents. Major sensory attributes of Salami such as odour, flavour, juiciness and fattiness were not affected by the fat

level, while minor differences in hardness were found as a function of fat level. Fat increased softness, although the overall acceptance was not affected. Thus, fat reduction can be made without loss of the eating quality of Salami. Acid flavour scoring did not agree with lactic acid content and pH found, getting the higher value in MF Salami.

Table 1. Effect of fat level on the proximate composition and drying-ripening of Salami prepared with different fat levels

	Fat level		
	High (M ± SD)	**Medium (M ± SD)**	**Low (M ± SD)**
Lipids NIR (g/100 g)	27.7±0.52 [a]	26.1±0.68 [b]	24.2±0.84 [c]
Moisture NIR (g/100 g)	34.3±0.33 [b]	38.4±0.87 [a]	37.9±1.43 [a]
Proteins NIR (g/100 g)	23.7±1.02 [a]	21.8±1.02 [b]	23.5±1.02 [a]
Ash (g/100 g)	5.4±0.33	5.3±0.33	5.3±0.33
a_w	0.89±0.01 [b]	0.91±0.01 [a]	0.90±0.01 [a]
pH	4.88±0.03 [a]	4.94±0.07 [a]	4.47±0.06 [b]
Lactic acid (g lactic 100 g^{-1})	0.67±0.02 [a]	0.51±0.03 [b]	0.67±0.07 [a]
Proteolysis (g NPN/100 g^{-1}TN)	11.08±1.42 [ab]	10.15±1.31 [b]	12.37±0.96 [a]
Fat acidity (mg KOH g^{-1})	4.43±0.36 [c]	6.87±1.11 [b]	14.36±1.94 [a]
L* Lightness (CIE units)	44.14±0.99 [b]	48.42±1.27 [a]	48.38±1.58 [a]
a* Redness (CIE units)	15.82±1.01 [b]	14.55±0.94 [b]	17.74±0.94 [a]
b* Yellowness (CIE units)	2.68±0.65 [b]	3.74±0.46 [a]	4.48±0.27 [a]
C* Chroma (CIE units)	16.06±1.09 [b]	15.02±0.98 [b]	18.29±0.95 [a]
º Hue (CIE units)	9.53±1.80 [b]	14.41±1.43 [a]	14.18±0.66 [a]

M: mean; SD: standard deviations; [a, b, c] Fat level effects (P≤0.05).

Table 2. Effects of fat level on the fermentative microflora (log fcu g^{-1}) of Salami prepared with different fat levels

	Fat level		
	High (M ± SD)	**Medium M ± SD)**	**Low (M ± SD)**
Total viable counts	8.83±0.14 [b]	8.72±0.08 [b]	9.20±0.09 [a]
Lactic acid bacteria	8.72±0.08 [b]	8.55±0.30 [b]	9.15±0.16 [a]
Micrococacceae	6.86±0.39 [ab]	7.33±0.41 [a]	6.45±0.23 [b]
Moulds and yeasts	5.16±0.15 [a]	5.32±0.33 [a]	4.45±0.22 [b]

M: mean; SD: standard deviations; [a, b, c] Fat effects (P≤0.05).

IV – Conclusions

Fat content of 24% (16% raw mass estimated by NIR) would be adequate to manufacture pork Salami from Chato Murciano breed, stuffed into natural gut and dried-ripened for 12 days. This fat reduction favoured the ripening properties of Salami, including lactic fermentation, without relevant loss of eating quality. Fat reduction could help with the commercialisation of Chato Murciano dry-cured sausages.

Table 3. Effects of fat level on the eating quality of Salami prepared with different fat levels

	Fat level		
	High (M ± SD)	**Medium (M ± SD)**	**Low (M ± SD)**
Lean colour	4.5±0.10 [a]	4.4±0.10 [a]	3.9±0.17 [b]
Odour	3.2±0.09 [b]	3.5±0.23 [a]	3.3±0.19 [ab]
Pepper odour	2.6±0.18 [ab]	2.4±0.21 [b]	2.8±0.16 [a]
Flavour	3.1±0.14 [b]	3.4±0.09 [a]	3.0±0.19 [b]
Pepper flavour	2.7±0.06	2.8±0.19	2.7±0.26
Acid flavour	3.0±0.19 [b]	3.9±0.13 [a]	3.1±0.15 [b]
Hardness	3.0±0.08 [b]	3.6±0.15 [a]	3.3±0.07 [a]
Juiciness	2.9±0.19	3.0±0.11	2.9±0.21
Fattiness	2.7±0.06	2.8±0.18	2.8±0.16
Acceptance	3.5±0.17	3.4±0.16	3.4±0.20

M: mean; SD: standard deviations; scoring scale: 1-5; [a, b, c] Fat effects (P≤0.05).

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