Meat quality traits of heavy pigs for the production of traditional Tuscan salami

Mani D., Balestri G., Pistoia A., Casarosa L., Poli P., Ferruzzi G.

in

De Pedro E.J. (ed.), Cabezas A.B. (ed.).
7th International Symposium on the Mediterranean Pig

Zaragoza : CIHEAM
Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 101

2012
pages 349-353

Meat quality traits of heavy pigs for the production of traditional Tuscan salami

D. Mani*, G. Balestri*, A. Pistoia*, L. Casarosa*, P. Poli* and G. Ferruzzi*

*Dipartimento di Agronomia e Gestione dell'Agroecosistema, Università di Pisa
Via S. Michele degli Scalzi 2, 56124 Pisa (Italia)

Abstract. The objective of the study was to evaluate the effect of the replacement of corn meal (CoM) by chestnut meal (ChM) in two diets of heavy pigs on the quality of meat and traditional Italian Salami obtained. Sixteen Large White pigs were divided in two groups and reared indoors in Garfagnana Valley (Tuscany, Italy). All animals were slaughtered after 464 days of trial at about 228 kg live weight. The quality of the *Longissimus lumborum* muscle, subcutaneous backfat and salami sausages was evaluated by chemical analysis and fatty acids profile. Data obtained show that ChM group increased the incorporation of unsaturated and monounsaturated fatty acids in muscle and backfat (P<0.05), moreover the diet with ChM significantly reduce (P<0.05) saturated fatty acids in backfat. Particularly ChM diet produced an increase (P<0.05) in the content of C18:1n−9 and significantly (P<0.05) reduce the content of C16:0, C18:0 and C20:0 in backfat. Inclusion of chestnut in the diet seems to have no significant effect on the fatty acid profile of salami. It is concluded that feeding a diet with ChM instead of CoM altered the fatty acid composition of *Longissimus lumborum* muscle and backfat without simultaneously affecting characteristics of salami sausages quality.

Keywords. Heavy pigs – Chestnut – Meat quality – Salami.

Qualité de la viande de porc lourd pour la production de charcuterie traditionnelle de la Toscane

Résumé. *L'objectif de cette étude était d'évaluer l'effet du remplacement de la farine de maïs (CoM) par de la farine de châtaignes (ChM) dans les régimes de porcs lourds, sur la qualité de la viande et du salami italien traditionnel obtenu. Seize porcs Large White ont été divisés en deux groupes et élevés à l'intérieur de la vallée de la Garfagnana (Toscane, Italie). Tous les animaux ont été abattus après 464 jours avec un poids d'environ 228 kg de poids vif. La qualité du muscle* Longissimus lumborum*, du lard et des salami traditionnels a été évaluée par analyse chimique et par profil en acides gras. Les résultats obtenus montrent pour le groupe ChM un niveau plus élevé en acides gras insaturés et monoinsaturés chez le muscle et le lard (P<0,05), en plus, le régime à base de ChM a conduit à une diminution significative (P<0,05) des acides gras saturés du lard. Particulièrement ChM a conduit à une augmentation (P<0,05) du contenu de C18:1n-9 tout en baissant (P<0,05) le niveau de C16:0, C18:0 et C20:0 du lard. L'inclusion de la châtaigne dans le régime ne semble pas avoir d'effet sur le profil en acides gras du salami. Nous avons conclu qu'un régime ChM au lieu de CoM modifie la composition en acides gras du muscle et du lard, sans pour autant avoir des interférences sur les caractéristiques de la qualité des salami.*

Mots-clés. *Porc lourd – Châtaignes – Qualité de la viande – Salami.*

I – Introduction

In the territory of Garfagnana (Lucca, Tuscany) pig rearing is carried out for processing meat into high quality traditional sausages (Register of traditional Tuscan products), the technique of production involves the use of animals slaughtered at high live weights (over 200 kg) and fed with by-products of the district derived from the processing of chestnut fruit (*Castanea sativa*) and spelt grains (*Triticum dicoccum*) for human food use. The high availability of these products allows local farmers to reduce feed costs and to typify the processed products.

These feed resources, especially the chestnut meal, confer specific dietary characteristics to meat by changing the lipid fraction increasing the proportion of unsaturated fatty acids (Coutron-Gambotti *et al*., 1998; Pugliese *et al*., 2005). Pigs used in this rearing system belong to cosmopolitan breeds indeed carcass traits are highly suitable for the processing into sausages.

The objective of this research was to evaluate the effect of substitution of corn meal with chestnut meal on chemical composition and fatty acids profile of muscle, backfat and a typical Tuscan salami derived from heavy pigs.

II – Materials and methods

The trial were carried out in a farm located in the Garfagnana district on 16 Large White reared intensively and slaughtered at around 228 kg live weight. In the growing period pigs were fed with a mixed diet (spelt meal, spelt bran, corn meal, soybean meal), while during the finishing period (95 days), heavy pigs were divided in two groups (Table 1) and fed with integration of corn meal (CoM) or chestnut meal (ChM).

Table 1. Composition of the experimental diets (%)

	Soybean meal	Corn meal	Chestnut meal	Spelt meal	Spelt bran
CoM†	6	44	0	38	12
ChM††	6	34	10	38	12

†CoM corn meal; ††ChM chestnut meal.

At the slaughtering, samples of muscle and backfat from each group were taken and stored for the chemical analysis. Traditional *Salame nostrano* were prepared by a local sausage make based from two diets. The lean meat (80%) were obtained from the sizing of ham, shoulder, loin, fillet, cup and fat part (20%) from backfat, cheek, shoulder. Minced into small pieces, the meat was mixed with salt (2.5%), black pepper (0.5%), infusion of garlic, nutmeg and white wine; no additives, sugar or starter were used. The meat was cut into a small pieces and were mixed for obtained a traditional grinding (7 mm). The dry sausages was made by means of a mechanical pressured sausages making machine and packed into natural gut casings (soft pork intestines) and hand-tied. Traditional salami after drying period (7 days) and ripening period (53 days) were prepared; the traditional room temperature ripening ranged from 7°C to 18°C, while the relative humidity ranged from 75% to 80%. At the end of experiment all the salami were weighed an average of about 550 g.

A representative samples of salami were vacuum packaged and stored at -20°C until chemical analysis. On the samples proximate chemical composition were carried out according to the AOAC method (1990), the extraction of total lipid was determined as described by Folch (1957), fatty acids methyl esters were prepared according to the method described by Christie (1982). FAMEs were analyzed by gas chromatography using a Thermo Quest (Milan, Italy) GC apparatus equipped with a 100-m high polar fused silica capillary column and a flame ionization detector (i.d. 0.22 mm, 0.25 µm film thickness; Chrompack CP-Sil 88 Varian, Middelburg, The Netherlands). Separated FAMEs were identified by comparison with the retention times of pure standards and reported as percentages of total fatty acids. Data were analyzed by one-way analysis of variance with JMP7 software (SAS Institute). Statistical significance was established at the level of $P<0.05$ and comparisons between means were conducted using the Tukey's HSD test.

III – Results and discussion

Results of the proximate chemical composition of diets are presented in Table 2 that were formulated as isoenergetic and isoprotein. CoM diet has a higher content of PUFA, particularly C18:2n-6 and C18:3n-3 while ChM showed a higher content in C18:0 and C18:1n-9 in agreement with other research on Corsican pig (Coutron-Gambotti *et al*., 1998) where the chestnut has increased the content of oleic acid in the diet.

Table 2. Chemical analysis (% DM) and major fatty acid composition of diets (% total FA)

	CoM	ChM
Moisture	9.27	9.06
Crude protein	14.04	13.88
Crude fat	2.72	2.66
Crude fiber	4.89	5.00
Ash	2.39	2.57
DE†	15.10	14.90
C14:0	0.04	0.15
C16:0	13.07	12.63
C16:1n-7	0.17	0.40
C18:0	1.28	1.68
C18:1 n-9	24.70	26.64
C18:2 n-6	54.95	52.93
C18:3 n-3	3.51	2.57
C20:0	0.21	0.35
C20:1 n-9	0.70	0.69
C22:0	0.18	0.20
C24:0	0.06	0.21
SFA	14.95	15.37
UFA	85.05	84.56
PUFA	58.46	55.60

† Digestible Energy expressed as MJ/kg DM.

No statistical differences were observed for the proximate analysis in muscle, backfat and salami among experimental diets (Table 3). The results for S*alame nostrano* were comparable with the data reported in the literature of Italian salami (Moretti *et al*., 2004).

The fatty acid composition of muscle in pigs fed with chestnut meal showed higher values of MUFA and PUFA (C18:3n-3) according to other research carried out on Cinta Senese and Iberian pig breeds (Pugliese *et al*., 2005; Andrés *et al*., 2001; Cava *et al*., 1999). The fatty acid composition of backfat showed a high values in SFA as a result of higher content in C14:0, C16:0, C18:0, C20:0 in CoM diet, while ChM significantly modified MUFA, particularly oleic acid and the PUFA/SFA ratio. The chestnut meal led to a higher content of C18:3n-3, C20:2n-6 and C20:4n-6 fatty acids, as reported previously by other authors (Diaz *et al*., 1996). In traditional salami obtained from pig fed with CoM diet the results showed a high level of cis-vaccenic (C18:1n-7) and linoleic (C18:2n-6) acid probably due to the high content of corn meal in diet.

IV – Conclusions

The integration of chestnut flour in the diet of heavy pig can affect the fatty acid profile of fresh products (backfat and muscle) by increasing the content of unsaturated fatty acids and particularly MUFA. In the processed product (salami) results show that the addition of small amounts of chestnut flour involves minor effects on the lipid fraction.

This research shows that the use of chestnut flour and other by-products of the area can improve the quality aspect and identify local meat products, moreover the use of these feed can help to reduce costs and represent an economic advantage for the farmer.

Table 3. Proximate analysis (%) and fatty acid composition of muscle, backfat, salami (% total FA)

	Muscle			**Backfat**			**Salami**		
	CoM	**ChM**	**SE**	**CoM**	**ChM**	**SE**	**CoM**	**ChM**	**SE**
Moisture	70.25	70.62	0.55	96.25	95.86	0.32	24.96	25.28	1.20
Crude Protein	76.40	76.28	1.88	-	-	-	38.98	35.28	1.43
Total Lipids	2.79	2.78	0.55	40.56	47.07	0.42	21.05	19.70	0.36
Ash	3.54	3.69	0.10	-	-	-	5.52	5.21	0.17
C10:0	0.18[a]	0.16[b]	0.01	0.08	0.09	0.01	0.08	0.07	0.01
C14:0	2.09	2.13	0.08	1.89	1.98	0.11	1.37	1.27	0.06
C16:0	21.78	21.88	0.40	22.16[a]	20.62[b]	0.36	22.59	23.08	0.27
C16:1 n-7	3.68	4.43	0.39	1.89	1.84	0.36	2.52	2.61	0.08
C18:0	10.54	9.31	0.56	12.25[a]	10.53[b]	0.51	11.67	11.81	0.30
C18:1 n-9	43.93	45.36	0.76	40.32[a]	42.62[b]	0.94	43.44	43.52	0.40
C18:1 n-7	4.66	5.25	0.30	2.49	2.51	0.30	3.13[a]	3.22[b]	0.10
C18:2 n-6	8.21	7.12	0.75	13.65	14.46	0.92	10.56[a]	10.02[b]	0.12
C18:3 n-3	0.26[a]	0.28[b]	0.22	0.64[a]	0.74[b]	0.02	0.51	0.47	0.01
C20:0	0.20	0.19	0.03	0.25[a]	0.20[b]	0.01	0.21	0.22	0.01
C20:1 n-9	0.75	0.92	0.16	1.20	1.15	0.15	1.02	1.02	0.01
C20:2 n-6	0.34[a]	0.33[b]	0.03	0.79[a]	0.84[b]	0.02	0.56	0.52	0.01
C20:4 n-6	1.10	0.60	0.15	0.17[a]	0.23[b]	0.20	0.21	0.21	0.01
C22:4 n-3	0.15	0.14	0.02	0.09	0.10	0.02	0.07	0.08	0.06
C22:5 n-3	0.10	0.06	0.03	0.02	0.05	0.03	0.05	0.04	0.01
SFA	35.79	33.67	1.38	36.85[a]	34.40[b]	0.59	36.50	37.04	0.49
UFA	63.67[a]	65.48[b]	1.34	63.03[a]	65.46[b]	0.58	63.38	62.85	0.48
MUFA	53.52[a]	56.96[b]	1.65	46.65[a]	49.38[b]	0.63	51.24	51.35	0.55
PUFA	10.15	8.52	1.38	15.70	16.81	0.72	12.22	11.60	0.16
PUFA/SFA	0.28[a]	0.25[b]	0.02	0.43[a]	0.49[b]	0.05	0.33	0.31	0.05
n-6/n-3	19.14	16.94	3.76	18.51	16.45	0.58	16.67	17.19	0.47

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

Acknowledgements

The project was supported by grant of Fondazione Cassa di Risparmio di Lucca. The authors thank to technical staff of Antica Norcineria, Ghivizzano (Lucca).

References

Andrés A. I., Cava R., Mayoral A. I., Tejeda J. F., Morcuende D. and Ruiz J., 2001. Oxidative stability and fatty acid composition of pig muscle as affected by rearing system, crossbreeding and metabolitic type of muscle fiber. In: *Meat Sci.*, 59: 39-47.

AOAC, 1990. Official Methods of Analysis 15th ed. Association of Official Analytical Chemists, Washington, DC, USA.

Cava R., Ruiz J., Ventanas J. and Antequera T., 1999. Oxidative and lipolytic changes during ripening of Iberian hams as affected by feeling regime: estensive feeling and alpha-tocopheryl acetate supplementation. In: *Meat Sci.*, 52: 165-172.

Christie W. W., 1982. A simple procedure for rapid transmethylation of glycerolipids and cholesterol esters. In: *J. Lipid Res.*, 23: 165-169.

Coutron-Gambotti C., Gandemer G. and Casabianca F., 1998. Effects of Substituting a Concentrated Diet for Chestnut on the Lipid Traits of Muscle and Adipose Tissues in Corsican and Corsican x Large White Pigs Reared in a Sylvo-Pastoral System in Corsica. In: *Meat Sci*., 50: 163-174.

Diaz I., García-Regueiro J. A., Casillas M. and De Pedro E., 1996. Trygliceride composition of fresh ham fat from Iberian pigs produced with different system of animal nutrition. In: *Food Chem.*, 55: 383-387.

Folch J., Lees M. and Sloane-Stanley G. H., 1957. A simple method for the isolation and purification of total lipids from animal tissues. In: *J. Biol. Chem.*, 226: 497-509.

Moretti V. M., Madonia G., Diaferia C., Mentasti T., Paleari M. A., Panseri S., Pirone G. and Gandini G. 2004. Chemical and microbiological parameters and sensory attributes of a typical Sicilian salami ripened in different conditions. In: *Meat Sci.* 66: 845-854.

Pugliese C., Bozzi, R., Campodoni, G., Acciaioli, A., Franci, O. and Gandini, G., 2005. Performance of Cinta Senese pigs reared outdoors and indoors. 1. Meat and subcutaneous fat characteristics. In: *Meat Sci.*, 69: 459-464.