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Natural antioxidant in pig feeding: Effects on meat and on salami quality

G. Pastorelli, R. Rossi, S. Cannata and C. Corino

Dipartimento di Scienze e Tecnologie Veterinarie per la Sicurezza Alimentare, Facoltà di Medicina Veterinaria, Università di Milano (Italy)

Abstract. The purpose of the present work was to evaluate the influence of polyphenols supplementation of diet during the last period of fattening (30 days) on oxidative process and chemical composition of pork and dry sausage. Material and methods. At slaughtering 36 samples of *Biceps femoris* (BF) muscle from heavy pigs fed control diet or supplemented diet with a natural extract of Verbenaceae (Ajute™) were collected by each dietary treatment group (n=18). Salami Cremona (PGI) were produced by a local plant according to the Disciplinary of Production and 6 salami for each treatment were submitted to sensory evaluation. Results and conclusion. No differences were found for proximate composition neither in fresh meat nor in salami. The oxidative stability, assessed using thiobarbituric acid reactive substances (TBARS), is lower in fresh meat ($P = 0.04$) and in salami ($P > 0.05$) of treated group. Sensory evaluation of Cremona salami discriminated the muscle color ($P = 0.04$) and the sour taste descriptors ($P = 0.02$) that resulted more intense in the treated group. The use of natural extracts determined a longer shelf life of meat due to the lower oxidation and a greater colour stability of salami over three months of ripening.

Keywords. Natural antioxidant – Heavy pig – Meat quality – Salame.

Effet de l'ajout d'antioxydants végétaux dans l'alimentation des porcs sur la qualité des viandes et des saucissons

Résumé. *Deux groupes de 18 porcs (poids initial: 128 kg, poids final: 160 kg) ont été nourris avec un régime témoin ou supplémenté avec un antioxydant d'origine végétale (AOV). Des échantillons de viande (muscle* Biceps femoris *– BF) et de saucissons issus de ces porcs ont été analysés: composition chimique, mesure des potentiels de lipopéroxydation (TBARS) et analyse sensorielle pour les saucissons. Les résultats montrent que l'ajout d'AOV dans les rations permet de diminuer les teneurs en TBARS dans le muscle BF. L'analyse sensorielle des saucissons secs montre que l'ajout d'AOV n'a pas d'effets majeurs sur les qualités organoleptiques (effet significatif limité sur la couleur et l'acidité).*

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

I – Introduction

Lipid oxidation is a major cause of chemical spoilage in food systems. To avoid or delay this autoxidation process, antioxidants such as Vitamin E in animal feeding have been utilised with the practice successfully in order to improve meat quality (Corino *et al*., 1999 a,b) and processed pork products (Zanardi *et al*.,1999). Natural antioxidant have been widely reported potent antioxidant effects (Nakatani 2000). The antioxidant properties are related especially to their phenolic contents. Among the polyphenols, verbascoside, constituent of many plants for food, flavoring and pharmaceuticals shows the highest scavenger activity inside the PPG tested (Wang *et al*., 1996). Recently Rossi *et al*., (2009) found that verbascoside has greater antioxidant power compared to other phenolic compounds and Trolox. The effects of phytochemical antioxidants on lipid oxidation in meat and meat products is of major concern. Considering the antioxidant effect of verbascoside tested, we likely hypothesized on the basis of a our preliminary study (Corino *et al*., 2007) that it could influence meat and processed meat quality. The aim of the present work was to evaluate the influence of polyphenols

supplementation of diet in pigs during the last period of fattening (45 days) on qualitative characteristics of pork and dry sausage.

II – Materials and methods

Hybrid Dalland pigs (36 female) of average weight 128 kg ± 13.2 were divided into two groups of 18 animals. The groups were randomly assigned to a growing-finishing diet supplemented with a natural extract of Verbenacee, titered in polyphenols, expressed as verbascoside, as to apport 6 mg/kg of feed (TR) or not (CON). Daily feed intake was restricted to 9% of metabolic live with water available for *ad libitum* consumption. After 45 d of feeding period, the animals were slaughtered at a commercial slaughter house (average weight of 160 kg). *Biceps femoris* (BF) muscle was sampled in order to analyze chemical composition (AOAC, 2000), drip loss (Rasmussen *et al*., 1996), cooking loss (Honikel 1998) and lipid oxidation measured as TBARS (Monin *et al*., 2003). Moreover two batches (TR and CON) were produced and sent to a processing factory in order to produce Salame Cremona (PGI) according to the Disciplinary of Production. Salame Cremona is an uncooked cured and matured sausage product Commission Regulation (EC) No 1362/2007. Six salami for each treatment were submitted to stability oxidation, chemical composition, color coordinates evaluation (L*, a*, b*) recorded using a Chroma Meter CR-300 (Minolta Cameras, Osaka, Japan) and sensory evaluation. Determinations were made in duplicate. Sensory analysis was performed using sensory profile method (ISO 13299, 2003). Descriptors selected were: muscle and fat colour, cohesion thin/fat, homogeneity of colour, consistency, oily, easily to peel, rancid, acid, salt, sweet and aged flavour. Samples were rated on a linear scale ranged from 1 (=minimum intensity) to 9 (=maximum intensity). All data were analysed by "Esplora" procedure in order to find outliers values, tested to the normality distribution and analyzed by T Student test with treatment as fixed effect (SPSS Inc., Chicago, IL).

III – Results and discussion

Results on chemical composition of fresh muscle and salame Cremona are presented in Table 1. No significant difference were found in any parameters analyzed. Results on chemical composition of muscle are in agreement with data reported in heavy pigs (Corino *et al*., 2002; Ventanas *et al*., 2006) and in BF muscle (Franci *et al*., 1995). The values found in Salame Cremona are in agreement with the Disciplinary of Production that establish a value of crude protein higher than 20% and water protein ratio maximum 2. Dietary treatment did not modify drip loss, according with Correa *et al*. (2006) on growing pigs.

Table 1. Chemical composition and drip loss of *Biceps femoris* muscle and Salame Cremona†

Item	BF muscle		Effect	Salame Cremona		Effect
	CON	TR	P	CON	TR	P
Moisture	77.73	77.56	NS	31.88	31.87	NS
Crude protein	22.26	22.43	NS	23.81	24.01	NS
Ether extract	3.82	3.30	NS	30.54	30.07	NS
Ash	1.12	1.24	NS	5.60	5.99	NS
Drip loss	4.14	4.34	NS	-	-	NS
Cooking loss	14.95	14.50	0.12	-	.	-

†Data expressed as percentage of wet weight.

The National Pork Board suggest a drip loss values equal to 2.5% at 24 h as indicator of meat quality; anyway the muscle analysed in the present work is different from that one individuated from the Commission. Cooking loss is a combination of liquid and soluble matters lost from the meat during cooking. The water is probably lost due to heat induced protein denaturation during cooking of the meat, which causes less water to be entrapped within the protein structures held by capillary forces. In this study even if no significant effect was deemed (P = 0.125), the treated group showed a numerically higher (+ 3%) retention value, important trait for the quality of pork meat since it is consumed especially cooked and therefore subjected to a protein denaturation. Verbascoside supplementation positively influenced the oxidative stability of fresh muscle (P<0.05) and salame Cremona (P>0.05) (Fig. 1). The effect is likely due to the antioxidant properties of the natural substances used and/or to a "saving" action on the Vitamin E as demonstrated by Casamassima *et al*., (2009). Studies on natural substances and their extracts have sometimes inconsistent results. Janz *et al*., (2007) did not find any effect on oxidative stability of pork meat from pigs fed with 0.05 % of essential oil, garlic, origanum and ginger. On the contrary Mason *et al*., (2005) reported that a supplementation with green tea, cathechin (200 mg/kg) in pigs from weaning to slaughtering improved significantly the oxidative stability of the LD muscle. The TBARS values of BF muscle are lower than those reported in literature; the reason could be dependent on the type of muscle used. In fact Novelli *et al*., (1998) analysed different muscles and found a value equal to 0.27 mg/kg MDA in BF muscle.

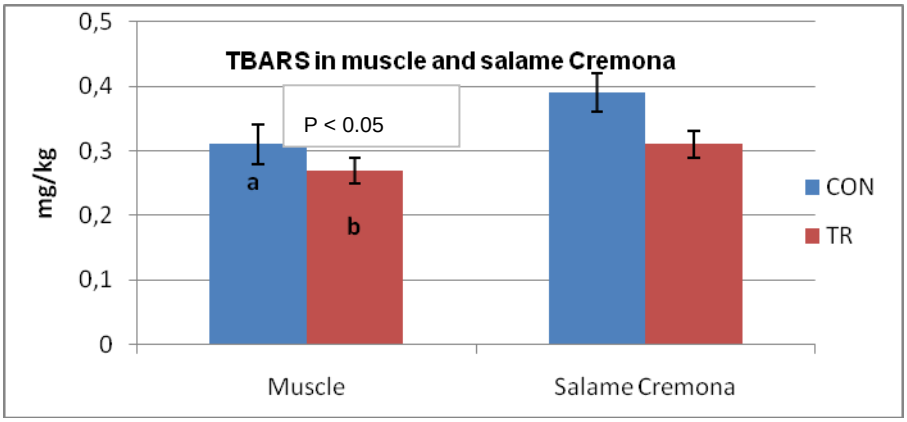

Fig 1. TBAR on BF muscle and on Salame *Cremona.*

In the present work the treated group showed values similar to those found by McCarthy *et al*., (2001) who reported 0.25 mg/kg of TBARS in BF samples muscle from pigs fed diets supplemented with different natural substances such as rosemary, aloe, ginseng, tea. The percentage reduction found herein is similar to that found by Corino *et al*. (1999), in LD muscle from pigs fed with a high Vitamin E dose (300 mg/kg). Concerning the transformed product, Martinez *et al*., (2006) found lower (P<0.05) values of TBARS in sausage treated with increasing values of green tea and borage. Results on Salame Cremona are in agreement with those found by Novelli *et al*., (1998) and Zanardi *et al*., (1998) in salame Milano in which values range from 0.22 to 0.30 mg malonaldehyde/kg sample. No significant difference was found for any descriptor excepting for muscle color and acid more intense in the treated group than CON group; this result is consistent with strumental data analysis (data not shown). Anyway sensorial analyses, for acid descriptor, releaved a values equal to one, far away to the maximum intensity fixed to nine. The result on colour agrees well with Ventanas *et al*., (2007) confirming the stability of the color during the seasoning process.

IV – Conclusions

In the present work a positive effect of dietary natural antioxidant has been noted, showing an improved oxidative stability equal to +15% in raw meat. Moreover the unchanged chemical characteristics of meat and salame Cremona and the surface color of salame stabilized also after a ripening period indicate that polyphenols supplementation in pig feeding is an effective way to improve color and lipid stability of muscle and transformed product.

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