PHYSICOCHEMICAL AND MICROBIOLOGICAL CHANGES IN SPANISH CHORIZO DURING RIPENING: EFFECT OF FAT AND LEAN ORIGIN AND PAPRIKA TYPE

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Introduction

Chorizo is one of the most typical Spanish meat products. Pork meat and pork backfat are the raw materials used in a normal recipe. However, occasionally, beef meat, especially that from lower price retail cuts from adult animals, could be used. In order to produce a high quality product, beef meat could be mixed with high quality fat tissues as that from Iberian pig. Iberian pig fat is characterized by a high percentage of unsaturated fatty acids and its beneficial effect on our health has been widely supported (Petrón *et al.*, 2004) but it has greater susceptibility to oxidation than saturated fat. Although synthetic antioxidants can retard the development of undesirable odours and flavours, questions regarding safety of these compounds together with consumer preference for "natural" products has provided an interest in natural antioxidants. The antioxidant effect of spices, garlic and paprika, has been widely demonstrated (Mateo *et al.*, 1997; Aguirrezábal *et al.*, 2000). Few studies have been done in fermented sausages without artificial additives (Mateo *et al.*, 1997; Aguirrezábal, *et al.*, 2000). Furthermore, no research has been carried out on using mixtures of beef meat and fat and lean from Iberian pigs to manufacture traditional Spanish chorizo. The aim of this study was to analyse the possibilities of using different mixtures of raw materials including shoulder beef meat and different fat tissues from Iberian pigs to make a high quality chorizo. The addition of sweet or spicy paprika was also studied.

Materials and Methods

Four different mixtures were produced as described in Table 1. Two batches were prepared of each mixture depending on the type of paprika used: one with 70% of sweet paprika and 30% of hot paprika (Batch A) and the other one with 70% of sweet paprika and 30% "ocal" paprika (Batch B), resulting in eight different batches. All mixtures had 20g/kg of salt, 30g/kg paprika, 0.35 g/kg oregano and 2g/kg fresh garlic.

Table 1: Raw materials and paprika type used in sausages.

	Beef meat	Cow fat	Iberian pig lean-fat	Iberian pig fat tissue	Paprika
Mixture 1A	60%	40%	-	-	Ocal/sweet
Mixture 2A	60%	-	40%	-	Ocal/sweet
Mixture 3A	50%	-	50%	-	Ocal/sweet
Mixture 4A	60%	-	-	40%	Ocal/sweet
Mixture 1B	60%	40%	-	-	Hot/sweet
Mixture 2B	60%	-	40%	-	Hot/sweet
Mixture 3B	50%	-	50%	-	Hot/sweet
Mixture 4B	60%	--	-	40%	Hot/sweet

After stuffing, the conditions during ripening were, 5 ± 2ºC and 75% relative humidity for the first ten days and 7± 2ºC and 65% relative humidity until the end of the ripening process (26 days). Three samples of each mixture were taken just before stuffing (day 0), and further samples were taken after 5, 8, 14, 20 and 26 days. The following analyses were performed on each sample: weight loss, pH, TBARS, Aw and bacteria counts (Aerobic psychotrophs, Enterobacteriace, Lactic acid bacteria).

Results and Discussion

Figures 1-3 show the changes in weight, water activity and pH of the different mixtures in relation to the origin of the lean and fat tissues used. No significant effect was found for type of paprika used for weight loss, pH, Aw, TBARs, and microbiological counts. Source of raw materials used significantly affected (P<0.001) weight loss along the ripening process (Figure 1), with the highest values for sausages made from lean and fat from cows, and the lowest for sausages formulated with Iberian pig internal fat, the rest being intermediate.

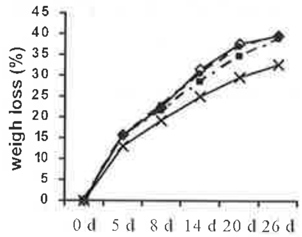

Figure 1: Weigh loss during ripening period

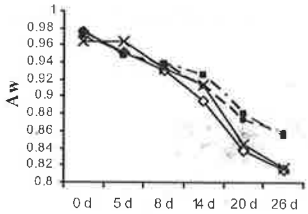

Figure 2: Changes in water activity during ripening period

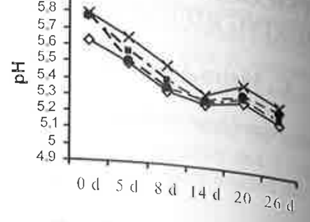

Figure 3: pH changes during ripening period

—◇— Mixture 1 - -■- - Mixture 2 —●— Mixture 3 —×— Mixture 4

In relation to Aw (Figure 2), as expected, a gradual decrease throughout the ripening process was observed, but statistically significant differences ($p<0.01$) were also found between samplings up to day 8 of ripening. Mixture 1 and Mixture 4 showed a faster decrease ($P<0.05$) in Aw values than Mixtures 2 and 3, which did not differ ($P>0.05$). As is usual in fermented products, a gradual decrease in pH occurred during the first two weeks of ripening ($P<0.01$) (Figure 3). After this, an increase in the pH was observed, followed by a slight decrease. pH value of sausages including Iberian pig fat tissue (mixtures 4) was higher up to day 5 of ripening, without differences among the rest of mixtures manufactured.

The TBARs values decreased during the 5 first days of ripening, increased after until day 14, and then decreased gradually until the end of cured process. Mixture 1 showed the highest TBARs values ($P<0.01$) throughout the ripening process. In any case, values ranged from 1.86 to 4.5 mg/kg, which are in the line to that observed by Aguirrezábal *et al.* (2000), and they can be considered acceptable. In this sense, several authors have observed that during the ripening of dry fermented sausage lipid oxidation did not occur, probably because the antioxidative effect of the species, curing agents and smoke (Domínguez and Zumalacarregui, 1991; Revilla and Quintana, 2006).

No significant differences were found for all microbiological groups tested ($P>0.05$) regarding raw materials used. The $\log_{10}$ value of total aerobic mesophilic bacteria was around 8 throughout the ripening period but *Enterobacteriaceae* counts decreased gradually throughout the cured process from a $\log_{10}$ value around 6 to a mean value around 4. Lactic acid bacteria counts increased gradually from a mean $\log_{10}$ value of 5 just after stuffing to a mean value of 8 at the end of the cured process, but statistically significant differences ($P>0.05$) were only found between days 0, 5 and 8.

Conclusion

From our results, physicochemical and microbiological changes during ripening process guaranteed the safety of the products elaborated. Since TBARs values can be considered acceptable, rancidity flavours are not expected. So, beef meat can be used as an alternative raw material to elaborate a quality product but it should be mixed with Iberian pork fat to decrease weigh loss.

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