INFLUENCE OF STARTER CULTURES ON SENSORY PROPERTIES AND BIOGENIC AMINES CONCENTRATION IN "CHORIZO"

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Background

"Chorizo" is a typical Spanish dry fermented sausage manufactured by different processing techniques. This product has been prepared for ages according to traditional methods but in the last decades modern plants have produced "chorizo" with the addition of nitrate and/or nitrite, sugars, reducing agents and starter cultures.

A very important function of starter cultures in dry sausage fermentation is the inhibition of growth of undesirable microorganisms. In addition, they produced lactic acid during the fermentation process, from sugars added to the sausage mixture, the pH decreases, imparting a tangy flavour to the product, and denatures the meat protein. This denaturation, which also results in water release, is largely responsible for the texture (Rovira et al., 1994).

On the other hand, it known that biogenic amines in foods are the result of microbial enzymatic decarboxylation of the precursor amino acids. During the manufacture of dry fermented sausages like "chorizo", there are favourable conditions for the formation of biogenic amines; there is a growth of microorganisms for several days, certain degree of proteolysis takes place allowing the presence of free amino acids as precursors and also, there is an acidic environment that favours the synthesis and activity of amino acid decarboxylases of bacterial origin (Bover-Cid et al., 1999). However, the addition of an adequate starter culture might prevent the amine accumulation (González-Fernández, 1999).

Objectives

The purpose of this work is to study the effect of three lactic acid bacteria, used as starter cultures, on the sensory properties and biogenic amines concentration of "chorizo" dry sausage.

Methods

Six batches of sausages were manufactured. Meat and fat were chopped in a cutter and all ingredients were then mixed in a mixer. The mixture was stuffed into 45 mm diameter collagen casings. All sausages were kept inside a ripening-chamber at 23ºC, 90% relative humidity for two days. Afterwards, the temperature was reduced to 13ºC and the relative humidity was decreased until 75%. These conditions were kept until the end of the process, twenty-two days later.

Each batch consisted of four different types of "chorizo": one of them without starter culture (control), other with a *Lactobacillus sakei* K29 ("chorizo" A), other with a *Pediococcus sp* P22 ("chorizo" B), both isolated from a traditional "chorizo" (Santos et al, 1997; 1998), and other with a commercial *Pediococcus sp* P208 ("chorizo" C) as starter cultures. Morphological, biochemical and physiological characterisation of the three strains was done according to the scheme described by Schillinger and Lücke (1987).

The identification of the starter strains during the ripening period was carried out via plasmid profile analysis according to the method of Anderson and Mc Kay (1983) modified by Reinkemeier et al (1996).

At the end of the ripening, a trained panel composed of 12 members assessed samples of each type of "chorizo". A triangle test and a quantitative descriptive analysis were carried out to look for differences between the control and the remaining sausages, scoring the following descriptors: elasticity, homogeneity, aroma, hardness, cohesiveness, chewiness, adhesiveness, juiciness, flavour, sourness, saltness and rancidity. Moreover, biogenic amines were analysed from 10 g of sample extracted with acetone/TCA and detected as their dansyl derivatives (pre-colum) by C18 reverse phase HPLC (Eerola et al., 1993).

Statistical analyses were performed with Statgraphics Plus 3.1. for Windows.

Results and discussion

- Sensory analysis

In the sensory analysis, the results of the triangle test revealed that there were differences between the control and the sausages made with starter cultures, however there were no statistic differences between the "chorizos" A, B and C (table 1).

The quantitative descriptive analyses showed that these differences were mainly focussed in texture parameters. However, there were hardly differences in other sensory parameters like flavour or aroma. In general terms, the control had the highest valour in elasticity and juiciness and the lowest valour in homogeneity, hardness, chewiness and cohesiveness.

- Biogenic amines

It agreement with the results of other authors (Vidal *et al.*, 1990; Hernández-Jóver *et al.*, 1997; Ayhan et al., 1999), putrescine and tyramine were the most abundant amines in these sausages. The production of biogenic amines differed depending on the type of lactic acid bacteria that was used as a starter strain. The highest amount of amines was found in the control "chorizo" (without starter culture); however, the "chorizo" inoculated with the strain of *L. sakei* (isolated from a traditional "chorizo") hardly contained biogenic amines (table 2).

- Statistical results

It was performed a discriminant analysis with all the studied parameters to know if was possible to differentiate between the four sausages. Using a stepwise selection algorithm, it was determined that four variables (elasticity, tyramine, putrescine and hardness) were significant predictors and amongst the observations used to fit the model, 82,1% were correctly classified. The plot of the discriminating functions showed that the control centroid was completely separated from the rest of centroids. However, the A, B and C centroids were very close between them, almost in the same point (figure 1).

Conclusions

On the basis of the above results, it may be concluded that lactic acid bacteria used as starter culture have a remarkable influence on "chorizo", especially on the texture parameters and the biogenic amines concentration.

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References:

- Anderson D. and Mckay L. (1993) Simple and rapid method for isolating large plasmid DNA from lactic *Streptococci*. Applied and Environmental Microbiology 46 (3), 549-552.
- Ayhan K., Kolsarici N. and Özkan A. (1999) The effects of a starter culture on the formation of biogenic amines in Turkish soudjoucks. Meat Science 53, 183-188.
- Bover-Cid S., Schoppen S.,Izquierdo-Pulido M. and Vidal-Carau M.C. (1999) Relationship between biogenic amine contenta and the size of dry fermented sausages
- Eerola S., Hinkkanen R., Lindfors E. and Hirvi T. (1993) Liquid Chromatographic determination of biogenic amines in dry sausages. Journal of AOAC International 76(3), 575-577.
- González-Fernández. C. (1999) Influencia de los cultivos iniciadores y la composición de azúcares en las características del chorizo. Ph Thesis of University of Burgos.
- Hernández-Jover T., Izquierdo-Pulido M., Veciana-Nogués M.T., Mariné-Font A. and Vidal-Carou M.C. (1997) Biogenic amine and polyamine contents in meat and meat products. Journal of Agricultural and Food Chemistry 45, 2098-2102.
- Reinkemeier M., Röcken W. and Leitzmann L. (1996) A rapid mechanical lysing procedure for routine analysis of plasmids from *lactobacilli* isolated from sourdoughs. International Journal of Food Microbiology 29, 93-104.
- Rovira J., Valverde E. and Jaime I. (1994) Aplicación tecnológica de cultivos iniciadores en la elaboración de embutidos crudos-curados. Eurocarne 31, 67-70
- Santos E.M., González-Fernández C., Jaime I. And Rovira J. (1997) Identification and characterization of lactic acid bacteria isolated from traditional "chorizo" elaborated in Castilla-León. Food Science and Technology International 3 (1), 1-9
- Santos E.M., González-Fernández C., Jaime I. and Rovira J. (1998) Comparative study of lactic acid bacteria house flora isolated in different varieties of "chorizo". International Journal of Food Microbiology 39, 123-128.
- Schillinguer U. and Lücke F.K. (1987) Identification of *lactobacilli* from meat and meat products. Food Microbiology. 4, 199-208
- Vidal M.C., Izquierdo M.L., Martín M.C. and Mariné A. (1990) Histamina y tiramina en derivados cárnicos. Revista de Agroquímica y Tecnología de los Alimentos 30(1), 102-108.

Table 1. Triangle test between the control (Cn) and the "chorizos" inoculated with *L. sakei* K 29 (A), *P. sp* P 22 (B) and *P. sp* P 208 (C).

	Batch 1	Batch 2	Batch 3	Batch 4	Batch 5	Batch 6
Cn-A	***	**	***	**	**	***
Cn-B	*	*	***	*	**	***
Cn-C	*	*	**	*	*	**
A-B	NS	NS	NS	NS	NS	NS
A-C	NS	NS	NS	NS	NS	NS
B-C	NS	NS	NS	NS	NS	NS

NS: not significant, *p<0.05 **p<0.01 ***p<0.001

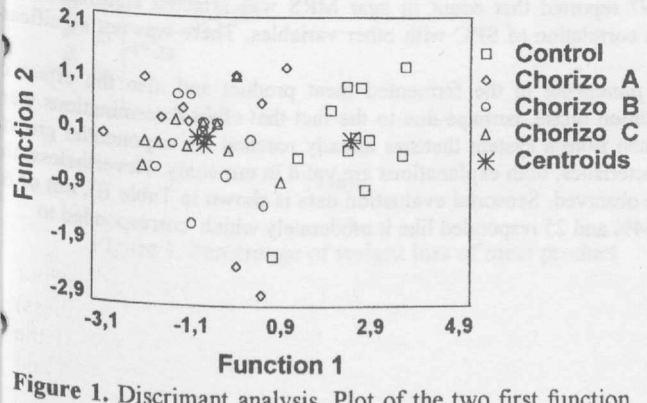

Figure 1. Discrimant analysis. Plot of the two first function score vectors. Location of samples in the plane.

Table 2. Concentration of biogenic amines (mg/Kg).

Amine	Control	Starter strain		
		L. sakei K29 (A)	*Pediococcus sp.* P22 (B)	*Pediococcus sp.* P208 (C)
Tryptamine	21^{b}	3^{a}	10^{ab}	11^{ab}
PEA	-	1^{a}	-	1^{a}
Putrescine	144^{b}	17^{a}	41^{a}	64^{a}
Cadaverine	7^{a}	1^{a}	2^{a}	5^{a}
Histamine	-	-	-	-
Tyramine	109^{c}	18^{a}	38^{ab}	57^{b}
Spermidine	1^{a}	1^{a}	1^{a}	1^{a}
Spermine	-	-	-	-

* Different letters in a file mean significant differences ($p< 0.05$)