USE OF STARTER CULTURES IN DRY-FERMENTED SAUSAGE ("CHORIZO") AND THEIR INFLUENCE ON THE SENSORY PROPERTIES

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Background: "Chorizo" is a dry-fermented meat product, popular in Spain, and its principal characteristic is that paprika is the main spice used in its formulation. Although the effect of starter cultures in the manufacturing of dry-fermented sausages, has been described in several studies (Coventry and Hickey, 1991; Berwal and Dinchev, 1993; Buckenhüskes, 1993; Hammes and Knauf, 1994), few information about the effect of starter cultures on the sensory properties of dry-fermented sausages can be found (Pérez et al, 1992, Klettner and Lücke, 1992, Sharma and Mukhopadhyay, 1995).

Objectives: The aim of this work is focussed on three points. First, the search of advantages that could offer the use of starter cultures in relation to the sensory properties, with special reference to texture. Then, the study of differences between the use of commercial *Lactobacillus sake* and *Pediococcus sp* and between two cultures of *Lactobacillus sake* of different origin, one commercial and other isolated from a traditional "chorizo" of a Spanish region (Castilla-León).

Methods: Two commercial starter cultures, *Lactobacillus sake* (Lc) and *Pediococcus sp* (Pc) and a *Lactobacillus sake* (A216) strain isolated from "chorizo" were used. These starter cultures were stored at -20ºC prior to use.

Characterization of the starter cultures. Previous to the inoculation of the starter cultures in the "chorizo" morphological, biochemical and physiological characterization of the three strains, were done according to the scheme described by Schillinger and Lucke (1987). Optimum growth temperature "in vitro" and maximum population of each strains were also investigated.

Formulation and processing of the sausage. Three batches of 24 Kg of "chorizo" were prepared using a standard formulation with 0.1% glucose. Meat and fat were chopped in a cutter and all ingredients were then mixed in a mixer. One type of "chorizo" was not inoculated to act as a control. As starter cultures, *Lactobacillus sake* Lc was added in "chorizo" type A, *Pediococcus sp* Pc in "chorizo" type B and *Lactobacillus sake* A216 in "chorizo" type C. The mixture was stuffed into 45mm diameter beef casings. All sausages were kept inside a ripening-chamber at 20ºC, 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 days later.

Product analyses. Thirteen samples were taken along the ripening process. During this period the following parameters were determined: lactic acid bacteria counts, pH, water activity (Aw) and evolution of texture. The last parameter was measured with a Texture Analyzer Stable Micro Systems XT.RA performing the instrumental Texture Profile Analysis (TPA) (Breene, 1975). Texture was determined on eight sausages slices of each type of sausage, with a cylindred probe of 1 cm diameter, at 1 mm/min speed and the level of compression was 70% of the thickness of the sample (1,5 cm). The test was accomplished always at room temperature (21ºC-25ºC).

Sensory analysis. At the end of the ripening, samples of each type and batch were assessed by a trained panel composed of 12 members. A triangle test was carried out to look for differences between the control and the remaining sausages. Then, with a quantitative descriptive analysis, descriptors as adhesiveness, firmness, flakiness, hardness, chewiness, juiciness, flavour, taste, sourness and saltness were scoring using 9-point scales, 9 denoted extremely high and 1 denoted extremely low. Samples were also evaluated by a consumer panel that ranked them according to preference for appearance, flavour, taste, texture and overall acceptability.

Results and discussion: The characterization of the strains revealed that the two species of *Lactobacillus sake* were quite similar. Nevertheless, strain A216 was lactosa-negative and grew poorly at pH 3,9. Pediococci strain produced acetoin, SH_2, fermented more carbohydrates than the lactobacilli strains, but it was not capable of hydrolysing arginine. For all the three strains, optimum growth temperature was 30ºC. However, lactobacilli strains, specially A216, grew faster than pediococci at lower temperatures. These results agree with the evolution of the microbial growth in the sausages. The two lactobacilli also grew quicker and they arrived to the maximum population in the third day of ripening (10^9 cfu/g), while the pediococci did not reach the maximum population until the fourth day of ripening. In the control sausage, the bacterial growth rate was much slower arriving to its maximum value in the seventh day of ripening. Concerning to Aw, all the sausages had the same behaviour reaching final values of 0,9. The evolution of the pH and the hardness resulting from Texture Profile Analysis (TPA) are represented in figure 1 and figure 2. At the end of the ripening period, the sausages elaborated with starter cultures had higher hardness values than the control, being this difference statistically significant.

In the sensory analysis, the results of the triangle tests, revealed that there were differences between the control and the sausages made with starter cultures, with a higher significance level in the sausages produced with lactobacilli (α=0,01) than in the sausages elaborated with the pediococci (α=0,05). In the quantification, there were differences between the control and the three sausages elaborated with starter culture, in adhesiveness, firmness and hardness, showing the control the lowest values (table 1). In the preference tests, there were no differences between the four sausages in appearance, taste and flavour, whereas in texture and in overall acceptability, the sausage elaborated with the strain of lactobacillus A216 was preferred.

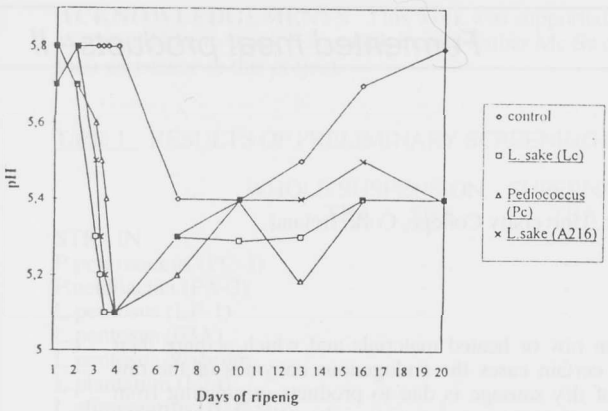

Fig. 1: Effect of starter cultures on pH during ripening of "chorizo".

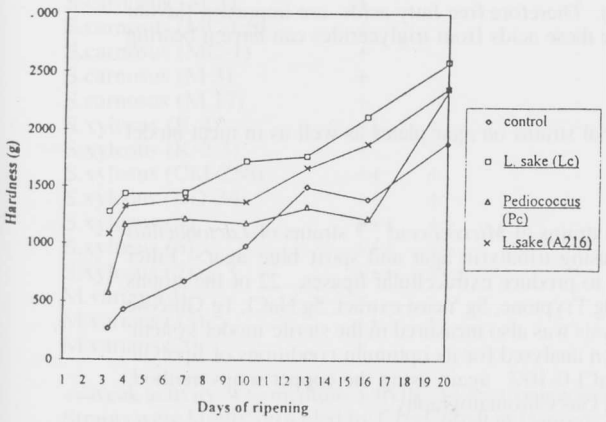

Fig. 2: Effect of starter cultures on texture during ripening of "chorizo"

Table 1. Sensory scores of the control (Cn) and the dry-fermented sausages inoculated with *Lactobacillus sake* Lc (A), with *Pediococcus sp* Pc (B), with *Lactobacillus sake* A216 (C), (means and standard desviations, n=36).

	Cn	A	B	C	Cn-A	Cn-B	Cn-C	A-B	A-C	B-C
Adhesiveness	4,7±1,7	5,6±1,7	6,0±1,5	5,5±1,5	**	***	*	NS	NS	NS
Firmness	3,2±1,3	4,1±1,5	4,0±1,5	4,0±1,4	**	**	*	NS	NS	NS
Flakiness	6,1±2,1	5,5±1,6	5,4±1,6	5,5±1,5	NS	NS	NS	NS	NS	NS
Hardness	3,2±1,2	4,4±1,4	3,9±1,3	4,3±1,5	***	**	***	NS	NS	NS
Chewiness	4,6±1,7	5,2±1,5	5,0±1,6	5,1±1,7	NS	NS	NS	NS	NS	NS
Juiciness	6,4±1,1	5,8±1,2	6,1±1,1	5,8±1,3	*	NS	*	NS	NS	NS
Flavour	5,8±1,2	5,3±1,3	5,6±1,2	5,7±1,1	NS	NS	NS	NS	NS	NS
Taste	5,3±1,4	5,7±1,3	5,6±1,4	6,2±1,1	NS	NS	**	NS	NS	*
Sourness	4,9±1,7	5,3±1,5	5,0±1,5	5,6±1,6	NS	NS	*	NS	NS	NS
Saltness	5,1±1,8	5,1±1,5	4,8±1,5	5,5±1,3	NS	NS	NS	NS	NS	NS

NS: not exist significant differences
Level of significance: * $p < 0.05$ ** $p < 0.01$ *** $P < 0.001$

Conclusions: The use of starter cultures has a favourable influence on sausage elaboration, shortening its manufacture time. Furthermore, sensory properties of the final product are modified, especially the texture, being increased some attributes as the adhesiveness, firmness and hardness, and reduced the juiciness. With a low quantity of carbohydrates (0,1%) in the formulation of "chorizo", there are no differences between the use of a *Lactobacillus sake* Lc and a *Pediococcus sp* Pc.

Though, the three starter cultures seem to affect in a different level the sensory properties of final product, there are no significant differences between them, except for taste that is more intense in the sausage elaborated with the lactobacillus A216. However, the type of used starter culture seems to have some influence on the sensory quality, especially on the texture, since the consumers concerning to texture and overall acceptability, preferred the sausage made with the lactobacillus (L. sake A216) isolated from a traditional sausage.

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