WHITE PRECIPITATES FORMED ON THE SURFACE OF "CHORIZO"

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BACKGROUND

Chorizo is a typical fermented sausage produced in Spain which is usually marketed without mould growth on the surface. "Sarta" is one of the best known low caliber chorizos, which are usually made up with only meat, fat, NaCl, paprika and garlic. For that reason, and in order to increase its shelf life, in recent years, it has been packaged in modified atmosphere and stored at refrigeration temperatures. However, after several days, some white substances often precipitate on the surface, giving an aspect to the product which could be rejected by some consumers. So far, the main precipitates formed during ageing and storage of meat products which have been studied are: tyrosine in dry-cured ham (Butz., et al 1974; Silla et al., 1985; Arnau et al., 1996), Na_2HPO_4 in dry-cured ham and fermented sausages (Arnau et al., 1997) and NaCl in dry-cured ham (Boadas et al., 2000).

OBJECTIVES

The aim of this study was to evaluate the composition of the white precipitates on the surface of "sarta" chorizo fermented sausages.

MATERIAL AND METHODS

Sampling

"Sarta" type chorizos with white precipitates on the surface were selected from the market and classified into three different batches according to the aspect:
1: Slight fine white precipitate.
2: White clusters.
3: Translucent crystals.
The surface of two samples per group was scraped and an energy dispersive X-ray microanalysis and X-ray diffraction were carried out. Part of the precipitate of batch 2 was dissolved in D_2O and the NMR spectra were determined. PH and Aw values and fat, moisture, NaCl, P_2O_5 and nitrogen contents were evaluated in 6 chorizos of groups A and B and 4 of group C after removing the casings.

Physicochemical analysis

Microanalysis was carried out with an energy dispersive X-ray microanalysis system (EDX) Link Isis L 200 B coupled with a scanning electron microscope Zeiss DSM 960A . X-ray diffraction analysis was carried out with a Difractometer Debye-Scherrer INEL CPS-120, radiation Kα Cu (λ=1.5406 A, 40 Kv; 30 mA). The results were compared with the Powder difraction file from the International Centre for Difration Data, Joint Committee of Powder Difraction Standards, (1998).
PH was measured with a combined electrode (Ingold 406, Ingold Urdorf, Switzerland) attached to a portable pH meter (Crison 507, Crison Instruments SA, Barcelona, Spain) in 6 points per chorizo and the mean was recorded; NaCl content by the Charpentier-Volhard method (ISO, 1970); Total nitrogen by the Kjeldhal method, moisture as weight loss at 103 $\pm$ 2 ^{0}C, P_2O_5 by the Molybdat-Vanadat method and fat by solid-liquid extraction with Soxhlet (Presidencia del Gobierno, 1979) and the water activity was obtained using an electric hygrometer provided with an automatic recorder (TESTO 650) by determining the equilibrium relative humidity.

RESULTS AND DISCUSSION

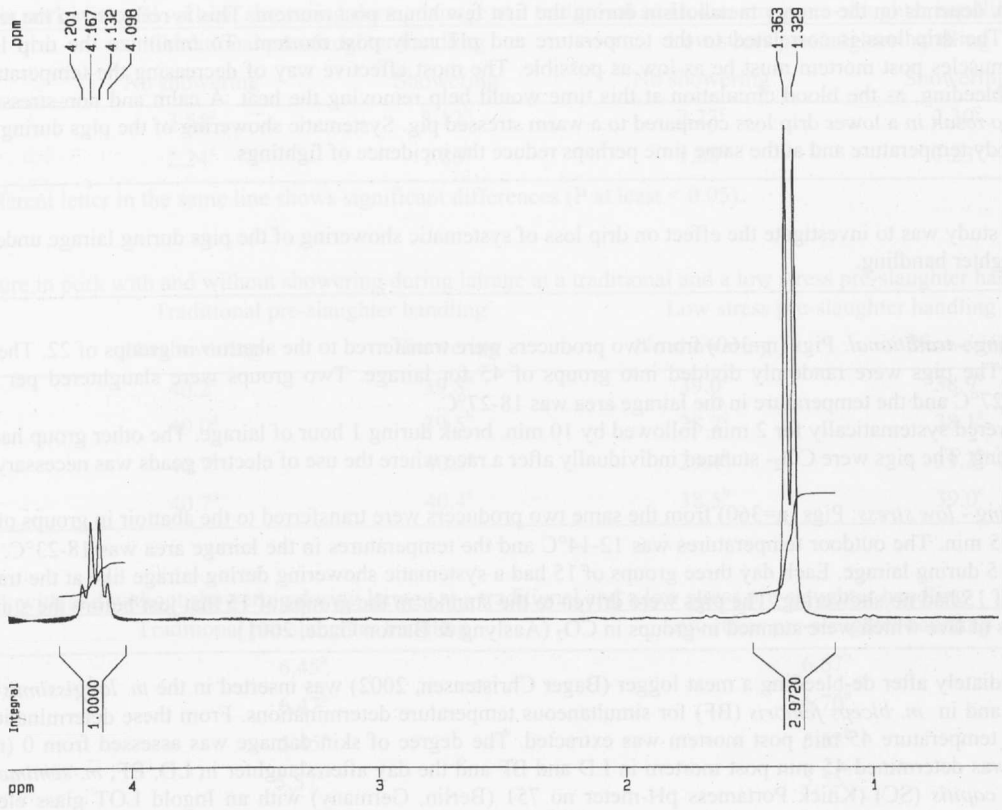
Energy dispersive X-ray microanalysis, indicated that the elements that were among the more important in the precipitates were: N and O for batch 1; O and Mg for batch 2 and P, O and Na for batch 3.
X-ray difraction showed that the composition of the precipitates was: 1: creatine.H2O, 2: not identified and 3: Na_2HPO_4. $7H_2O$.
Fig. 1 shows an NMR spectrum of a sample of batch 2 surface precipitate which could be associated with lactate ion.
Creatine and phosphate are substances that naturally exist in the muscle, and the hypothetical presence of magnesium lactate could be due to the combination of lactate (formed in the muscle after the slaughter and during chorizo fermentation) and magnesium which is present in the meat in a concentration that ranges from 25 to 29 mg/100 g (Souci et al., 1986) and in other ingredients (salt, paprika and water).
The concentration of these substances in the water phase increases during the ageing process and could be higher than their maximum solubility due to their low moisture content (Table 1). Moreover, NaCl content and the refrigeration temperature could reduce their maximum solubility and facilitate their precipitation.
Batch 3 showed the highest P_2O_5/moisture and NaCl/moisture ratios and the pH was significantlly higher than in batch 2, and according to Arnau et al., (1997) the Na_2HPO_4 precipitation is facilitated. Of the three possible Na_2HPO_4 hydrates, only Na_2HPO_4. $7H_2O$ was found in this study, maybe due to the low water activity of the chorizos (Comaposada et al., 2002).
In conclusion, the three different types of precipitates found on chorizo surface were made up of creatine.H_2O, Na_2HPO_4.$7H_2O$ and maybe of magnesium lactate.

Table 1. Physicochemical parameters of "sarta" chorizos with different precipitates on the surface.

Batch	Protein (1)	Moisture (1)	Fat (1)	NaCl (2)	P_2O_5 (2)	Aw	PH
1	25.29±1.76	23.42±2.41a	44.76±2.93a	13.47±1.61a	1.04±0.12a	0.83±0.02a	5.83±0.03a
2	24.24±0.35	23.88±0.76a	44.82±0.83a	14.03±0.93a	1.08±0.02a	0.83±0.01a	5.51±0.02c
3	24.28±1.25	17.62±1.90b	50.11±1.86b	18.56±2.13b	1.40±0.22b	0.79±0.02b	5.70±0.06b

a, b, c: means within the same column with different letters are significantly different (P<0.05)
(1): Percentage on wet weight, (2): Percentage referred to water content

Figure 1. NMR Spectrum of a sample of batch 2 surface precipitate dissolved in D_2O.



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