

EFFECT OF THE SODIUM NITRITE ON CHEMICAL AND MICROBIOLOGICAL COMPOSITION OF "SALPICÃO" - A TRADITIONAL PORTUGUESE DRY SMOKED SAUSAGE

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SUMMARY

"Salpicão", a dry smoked sausage marketed in Portugal, is traditionally prepared without curing agents. The effect of nitrite on the chemical and microbiological composition of the "salpicão" from Vila Real was studied during ripening. The pH, a_w , cured meat pigment, thiobarbituric acid (TBA), nitrite, plate counting for mesophilic, *Lactobacilli*, *Micrococcaceae*, lipolytic and coliform bacteria were determined through 56 days of ripening. In addition sensory evaluation of two batches was made after 28 days of ripening. The addition of nitrite increased the cured meat pigments, the number of viable cells of *Lactobacilli* and lipolytic bacteria while the addition of nitrite decreased pH, TBA values, number of viable cells of coliform bacteria and had no action in a_w and *Micrococcaceae*. Statistically significant preference was detected in the batch with nitrite. At the same time the residual level of nitrite was very low in the consuming period of the product (after 28 days of ripening).

INTRODUCTION

Portugal has a large variety of traditional sausage products. Among the various kinds of smoked dry sausage (salpicão), available in northern Portugal, there is the "salpicão" from Vila Real, which is the object of this study. This product has been prepared for ages according traditional methods. It consists of a single piece of pork loin, matured with salt, garlic and red wine, but without the addition of nitrate, nitrite, sugar or start cultures. This sausage is smoked in a traditional smokery and ripened at environmental temperature during coldest months (from December to April). It has been scarcely studied (Martins *et al.* 1987) unlike other international traditional sausages which

have been extensively studied (Favre and Duran, 1977; León Crespo *et al.*, 1978; Mendoza *et al.* 1983; Ferrer and Arboix, 1986; Lois *et al.*, 1987).

The purpose of this study was to investigate the effect of the addition of sodium nitrite on the chemical and microbiological composition and sensory evaluation of "salpicão".

MATERIAL AND METHODS

The experimental production of "salpicão" was carried out in a local factory following traditional practices. The "salpicão" from Vila Real consists of a single piece of pork loin, weighing about 350 g. In batch 1 the seasoning was the same as the traditional process: 4.5% of salt, 0.2% of garlic and 7.5% of red wine. The batch 2 had the same seasoning as batch 1 with the addition of 0.2% of nitrite salt (150 mg NaNO_2/Kg of meat) and 0.2% of ascorbic acid. Both batches were matured for twelve days at 6°C and 75% RH. The stuffing is filled into gross pork gut, which produced a 350 g and 50 mm diameter sausage. They were subject to the drying effect of smoke in a traditional smokery for 9 days, and kept at environmental temperature ($\pm 20^\circ\text{C}$) for a further period of 35 days.

Samples from each batch were collected at different times (days): 0 (meat), 2, 6, 12 (during maturation), 21 (after smoking), 28, 42 and 56 days of ripening.

The pH was measured with an Orion pH meter, model 601A, in the water extract. The a_w was determined in a Rotronic Higrroskop DT at 25°C. Cured meat pigments were evaluated according to the method of Hornsey (1956) described by León Crespo *et al.* (1978). The residual nitrite was determined colorimetrically using Zambelli's reagent (Methodes de Controle, 1978). Thiobarbituric acid was determined as described by Pearson (1973), and the results were expressed in mg of malonaldehyde per Kg of sample.

Microorganisms were enumerated using the following procedures: total plate count of mesophilic on plate count agar (PCA-Difco) (3 days at 30°C); *Micrococcaceae* on manitol salt agar (MSA-Difco) with 3 days at 30°C; *Lactobacilli* on MRS (described by Ribeiro *et al.*, 1967) with 3 days at 30°C; Lipolytic bacteria on trybutirin medium (6 days at 25°C) (Fryer *et al.*, 1967); and coliform bacteria were counted on desoxicolate agar media (Ribeiro *et al.*, 1967) incubated 24 hours at 37°C.

The sensory evaluation was carried out by eleven persons, all familiar with organoleptic evaluation of "salpicão", using a scoring system and a descriptive method (León Crespo *et al.*, 1984). Colour, taste, odor, and preference were evaluated at 28, 35, 42, 49 and 56 days of ripening.

RESULTS

Results are shown in figures 1 through 7 and table 1. Each value is the mean of six repetitions.

The pH values showed significant differences ($P > 0,05$) among batches and time of ripening. Although the meat of batch 2 initially had a higher pH (Fig. 1). There was a sudden decrease of the pH values, which persisted in batch 2.

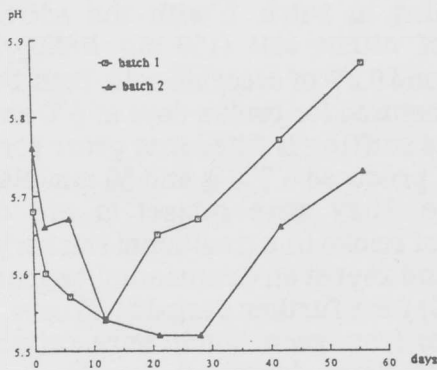


Figure 1 - The pH values of "salpicão" in two batches during ripening.

The a_w values decreased with drying process (Fig. 2). The additives had no influence in this parameter, showing no significant differences among batches.

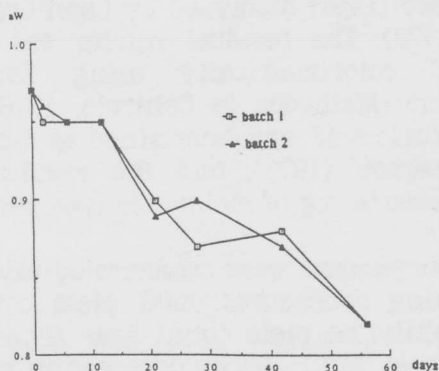


Figure 2 - The a_w values in two batches of "salpicão" during ripening

The meat pigments and pigment conversion (Fig. 3 and 4) show significant differences ($P < 0,001$) among batches. The batch 2 always had higher values, especially as far as the pigment conversion is concerned.

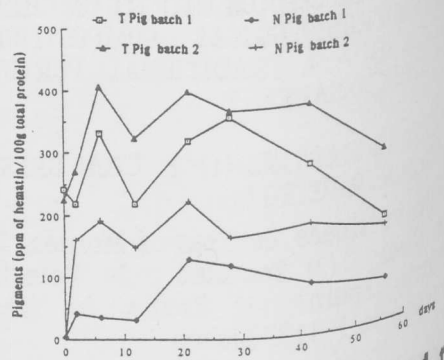


Figure 3 - Total pigment (T Pig) and nitrosopigment (N Pig) values during ripening of two batches of "salpicão"

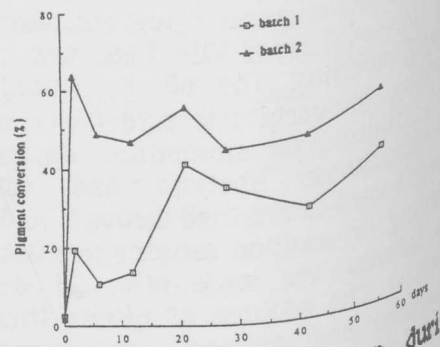


Figure 4 - Pigment conversion during ripening in two batches of "salpicão"

The residual value of nitrite reaches the maximum in batch 2 on the second day of maturation decreasing to a residual level near batch 1 without nitrite. Both batches have low residual values of nitrite (≈ 4 ppm) at the moment of commercialization of the product.

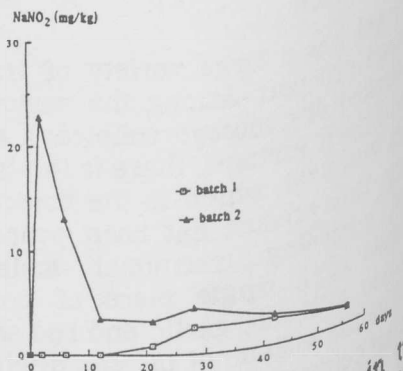


Figure 5 - Residual nitrite value in two batches of "salpicão" during ripening.

The TBA values showed significant differences ($P < 0,001$) among batches, being higher

in batch 1, thus demonstrating the results of antioxidant action of additives.

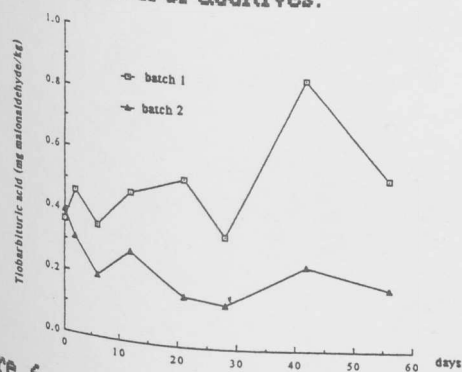


Figure 6 - TBA values in two batches of "salpicão" during ripening.

The results of plate counting microorganisms are shown on figures 7. They have significant differences among batches for every studied microorganisms, excepting *Micrococcaceae* that has no effect on additives. The dominant microflora in both batches is *Lactobacilli* with the more viable cells in batch 2, showing the selective action of nitrite in these bacteria. The lipolytic bacteria have an evolution similar to the *Micrococcaceae*, for most of them belong to the latter family, although they reach higher number in batch 2. The nitrite decreased coliform bacteria in batch 2 at higher levels of a_w while in batch 1 these reduction derived from the drying effect in the last stage of ripening.

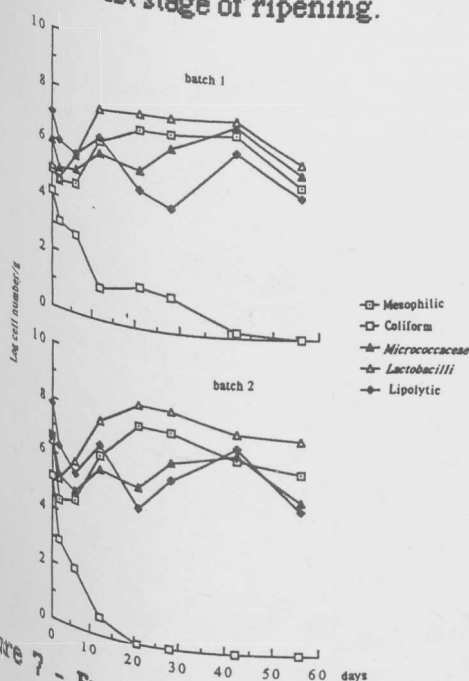


Figure 7 - Evolution of microorganisms in two batches of "salpicão" during ripening.

In the sensorial evaluation significant differences ($P < 0.001$) have been found among batches for colour, taste and preference. Batch 2 has always higher values in the studied organoleptic characteristics (table 1). The colour indicator is the parameter with more differences.

Table 1 - Results of sensory evaluation of "salpicão"

days	colour		odor		taste		preference	
	batch 1	batch 2	batch 1	batch 2	batch 1	batch 2	batch 1	batch 2
	28	5.2	6.9	6.2	5.9	6.2	6.4	6.3
35	6.2	6.3	5.9	5.6	5.8	6.5	6.1	6.3
42	6.3	6.5	6.0	5.7	5.9	6.2	6.2	6.4
49	5.4	7.4	5.7	6.7	5.9	6.7	5.4	6.6
56	6.4	7.4	5.9	6.2	6.4	6.6	5.8	6.5
x	5.9	6.9	5.9	6.0	6.0	6.5	6.0	6.5

each value is the mean of scoring by eleven persons in three repetition

CONCLUSION

The addition of nitrite significantly increased cured meat pigments and decreased both pH and oxidative rancidity. On the contrary, nitrite does not affect a_w . The number of viable cells of *Lactobacilli* and lipolytic bacteria increased with the addition of nitrite. *Micrococcaceae* were not affected and coliform bacteria significantly decreased whenever the curing agent was present. Statistically, significant colour and taste differences were observed in products with and without nitrite: statistically significant preference was detected in the presence of the chemical food additive. In addition, the residual level of nitrite was very low (± 4 ppm) after 28 days of ripening.

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