



INFLUENCE OF THE ONION VARIETY ON THE SHELF LIFE OF THE BLOOD SAUSAGE “MORCILLA DE BURGOS”

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Background

Morcilla de Burgos is a popular cooked blood sausage produced in the region around Burgos, in the north of Spain. *Morcilla* is made of a mixture of chopped onion, rice, animal fat, blood, salt and different spices such as black pepper, paprika and cumin. Physicochemical and sensory properties of this traditional product were investigated in order to support the claim for a Protected Geographical Indication.

Three types of *morcilla* could be differentiated according to their sensorial and physical-chemical characteristics, composition and geographical origin (Santos et al., 2003). Due to the high percentage of onion included in this product (between 15% and 70%), especially in two of the types, this ingredient is determinant of their sensory properties (Santos et al., 2002) and probably it will have a great influence on shelf-life of the product.

“Horcal” is a regional variety of onion, grown in river banks. This onion has an elliptical shape and bigger size compared with others kinds of onions. This variety is the most often used as ingredient of *Morcilla de Burgos*, since, according to traditional manufacturers, its less firm texture and mild pungent flavour gives to *Morcilla* a sensibly better sensory quality. However, its crop is seasonal with a short period of storage and it must be substituted by other varieties of onion when *morcilla* manufacturers run short of “Horcal” onion of suitable quality. In this case, the variety most often used is “Grano” or “Valenciana”, with globular shape. Besides, it is smaller than “Horcal” variety and its sensory properties also differ, since it is firmer and more pungent than “Horcal” onion.

Objectives

The aim of this study is to know the effect of the variety of onion used in the manufacture of the blood sausage “Morcilla de Burgos” on their sensory characteristics and shelf-life of the product.

Materials and methods

Samples: Two batches of 60 *morcillas* were made with the same formulation with the only difference of the kind of onion added. One batch was made with a local variety of onion *Allium cepa* L. var. horcal and the other batch with *Allium cepa* L. var. grano. Sausages were vacuum-packaged in the factory, after cooking and cooling. *Morcillas* were kept in refrigeration at 4°C, during storage. Samples for microbiological and physical-chemical analysis were taken after manufacture (day 0) and at days 7, 14, 21, 33 and 63 of storage. At each sampling time two *morcillas* were analysed, randomly chosen. Initially samples for microbiological analysis were taken, under sterile conditions, and later, from the same *morcillas*, samples for physical-chemical analysis were taken. All analysis were made in duplicate.

Microbiological analyses. The microbiological parameters analysed were Total Viable Count (TVC) using pouring-plate method on PCA agar (Oxoid. Basingstoke, UK), incubated at 30°C for 48h; Lactic Acid Bacteria (LAB) on MRS agar (Biokar Diagnostics. Beavais, France) incubated at 30°C for 48h in aerobic conditions; *Pseudomonas* spp. (PSD) on Pseudomonad agar (Oxoid) supplemented with CFC (supplement Oxoid), incubated at 30°C for 48h; *Clostridium perfringens* on TSN agar (Biokar Diagnostics. Beavais, France.), using the pouring method, and incubated at 37°C for 48h; anaerobic conditions were achieved by pouring an agar sealing tap around 20mm high on solid TSN agar, after sample inoculation. Samples consisted of 25g of *morcilla* slices with casing (Santos, 2001).

Physical-chemical analysis. Along storage time pH was measured with a penetration probe in four different points for each sample.



Organic acids analysis was done after some preliminary steps as desiccation and fat removing. Five grams of *morcilla* were placed on a plate and kept in a desiccator cabinet for 24h at 105°C. Then, fat were extracted for 6 h by Soxhlet method and finally organic acids were extracted from the dry and defatted sample. The organic acids were extracted by miliQ water (1:3, w/v), heated till boiling, clarified by centrifuge at 13000 rpm for 10 minutes and the supernatant was membrane filtered (0.45 µm) before injection.

Chromatographic analysis was carried out using a Hewlett-Packard Series HP 1100 with diode array detector and Chemstation software. Aliquots from each extract (20 µl) were injected onto a 30 cm x 7.8 mm i.d. Supelcogel C-610H (Bellefonte, PA), which was maintained at 40 °C with a column heater (Bio-Rad Ca, USA), and eluted using 0.1 M H₃PO₄ at a flow rate of 1ml min⁻¹. The eluate was monitored at 210 and 280 nm.

Sensory analysis comprises two different steps. First, sensory differences between *morcillas* made with different kinds of onions were determined at the beginning of storage by consumer analysis. A triangle test was done by a panel consisting of 40 not trained panellists. Panellists were asked to found overall differences between samples. Additionally, panellists evaluated the intensity of odour and taste, soft texture and presence of onion. *Morcilla* was served to the panellist in slices of 1 cm thickness and cooked in microwave till 70°C in the core. The second step evaluated the influence of onion on self-life of the *morcilla*. At the 22nd day of storage, 34 sausages of each type were examined by a trained panel of 5 panellists and graded them in three groups: acceptable, medium and rejected. Visual parameters of the sealed packs were evaluated and visual and odour parameters were tested after opening the packs. “Acceptable” corresponds to sausages without defects, “Medium” sausages present some small changes, but they would not be rejected by consumers and “Rejected” corresponds to sausages with remarkable defects. The typical sensory changes occurring in spoilage of “Morcilla de Burgos” are blowing of the packs, development of drip, slime formation and souring of the product (Borek, 2002).

Results and discussion

At the beginning of storage, *morcillas* made with “horcal” and “grano” varieties show differences. Piruvic acid concentration is higher in *morcilla* with “grano” onion (Table 1), in agreement with Llamazares et al. (2003). Piruvic acid is the main responsible for the pungency of onion (Bedford, 1984; Schwimmer and Weston, 1961), and therefore it would have also a significant contribution to pungency in the *morcilla*. Their concentration could be considered an index of hot taste of product.

According to sensory discriminatory tests both kinds of *morcilla* were significantly different ($\alpha = 0,01$). If specific parameters are considered the intensity of odour and taste of both kinds of *morcilla* were not significantly different, but differences were found in the presence of onion and texture. With the descriptor “presence of onion” panellists evaluated distinguishable particles of onion and also smell and taste of onion, being more intense in *morcilla* with grano variety than with horcal variety. Concerning texture, *morcilla* with horcal onion was softer than *morcilla* with grano onion. These results suggest the high influence of onion variety on sensory properties of onion since grano variety is firmer and more pungent than horcal variety.

Table 1 shows physical-chemical parameters of both types of *morcilla* along storage period. These results were expected, since the increase of concentration of lactic acid and the decrease of pH can be related to the development of lactic acid bacteria throughout the 63 days of storage. Lactic acid increases along storage, although until the day 14 it is not detected due to the level of detection of the analytical method used. Differences were found between *morcillas* with the two varieties of onion. A more rapid formation of lactic acid and the fall of pH in *morcillas* with “horcal” onion was observed. Pyruvic acid, present in onion, also decreases, since it can be used as nutrient by LAB. Piruvic acid increases in the first days of storage and later decreases progressively along time in a similar rate in both types of sausages.

Concerning to microbiological data, table 1 shows the results for all parameters analysed, except for *Clostridium perfringens* because no colonies were identified during the study. Total Viable Counts (TVC) and Lactic Acid Bacteria (LAB) present a progressive increase along storage. Some differences were found between both *morcillas*, since initial number and rate of growth were slightly higher in *morcilla* with horcal onion.

Pseudomonads present a growth until to reach a maximum count, afterwards counts suffer a decrease due to the lack of oxygen because of vacuum packaging. The initial development of these microorganisms owing to the low concentration of retained oxygen in the vacuum package and after 14 days, when oxygen is depleted, their decline comes about. The pattern of PSD development is similar in sausages with both kinds



of onion, but in *morcilla* with “horcal” onion counts are around 1000 ufc/g higher than in sausages with “grano” onion.

The change in the rate of growth of lactic acid bacteria and in the production of lactic acid and fall of pyruvic acid concentration happen one week before of sensorial deterioration of *morcilla* and this coincide with pH fall. This evolution is mainly similar for *morcilla* made with both kinds of onions, however, it differs the time when the changes in *morcilla* characteristics come about. In *morcilla* made with “horcal” onion spoilage takes place at the days 14 to 21, as in *morcilla* made with “grano” onion takes place the days between 21 to 33.

Results obtained in sensory evaluation of spoilage parameters are shown in table 2. Panellists evaluated acceptability of *morcillas* at the day 22 of storage. Overall appearance of packages and *morcillas* showed different signals of spoilage as blowing, slime, sour, pungent and acid odour, pink and green colours. These sensory changes came about one week earlier in horcal than in grano onion *morcillas*.

The main deterioration process is the blowing of the package; later pink spots appear, followed by slime production with milky appearance together with the change in the texture of the product and also the modification of odour characteristics. The sausage becomes soft and presents a release of acid odour.

This results agree with other researchers (Mattana et al., 1980, Lin et al., 1995, Llamazares et al., 2002) that found potential preservation of onions depends on variety; usually smaller onions and with higher contents of dry matter have longer shelf-life. These onions are firmer and more pungent than onions of bigger size. Oxygen is necessary for the formation of compounds responsible for pungency. Smaller onions present a low resistance to penetration of oxygen, with easier development of these compounds. The smaller superficial area led to lower initial contamination, and so preservation of these onions is better, in agreement with results obtained in this study for “grano” onion.

Conclusions

The variety of onion used in the formulation of cooked blood sausage *morcilla* has a notable effect on physical-chemical and sensory characteristics of the product. The only difference of the kind of onion used leaves to significantly different its sensory properties.

On the other hand, the type of onion has also a remarkable influence on *morcilla* preservation, since sausages made with “horcal”onion are spoiled around one week earlier than the sausages manufactured with “grano” onion. It could be due to the amount of sugars, fibre, alcohols, aldehydes, aromatic compounds, and the different compounds coming from the onion as potential nutrients of the microorganisms.

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Table 1.- Physical-chemical and microbiological parameters in *morcilla* made with two different varieties of onion. Morcilla A: *Allium cepa L.* var. horcal, Morcilla B: *Allium cepa L.* var. grano.

Morcilla A						
Day	% Piruvic acid	% Lactic acid	pH	LAB (log cfu/g)	TVC (log cfu/g)	PSD (log cfu/g)
0	3.03	0.00	6.43	3.55	4.30	3.48
7	3.79	0.00	6.24	4.76	5.94	4.01
14	2.35	1.77	6.02	7.79	6.03	5.80
21	2.16	3.06	5.12	8.20	8.18	5.63
33	1.47	6.22	4.69	8.20	8.32	4.58
63	1.38	7.74	4.45	8.85	8.42	3.57
Morcilla B						
Day	% Piruvic acid	% Lactic acid	pH	LAB (log cfu/g)	TVC (log cfu/g)	PSD (log cfu/g)
0	3.60	0.00	6.13	2.70	4.60	2.70
7	3.94	0.00	6.26	4.67	5.62	4.30
14	2.80	0.67	6.19	7.67	7.70	4.30
21	2.62	2.42	5.78	7.62	8.34	4.93
33	2.09	5.80	5.14	7.62	7.92	3.10
63	1.41	7.24	4.52	8.44	8.48	2.51

Table 2.- Grading of *morcilla* made with two different varieties of onion according to sensorial signals of spoilage at day 22 of storage (expressed as percentage). Morcilla A: *Allium cepa L.* var. horcal, Morcilla B: *Allium cepa L.* var. grano.

Groups	Percentage of sausages	
	Morcilla A	Morcilla B
Aceptable	31	60
Medium	23	30
Rejected	46	10