MICROBIOLOGICAL, CHEMICAL AND PHYSICAL CHANGES IN ITALIAN "LONZA"

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Background

"Lonza" is a traditional Italian meat product, mainly produced in Central Italy, obtained by dry-curing of pork loin; this product is sometimes called "Lonzino". It was originally produced by peasants from heavy Italian pork during Winter, kept in dry rooms for dry-curing and maturation and consumed in summer and autumn. At present, chilled pork loins are usually sold as raw meat, and a minor part of production is used for curing. In modern factories, the production process starts by trimming pork loins in order to remove external fat, aponeurosis, and tendons. Soon after trimming, loins are seasoned with salt, flavoured and pickled at refrigeration temperature for one week. Then, loins are stuffed into cellulose casings, which are tied up and left to dry in dry-curing chambers, maintained at a relative humidity of 55 to 75 % and a temperature of 25°C to 18°C for about one week. Dry-cured loins are placed for maturation in chambers maintained at a relative humidity of 70 to 90 % and a temperature of about 14°C for 30-40 days. The present manufacturing process is considerably shorter than the original one, due to the lower fat content of raw materials.
Although Lonza is very appreciated in the European market, no data are available on the microbiological, chemical and physical changes which take place during the manufacturing process of this product.

Objectives

The aim of the present work is to point out the features of Italian Lonza, considering microbiological, chemical and physical changes throughout its manufacturing process. In order to obtain more details on the evolution of qualitative parameters, surface and core samples were collected and analysed.

Materials and methods

Sampling. Lonza samples were collected from two production cycles in the same factory. Sampling was carried out at different process times (days): 0 (raw pork loin), 1(start salting, after tumbling), 5 (salting), 8 (end salting), 8,5 (start dry-curing), 13 (dry-curing), 15 (end dry-curing), 20-22-27-29-33-35 and 45 (maturation). Analyses were performed on slices taken from the central portion of the product, collecting samples from the core (inner) and the surface (outer).
Microbiological analyses. Core and surface samples (10 g) were homogenized in a Stomacher lab-blender in 90 ml physiological solution. Decimal dilutions of the suspension were prepared in physiological solution, plated, and incubated as follows: mesophilic aerobic count (PCA, Oxoid: 30°C x 48 h), lactic acid bacteria (MRS Broth, Oxoid: 37°C x 72 h, anaerobiosis), micrococci (MSA, Oxoid: 37°C x 24 h), *Staphylococcus aureus* and coagulase-negative staphylococci (BPA + Egg Yolk Tellurite Emulsion, Oxoid: 37°C x 48 h), total yeasts and moulds (Sabouraud + 150 ppm chloramphenicol, Oxoid: 25°C x 48 h and 5 d, respectively).
Chemical and physical analyses. pH values were measured using a Mettler Toledo MP 220 pHmeter on aqueous dispersions (1:10) of the samples. Moisture was determined using the AOAC (1980) method. Water activity (a_w) was measured using a dew-point hygrometer Aqualab CX2 (Decagon Devices). Hunter L*, a*, b* values were determined by Minolta CM-508d colorimeter and chromaticity index (a*/b*) was calculated. Texture was evaluated using an Instron Universal Testing Machine mod. 5542, equipped with a 500 N load cell; penetration test was carried out by using a punch (diameter: 10 mm) at a cross-head speed of 0.83 mm s^{-1}. The maximum penetration force was considered as hardness index.

Results and discussion

Figure 1a shows the evolution of lactic acid bacteria (LAB) during the manufacturing process. After tumbling (24 hours), changes in LAB numbers were similar to those observed for mesophilic aerobic count (data not shown), but LAB increased more rapidly in core samples; this behaviour might be attributed to the stimulating effect of a lower redox potential inside the product. LAB count increased sharply throughout dry-curing, due to the inhibitory effect of the low a_w on competitive microbial populations. A slight decrease was observed in the second half of the maturation period (after 30 days), possibly due to the a_w decrease; similar results in surface and core samples were described by Vilar et al. (2000) in dry-cured lacón.

This salting effect is confirmed by the evolution of micrococci and coagulase-negative staphylococci (CNS), described in Figures 1b and 1c, respectively. Micrococci, and particularly CNS, are the microorganisms which are usually isolated in the greater proportion in dry-cured meat products (Carrascosa *et al.* 1992; García *et al.* 1995), due to their salt-tolerance, as well as to their resistance to low a_w and high osmotic pressure conditions. The salt effect on micrococci became evident during dry-curing, leading to 9 Log CFU g^{-1} in surface samples and 7 Log CFU g^{-1} in core samples throughout maturation. *Staphylococcus aureus* was not detected on the surface and inside the product during the manufacturing process.

In Figures 1d and 1e, the evolution of yeasts and moulds is shown. Yeasts numbers were generally higher in surface samples at the beginning of maturation (20 days). At the same time, temperature and relative humidity conditions during maturation contributed to increase the moulds count, up to 8.5 Log CFU g^{-1}. Moulds and yeasts have been reported as dominant organisms on the surface of different types of dry-cured ham throughout maturation (Nuñez et al 1996). In fact, it is known that they may contribute to ripening by means of their proteolytic and lipolytic activity.

Moisture and a_w (Table 1) decreased progressively during processing, as a consequence of air-drying and water-binding effect of salt on meat. As expected, these changes were more significant in the outer zone of the product. After salting, a deep decrease of pH occurred, possibly due to LAB growth, reaching the lowest value at the end of dry-curing. pH increase during maturation could be related to the activity of endogenous and microbial enzymes; this evolution is particularly evident in surface samples, where moulds are dominant (Figure 1e).

Lightness (L*) decreased throughout the process, whilst the chromaticity index (a*/b*) increased. These results could be attributed to both water loss and the progressive formation of meat pigments, in the presence of a source of nitric oxide, resulting in the typical and desidered color of dry-cured meat products.

Lastly, texture changes were observed in the product during the manufacturing period (Table 1). A marked decrease of hardness was detected in the samples taken after dry-curing, possibly related to the endogenous and microbial proteolytic activity (Parreno *et al.* 1994; Rodríguez *et al.* 1998). However, protein denaturation and oxydation, as well as water loss, caused a progressive hardness increase during maturation, more evident in the outer zone.

Conclusions

The prevalence of coagulase-negative staphylococci, micrococci, and lactic acid bacteria in the final product show a correct evolution of microbial populations during the manufacturing process of Italian Lonza. Final a_w and moisture were similar to those observed in other traditional dry-cured meat products. Colour and texture changed as a consequence of the processes occurring during maturation, greatly contributing to the product quality. The combination of salt and nitrites as preservatives, competitive lactic acid bacteria, a lowered pH and a_w, can be considered efficient hurdles, contributing to the quality of this traditional product, as well as to its microbiological and chemical stability.

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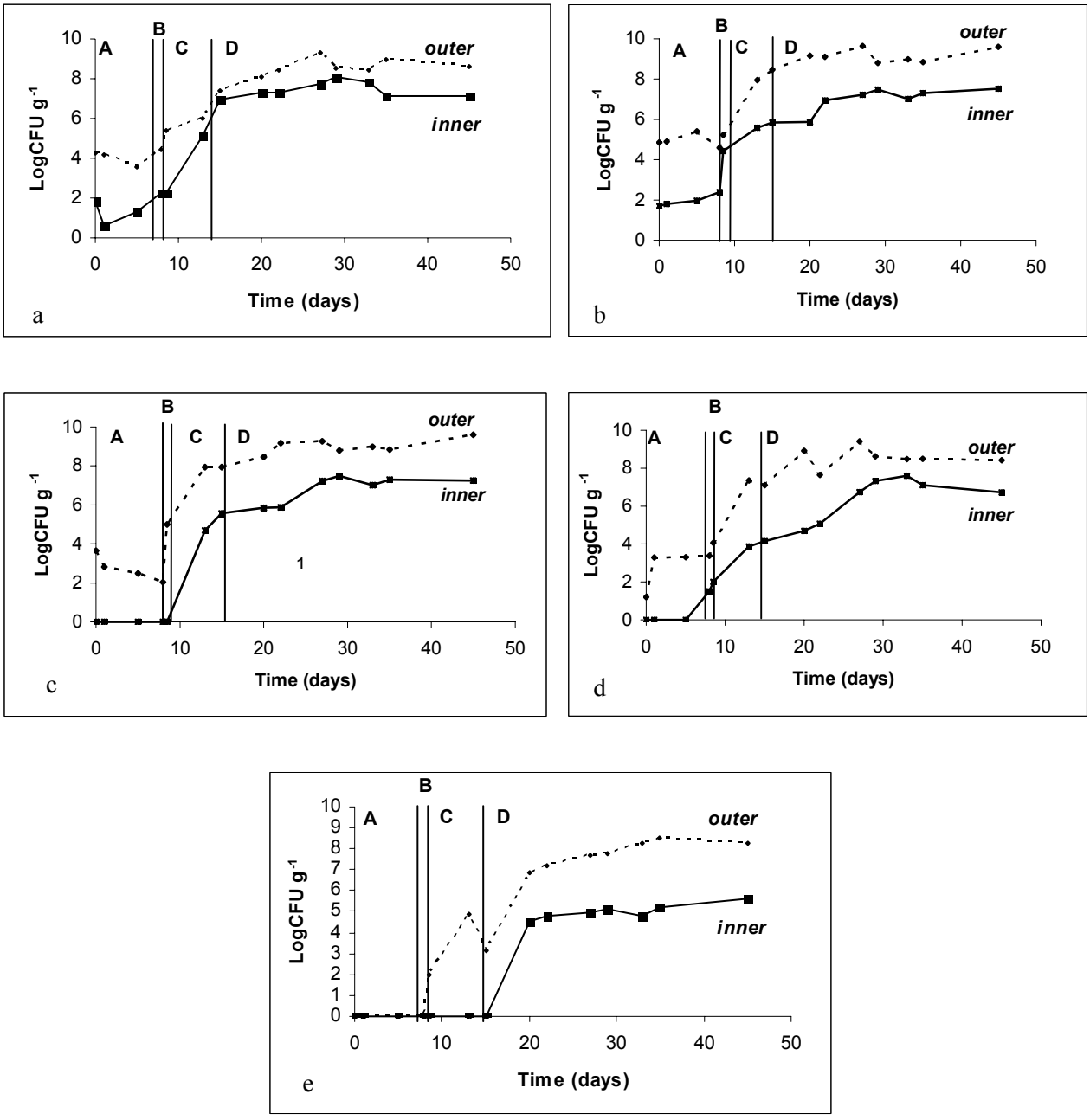

Figure 1: Evolution of LAB (a), micrococci (b), coagulase-negative staphylococci (c), yeasts (d) and moulds (e) during the manufacturing process of Italian Lonza (process steps: A: salting; B: stuffing; C; dry-curing; D: maturation).

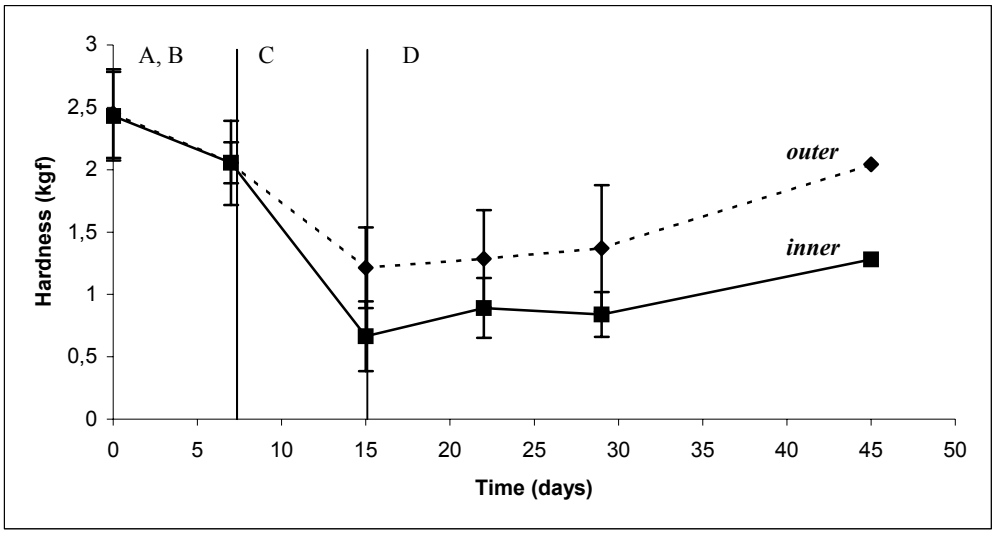

Figure 2: Textural changes of Italian Lonza (inner and outer zone) during the manufacturing process (process steps: A: salting; B: stuffing; C; dry-curing; D: maturation).

		Process steps					
		Raw meat	***Salting***	***Curing***	***Maturation***		
		days					
Parameters	***Zone***	0	7	14	**21**	**35**	**45**
Moisture	inner		70,20	64,87	69,18	66,13	63,64
	outer		67,18	55,54	62,34	55,68	49,94
a_w	inner	0,99	0,98	0,96	0,96	0,94	0,94
	outer	0,99	0,98	0,94	0,94	0,93	0,91
pH	inner	5,62	5,72	5,42	5,67	5,56	5,89
	outer	5,59	5,67	5,47	6,17	6,19	6,71
Colour(*) L*	inner	48,7	44,92	45,23	42,67	42,88	40,81
a*/b*		0,23	0,83	1,01	0,83	1,08	1,21

Table 1: Moisture, a_w, pH and colour parameters of Italian Lonza at different process steps.

Acknowledgements

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