

INACTIVATION OF *LISTERIA MONOCYTOGENES* BY SODIUM LACTATE, SODIUM CITRATE AND ACETIC ACID IN ITALIAN PORK SALAMI

Silvana Barbuti, Giovanna Dellapina, Elisabetta Pancini, Paola Mutti and Stefania Quintavalla
Experimental Station for the Food Preserving Industry, Parma Italy

Background

Since the minimum infective dose for human listeriosis is still unknown, it is important to reduce the incidence of *Listeria monocytogenes* in food. It is necessary to ensure the safety of meat, particularly of dry fermented products.

A potential means of preserving fermented meat is the use of substances which are inhibitory to *L. monocytogenes*

Objectives

The current study was undertaken to determine if sodium lactate, sodium citrate and acetic acid could be used to enhance the inactivation of *L. monocytogenes* in Italian salami without affecting the organoleptic quality of the product.

Materials and methods

Pork salami with varying contents of sodium lactate, sodium citrate and acetic acid were manufactured at one meat industry.

According to experimental design, four batches were prepared (Tab. 1). A commercial starter culture was added to each mince.

The experimental design was performed to assess the effect of the factors on *Listeria* inactivation.

The modifiers of pH to be added to the minces were chosen among the substance which normally found in a cured salame, derived from the fermentation of lactic-acid bacteria; from bibliographical notes they were shown to possess antilisterial activity (Virgili and Parolari 1986).

Tab. 1 - Experimental design

Batches	additive			
	destose %	acetic acid %	sodium lactate %	sodium citrate %
control	1.0			
A	1.0	0.05		0.1
B	1.0	0.05	1.0	0.1
C	1.0		1.0	0.1

Microbiological and physicochemical analysis were carried out after 0, 7, 30, 45 and 60 days according to Dellapina *et al* 1994.

Sensory analysis were carried out at the end of the maturing period on the 60th day.

The panel comprised 6 persons; the most relevant odour and flavour attributes were judged on a scale from 1 to 10. (Virgili *et al* 1994).

L. monocytogenes detection was made according to a modification of the USDA method (Barbuti *et al* 1995).

Results and discussion

The effects of sodium lactate, sodium citrate and acetic acid on inactivation of *Listeria* sp and *L. monocytogenes* are shown in figure 1 and 2 respectively.

The level of naturally *Listeria* sp present in all minces was lower than 100 cfu/g.

Fig. 1 Behaviour of *Listeria* sp

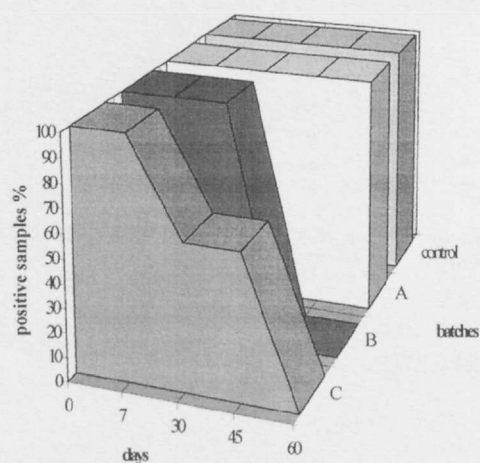
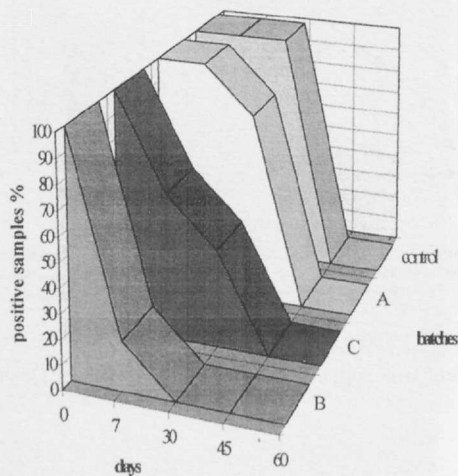


Fig. 2 Behaviour of *L. monocytogenes*





The search for *Listeria* sp produced a positive result both in the control and in A batch (acetic acid and sodium citrate) where total recovery was observed until the 60th day, whereas in B batch (acetic acid, sodium lactate and sodium citrate) all the samples were negative from the 45th day. In recipe C (sodium lactate and sodium citrate) a slow decrease in the number was observed starting from the 7th day, leading on to the disappearance of *Listeria* on 60th day.

The inactivation of *L. monocytogenes* present in all minces used in the preparation of salami, was shown to be influenced both by parameters which normally occur at the moment of the stabilization of the salami (a_w and pH) and of inactivating agents.

In the control batch the disappearance of positive samples was noted from the 45th day; in batches A and C also, with the progressive decrease in positive samples, the disappearance of the pathogen was observed on the 45th day. The best result were observed in batch B with a decrease in positive samples from 100% to 20% on the 7th day and complete disappearance on the 30th day.

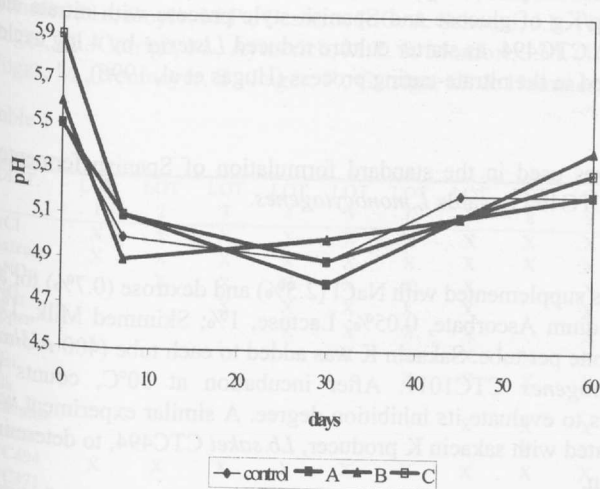
In view of the use of a rather high concentration of dextrose, a marked reduction of pH was observed to values of 4.8 and 4.9 (Figure 3); this decrease concomitant with the use of substances with an antilisterial action definitely had an influence on the outcome of the sensorial analysis. The salami of the modified batches were shown to be more acid and pungent than those of the control batch.

The progress of microbial flora, total bacterial count, *Lactobacillus*, *Staphylococcus* and *Enterococcus* was shown to be similar both in salami of the control batch and in modified batches (data not shown).

The values of activity water (a_w) in all batches, caused the registration of a progressive decrease reaching a value of 0.90 at the end of the curing period.

The dependency of *L. monocytogenes* inactivation on the interaction of pH, acidulant identity was in general agreement with the results of other investigators (Buchanan et al. 1993; Weaver et al. 1993).

Fig. 3 Progress of pH values



Conclusions

The inactivation during brief periods of *Listeria* sp and in particular of *L. monocytogenes* in Italian salami was obtained in the presence of 1.0% of sodium lactate and /or of 0.05% acetic acid. The inactivating effect was probably determined by a synergism between the substances used and a considerable decrease in pH values.

The results obtained confirm that the decrease in pH, recorded in various batches, while not determining *per se* a complete inactivation, nevertheless definitely had an influence on the inhibitory action of the substances that were added.

The use of lower levels of multiple acids could be advantageous as a mean of avoiding organoleptic limitations associated with higher concentrations of a single organic acid. In fact the combinations of sodium lactate, acetic acid and sodium citrate, made it possible to obtain inactivation results while maintaining organoleptic characteristics.

Pertinent literature

- Barbuti, S., Pancini, E., Dellapina, G. (1995) Use of an immunochromatographic method for rapid determination of *Listeria* in meat products. *Ind. Conserve*, 70, 398.
- Buchanan, R. L., Golden, M. H., Withing, R. C. (1993) Effect of pH and acid concentration on *Listeria*. *J. Food Protect.*, 56 474.
- Dellapina, G., Blanco, D., Pancini, E., Barbuti, S., Campanini, M. (1994) Use of an immunochromatographic method for rapid determination of *Listeria* in meat products. *Ind. Conserve*, 69, 85.
- Virgili, R., Parolari, G. (1986) Quality control in the production of ripened salami. *Ind. Conserve*, 61, 236.
- Virgili, R., Parolari, G., Schivazzappa, C., Casiraghi, E., Pompei, C. (1994) Sensory analysis of italian dry cured sausage: Checking of panel performance. *Labensm. Wiss u Technol.*, 27, 278.
- Weaver, R. A., Shelef, L. A. (1993) Antilisterial activity of sodium, potassium or calcium lactate in pork liver sausage. *J. Food Safety*, 13 133.