

Comparison between different treatments with lactic acid and sodium lactate on the microbiological, chemical and sensory qualities of porcine jowl

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Backgrounds

It has been stressed that the most important factor in controlling the degree of initial contamination is hygiene. However, despite the use of good hygienic measures, carcasses contaminated with pathogenic and deteriorative bacteria are still found. When linked to a high degree of plant sanitation, decontamination with some agents, such as lactic acid, may produce a safer product and extend its shelf-life. However the use of decontaminating agents should only be allowed as an integrated part of a well determined hygiene program on the slaughter line.

The bactericidal and bacteriostatic effects of some decontaminating agents are well known. The antimicrobial action of decontaminating agents depends on the effect of pH, the extent of dissociation of the acid and a specific effect related to the acid molecule (Smulders et al., 1986). An acid which decreases the pH of a food will extend the lag phase of acid sensitive microorganisms and may result in the death of the microorganisms. The amount of acid and the buffering capacity of the food will influence the pH drop attained and the period during which it is maintained.

Some sensory properties of a product, such as odour and appearance, are sensitive criteria to judge the acceptance of the food product and to determine its shelf-life. Decontaminating agents may affect the appearance, colour and flavour of treated meat to a certain extent, depending on its nature and concentration. Also, the species of animal and the kind of cut submitted to the treatment, should be considered.

Objectives

The purpose of this study was to evaluate the microbiological, chemical and sensory properties of porcine jowl during refrigerated storage, after spraying the surfaces of the cuts with 1% and 2% (v/v) lactic acid and 3% (v/v) sodium lactate.

Methods

Jowls from 96 porcine carcasses obtained at a pig slaughter-house, were treated. Half of the samples were treated by spraying commercial preparations containing the following organic acids: 1% and 2% (v/v) lactic acid and 3% (v/v) sodium lactate. Solutions were prepared from 85.0% (v/v) lactic acid (Purac FCC 85, Brazil) and 60.0% (v/v) sodium lactate (Purasal S/SP60, Brazil). The agents were sprayed on the jowls at a distance of 20 cm. The untreated meat was used as the control. The untreated and treated jowls were stored at $2 \pm 1^\circ\text{C}$, 76.5 – 98.3% relative humidity (measured with a hygrometer Vaisala HMI 31, Helsinki, Finland) and 0.3 m/s air velocity (measured with an anemometer, George Rosenmüller, Dresden, Germany). Microbiological, chemical and sensory tests were carried out after 0, 1, 4, 9, 11, 15, 18 and 24 days. Measurements were taken each time from three samples chosen at random.

The surface and the internal part (3 to 5 cm below the surface) of the jowls were assessed using a pH meter (model MP 125, Mettler Toledo, Schwerzenbach, Switzerland) with the electrode (Mettler Toledo, Schwerzenbach, Switzerland, LOT406-MG6-DXK-57/25).

Samples were taken for the microbiological examination using the non destructive swab method (50 cm²) in areas free of fat. During the shelf-life evaluation, *Enterobacteriaceae* counts and psychrotrophic aerobic colony counts were carried out. The tests were conducted according to Vanderzant and Splittstoesser (1992). Colony counts were expressed in colony forming units (c.f.u.) per cm².

Sensory attributes were assessed visually by 6 to 9 trained panelists to identify meat colour, flavour and appearance, according to the quantitative descriptive analysis method (QDA, Stone and Sidel, 1985). The Compusense system, version 4.2, was used to assess the data. Differences between data were assessed using ANOVA and differences in mean scores were compared by the Tukey test ($p \leq 0.05$) and Dunnett test ($p \leq 0.05$).

Results and Discussion

Decontaminating agents caused a decline of the mean pH of the surface from 6.45 for the control, to 6.14, 5.97 and 6.21 on treatment with 1% lactic acid, 2% acid lactic, and 3% sodium lactate, respectively; while the mean pH of the interiors were: 5.95 for the control, 5.96 for 1% lactic acid; 5.99 for 2% acid lactic and 5.89 for 3% sodium lactate.

We observed that 2% (v/v) lactic acid was 38.93% more efficient in reducing the psychrotrophic aerobic colony count than the control; 8.83% compared to 1% (v/v) lactic acid and 23.54% compared to 3% (v/v) sodium lactate (Figure 1). Also the *Enterobacteriaceae* counts were more affected by 2% (v/v) lactic acid than by the other decontaminating agents: being 15.85% more efficient compared to the control; 2.78% compared to 1% (v/v) lactic acid and 5.42% compared to 3% (v/v) sodium lactate (Figure 2).

The results indicating the most acceptable organic acid in affecting the odour are shown in Figure 3. On the 15^o day a putrid odour was identified in the control and a rancid odour noticed in all samples. Thus the controls were discarded on the 15^o day and the treated samples from the 19 to the 23^o days. Table 1 shows the shelf-life of porcine jowls based on various sensory attributes.

Data

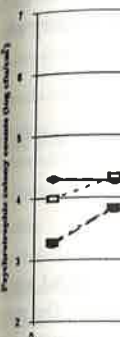


Figure 1.

Table 1.

Treatment

Control
1% lactic acid
2% lactic acid
3% sodium lactate
(1) Shelf-life
(2) Shelf-life

Acknowledgements

This research

Conclusions

The results of this investigation demonstrate a superior effect of 2% lactic acid on the microbiological, chemical and sensory qualities of porcine jowls, followed by 3% sodium lactate.

Pertinent literature

- Smulders, F.J.M.; Barendsen, P.; van Logtestijn, J.G.; Mossel, D.A.A.; van der Marel, G.M. Review: Lactic acid: considerations in favour of its acceptance as a meat decontaminant. *Journal of Food Technology*, v.21, p.419-436, 1986.
- Stone, H. and Sidel, J.L. *Sensory evaluation practices*. Academic Press, 311p. 1985.
- Vanderzant, C. and Splittstoesser, D.F. *Compendium of methods for the microbiological examination of foods*. 3.ed. Washington, DC: American Public Health Association (APHA), 1992.

Data

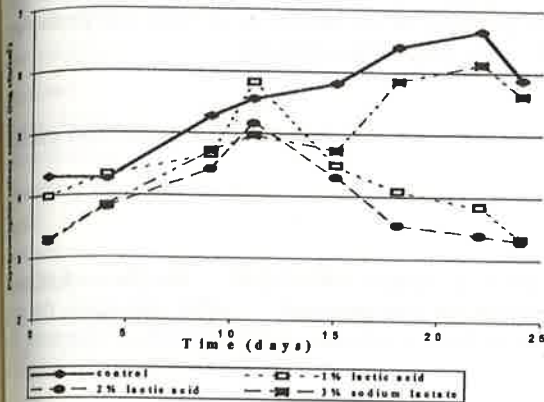


Figure 1. Effect of decontamination on the psychrotrophic aerobic colony count during storage at $2\pm 1^\circ\text{C}$.

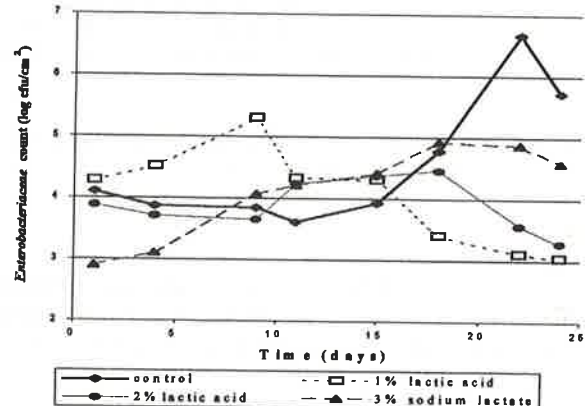


Figure 2. Effect of decontamination on the *Enterobacteriaceae* counts during storage at $2\pm 1^\circ\text{C}$.

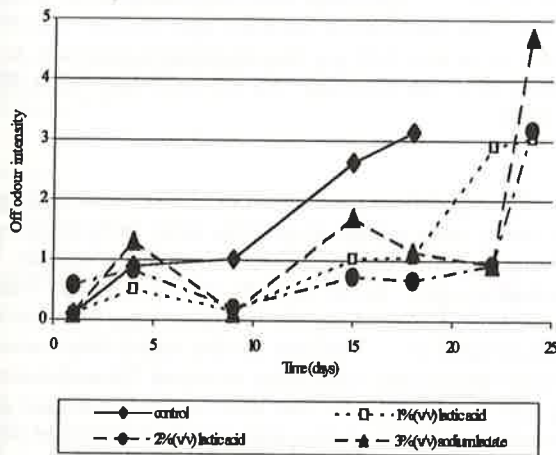


Figure 3. Effect of decontamination on off-odour during storage at $2\pm 1^\circ\text{C}$.

Table 1. Effect on the shelf-life of porcine jowls treated with decontaminating agents during storage at $2\pm 1^\circ\text{C}$.

Treatment	Off-odour ⁽¹⁾	Appearance ⁽²⁾			
		Creamy fat colour	Pinkish meat colour	Surface dryness	Surface brightness
Control	10 - 14	18	5 - 8	2 - 3	5 - 8
1% lactic acid	19 - 21	23	5 - 8	2 - 3	5 - 8
2% lactic acid	23	23	22	2 - 3	9
3% sodium lactate	23	23	16 - 17	2 - 3	5 - 8

⁽¹⁾ Shelf-life criterion of off-odour: putrid odour.

⁽²⁾ Shelf-life criterion of appearance: 50% loss of initial sensory quality

Acknowledgements

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