PRESERVATION OF FRESH SAUSAGE USING SODIUM LACTATE

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Background

In recent years, the need to produce processed foods which are healthier and more secure as regards their chemical composition and microbiological content has forced the processed food industry to reanalyze their formulations and seek new ways to guarantee and increase the shelf-life of their products. A major concern for the food industry has been meat and fresh-meat derivatives, which have a high content of water, protein, carbohydrates, lipids and mineral salts as well as a pH range ideal for the growth of the majority of pathogenic and non-pathogenic microorganisms (SILVEIRA, FRIES, TERRA, 2002) and which do not receive thermal treatments to reduce their microbiological load.

The possible long-term effects of synthetic additives has not been well-defined in the scientific literature and the use of this class of additives in fresh-meat products has been widely questioned, because of which the use of natural ingredients such as the salts of organic acids has been investigated by some workers (BREWER, et al., 1991; BRUL, COOTE, 1999; DEVLIEGHERE, et al., 2000) with the intention of providing increased chemical and microbiological security for meat-products. Sodium lactate, an organic-acid salt produced by the fermentation of sugars, is generally recognized as safe (GRAS) by the United States Food and Drug Administration (FDA) and has been approved by the Brazilian health and agriculture ministries for use as a humidifying agent in meat-products (RODRIGUES, TERRA, FRIES, 2000). It thus seems that the use of natural products to preserve and extend the shelf-life of food products is a new option for the food industry, being of especial interest to the meat-processing industry.

Objectives

Verify the effect of the addition of different quantities of sodium lactate to fresh smoked sausages using microbiological and physical-chemical analysis.

Methods

Fresh smoked sausage was produced in a company producing industrialized beef and pork meat products, the full recipe and list of ingredients being a trade secret but they were known to contain minced pork, salt and herbs. For our experiments, special batches of sausage were produced containing 0 (control), 2, 3.5 or 5% (weight/volume) added sodium lactate and were stored aerobically at 4°C during the course of the experiments.

Samples were taken twice a week for three weeks (21 days) and subjected to physico-chemical (five replicates) and microbiological (three replicates) evaluation. The physico-chemical parameters investigated were humidity and acidity (Terra & Brum, 1988), peroxide index according to the methods of the Brazilian National Animal Reference Laboratory (Laboratório Nacional de Referência Animal (LANARA), 1981), pH using a DM-20 pH-meter (DIGIMED, São Paulo, Brazil) with a probe-type electrode, and water-activity using a CX-20 water-activity meter (AquaLab, São Paulo, Brazil). For microbiological evaluation 25 grams of sausage was homogenized in 225 ml of saline to produce a 10^{-1} dilution, further serial dilutions being made with saline up to 10^{-5}, the number of viable mesophiles and lactic acid bacteria being counted using the methods described by Silva, Junqueira & Silveira, (1997) and the number of *Pseudomonas* using the American Public Health Association (ASM, 1984) method.

For both the physical-chemical and microbiological tests the results were evaluated by comparison of means using the student's t-test.

Results and Discussion

The results of the physico-chemical evaluations are shown in Table 1, while the comparison of means for the various levels of sodium lactate are shown in Table 2.

Only pH and peroxide index showed significant differences, demonstrating that sodium lactate has a buffering effect on the pH of fresh sausage, similar results having been obtained by Rodrigues, Terra e Fries (2000). Mbandi & Shelef (2002) reported that 2% (w/v) [I have used this instead of 'treatment 2' - please check that I am correct.] sodium lactate gave good results in terms of preventing deterioration and having the best cost-benefit relation, although this was not observed by us. Our data suggests that, while not being totally efficient, 5% sodium lactate succeeded in maintaining the best physical-chemical parameters during the shelf-life of the sausage, although Rodrigues, Terra & Fries (2000) have pointed out that meat products with sodium lactate concentrations above 5% have a very acid taste.

Our microbiological evaluation showed that in the first two sampling periods sodium lactate succeeded in retarding the growth of mesophilic bacteria, the 10^{-4} and 10^{-5} dilutions producing no growth when plated on suitable media. This was reversed with the other analyses, with all samples giving heavy growth of lactic acid bacteria throughout the 3 weeks of the experiment. Lactic acid bacteria produce lactic acid which acts as a preservative because it inhibits the growth of acid-sensitive bacteria, some of which are potential food spoilage organisms. Although the presence of low numbers of lactic acid bacteria is considered beneficial, higher numbers can produce undesirable levels of lactic acid which alters the physical-chemical properties of the product.

Bacteria belonging to the pseudomonas group are considered to be indicators of spoilage (FRANCO & LANGRAF, 1996), the presence of such organisms indicating that a foodstuff is unfit for human consumption. We detected *Pseudomonas* in the second and third samples (i.e. the end of the first week and the beginning of the second week of incubation) but none were detected in the last sample (number 6) taken after three weeks incubation, probably because pseudomonads are extremely sensitive to acid pH (FRANCO & LANGRAF, 1996).

Conclusions

Our data shows that 5% sodium lactate had the greatest influence on the physical-chemical and microbiological properties of the sausages investigated, microbial counts showing that the unwanted proliferation of pseudomonads was below that of the other concentrations tested. Because cost is an important factor the production of processed food and high levels of acid give undesirable tastes to the finished product it

is desirable to use the lowest level of preservative, and it seems that 5% sodium lactate provides a cost-effective solution. Although we did not have the opportunity to analyze the raw ingredients of these sausages because the ingredients were a trade secret it appears from the plate counts taken in the first week (samples 1 and 2) that there was a high level of microbial contamination, which may have reduced the overall effectiveness of sodium lactate resulting in 5% being the lowest effective concentration.

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Table 1. Physical-chemical evaluation of sausages. Values shown are the average for five replicates. Control = 0% sodium lactate.

Sodium Lactate added (%, w/v)	**Humidity (% w/w)**	**pH**	A_w	**Peroxide Index**	**Acidity**
0	24.75	5.35	0.90	0.85	2.56
2	26.16	5.65	0.87	0.28	2.30
3.5	26.06	6.11	0.85	0.27	2.03
5	33.03	6.13	0.87	2.19	1.61

Table 2. Student's t-test comparison between means for each physico-chemical variable. In each column, values which are significantly different at the 5% probability level are marked with a star (*), other values being non-significant. Control = 0% sodium lactate.

Sodium lactate added (%, w/v)	Humidity (% w/w)	pH	A_w	Peroxide index	**Acidity**
0 compared with 2	0.291	1.950	0.992	1.362	1.133
0 compared with 3.5	0.262	7.550*	1.582	1.450	1.436
0 compared with 5	1.239	9.230*	1.021	2.355*	2.098
2 compared with 3.5	0.019	3.938*	0.697	0.232	0.717
2 compared with 5	0.005	4.650*	0.077	6.086*	1.906
3.5 compared with 5	1.003	0.268	0.606	6.424*	1.214