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SODIUM LACTATE EFFECTS ON SHELF-LIFE, SENSORY AND PHYSICAL CHARACTERISTICS OF REFRIGERATED VACUUM PACKAGED FRESH CHICKEN SAUSAGE

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BACKGROUND

Over the past ten years, the poultry processing industry in Brazil has experienced a great increasing in production, reaching high volumes. In order to add value to the poultry meat a variety of products have been developed, among them the fresh chicken sausage, especially by the small and medium processors. Consumers commonly rely on sensory characteristics such as appearence and odor when making decisions regarding safety and acceptability of meat for consumption (Brewer et al., 1991). A variety of packaging treatments and/or additives with potential for inhibiting various groups of microorganisms have been investigated on meat products. Vacuum packaging extends shelf-life for meat products, however it creates na essentially anaerobic condition for growth of human pathogens. Sodium lactate has been used in meat products preservation, because it delays microbial deterioration, besides other properties such as slight antioxidant effects, flavour enhancement, improving water holding capacity and a positive effect on colour and texture (Shelef, 1994).

OBJECTIVES

The purpose of this study was to determine the effects of sodium lactate on physical, sensory and microbiological characteristics of vacuum packaged fresh chicken sausage over time in refrigerated storage.

MATERIAL AND METHODS

About 30 kg of fresh chicken sausage was prepared at the Centro de Tecnologia de Carnes of Instituto de Tecnologia de Alimentos. Breast and leg meat were coarse ground separately through 18mm plate and skin were finely ground through 8mm plate. Total moisture, fat and protein content were determined for each raw material. Skin was added to breast and leg meat resulting in a 20% of total formulation. Course ground raw materials were mixed three minutes in a paddle mixer. When necessary, appropriate food ingredients were added during the mixing process (dry ingredients followed by the addition of water and lactate). After mixing, the meat mixtures were stuffed in natural casing (lamb tripe) and then vacuum packed using CRYOVAC bags with an oxygen transmission rate (OTR) of 30cc/m^2/24h at 22.8°C. Chicken sausages were held at 5-7°C (retail temperatures) prior to all analysis. The treatments tested included 0, 1,5 and 3% of 60.0%(v/v) sodium lactate (PURASAL S/SP60, PURAC Syntheses, Brazil), besides other ingredients as shown in Table 1. Sufficient samples of each treatment were prepared to allow two complete replications. The samples were stored at 5-7°C for 0, 1, 2, 3, 4, and 5 weeks exccept for treatment 0% lactate which was held for 3 weeks for sensory analysis. The analysis carried out were the follwing: a)Physico-chemical: total moisture, total fat and total protein content , water activity (A_w) and pH. Samples taken were 0, 1, 2, 3, 4, and 5 weeks storage time for Aw and pH; b)Microbiological analysis: Psychrofhyllic microorganisms, Lactic acid bacteria, Enterobacteriaceae were obtained for each treatment on the day of preparation. Randomly selected packs of sausage were sampled every week for the analysis and c) Sensory analysis: Quantitative Descriptive analysis was carried out by a trained 6 member sensory panel. The quantification of descriptors was done by using a non structured scale from 0 to 10 points where zero indicated absence and 10 maximum intensity. The sensory profile consisted of descriptors grouped in blocks: a)Visual attributes assessed before opening the package (freshness, gas production, fat colour, meat colour, apparent viscosity of exudate and apparent amount of exuded) ; b) Olfactory attributes after opening the package (sour smell, lactate odor) and c) Flavour attributes (characteristic flavour, umami, saltiness). To assess the data Compusense 4.2 was used. Data were analysed as a completely random design using ANOVA and a significance level of $p<0.05$ (Dunnet test and Tukey test) was used for all mean evaluation .

Table 1. Composition (%) of different sausage formulations.

	Breast Meat	Leg meat	Skin	H_2O	NaCl	Sodium Nitrite	TPP	Sodium Ascorbate	Sodium Lactate	Dextrose	Spices
Control	20	50	20	6.65	1.8	0.02	0.25	0.05	0	0.2	1.0
1,5% SL	20	50	20	4.87	1.08	0.02	0.25	0.05	2.5	0.2	1.0
3,0% SL	20	50	20	2.81	0.64	0.02	0.25	0.05	5.0	0.2	1.0

RESULTS AND DISCUSSION

Total fat content for the different treatments was as follows: 11.88% (control), 11.38% (1.5% SL) and 12.02% (3.0% SL). Sodium lactate addition caused a decline in pH from zero time to after 5 weeks storage time was as follows: from 5.93 to 5.51 (control), from 5.98 to 5.84 (1.5% SL) and from 6.18 to 5.88 (3.0% SL). There was a marked decrease in pH in the final sampling time (5 weeks of storage) for all treatments, although the control treatment was the most affected. This pH decline was problably due to microorganisms activity which was delayed by sodium lactate addition, especially at levels of 3% in the final product as observed by Brewer et al (1991) in fresh pork sausage and many other authors (Papadopoulos et al, 1991; Egbert et al., 1992; Shelef, 1994).
No changes in water activity were observed between the different treatments, although its well known that sodium lactate is capable of linking water in cooked meat (Papadopoulos et al., 1991). **Figure 1** shows the Psychrophillic plate counts, Enterobacteriaceae plate counts and Lactic acid bacteria plate counts respectively, for all treatments during the storage period. The effectiveness of sodium lactate against microbial spoilage was indicated by na increase in lag time and a slower rate of exponential growth as the

sodium lactate content increased for all bacteria groups evaluated, especially Psychrophillic bacteria and Lactic acid bacteria. Enterobacteriaceae showed also an increase in lag time when sodium lactate was added, although no differences were observed between the treatments 1.5%SL and 3.0% SL. The control samples had the most rapid rate of growth when compared to the other samples. Visual attributes assessed before opening the package were not affected by sodium lactate addition. Sensory descriptors were affected by the storage time for some attributes, especially regarding the control treatment , as shown on Table 2. Panelists perceived rancid odor on control (after 2 weeks storage) and 1.5% SL(after 4 weeks storage). No differences between treatmentes were observed for saltiness.

Table 2. Effect of sodium lactate on some flavour attrbutes of fresh chicken sausage.

STORAGE TIME (weeks)	Lactate flavour			Sour smell			Characteristic flavour			Umami		
	Control	1.5%	3.0%	Control	1.5%	3.0%	Control	1.5%	3.0%	Control	1.5%	3.0%
0	1.94^{a}	5.41^{a}	4.29^{ac}	1.13^{a}	1.43^{ab}	1.07^{a}	6.70^{a}	7.03^{a}	7.19^{a}	3.72^{a}	4.30^{a}	5.03^{ac}
1	1.16^{a}	3.45^{ab}	5.55^{a}	0.77^{a}	0.71^{a}	0.87^{a}	7.64^{a}	7.49^{a}	7.46^{a}	4.11^{a}	4.62^{a}	5.60^{a}
2	1.07^{a}	1.80^{b}	4.57^{ac}	1.73^{a}	0.83^{ab}	1.29^{a}	7.19^{a}	7.48^{a}	7.41^{a}	1.87^{a}	4.11^{a}	5.07^{ac}
3	3.01^{a}	6.69^{ab}	0.96^{b}	2.17^{a}	2.15^{ab}	2.09^{a}	-	6.53^{a}	6.97^{a}	-	4.13^{a}	4.96^{ac}
4	1.84^{a}	1.58^{b}	3.19^{a}	2.11^{a}	2.50^{ab}	0.96^{a}	-	6.80^{a}	5.67^{ac}	-	4.04^{a}	3.26^{ac}
5	1.40^{a}	1.68^{b}	2.32^{bc}	2.28^{a}	3.20^{b}	1.93^{a}	-	6.46^{a}	4.50^{bc}	-	3.91^{a}	2.57^{bc}

Means within a column which are followed by the same superscript are not different (P>0.05)

CONCLUSIONS

Addition of 1.5% and 3.0% sodium lactate to fresh chicken sausage delayed microbial deterioration, pH decline, and development of off flavors (rancid odor). Sodium lactate enhanced chicken sausage flavour at 1.5% level . Adjusting sodium level is recomended in order to avoid excessive saltiness in products whre sodium lactate is added. More work is needed in order to determine if the sodium lactate delayed or masked the onset of oxidative rancidity and also to determine if there is an additive effect of NaCl and sodium lactate in shelf life extension of vacuum packaged fresh processed meat.

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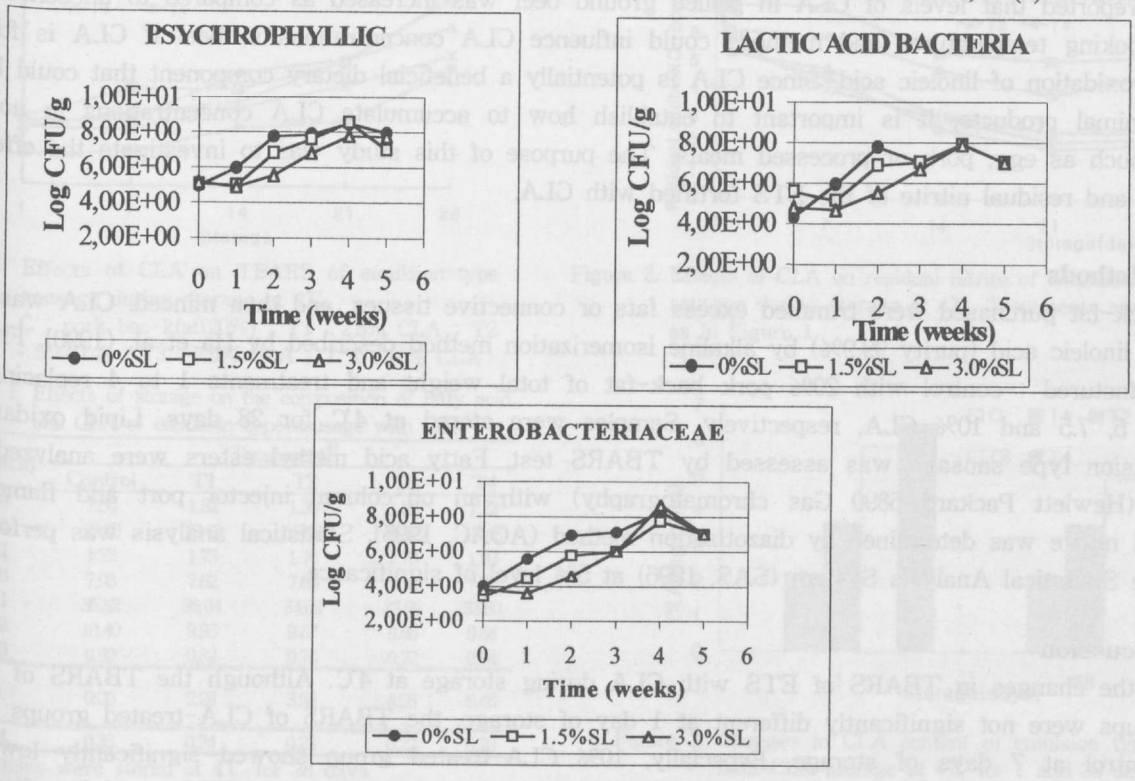

Figure 1. Psychrophyllic, Lactic Acid bacteria and Enterobacteriaceae plate counts of fresh chicken sausage during 5 weeks refrigeratedstorage.