



Instituto Politécnico de Viana do Castelo
Escola Superior
de Tecnologia
e Gestão



Application of nisin and chitosan as antimicrobial agents in traditional cured and smoked “Alheira”

S.C. Fonseca¹, S. Jácome¹, R. Pinheiro¹, M.R. Alves¹, L. Noronha², J. Silva², G. Almeida², S.D. Todorov³, M. Pintado², A. Gomes², A.M.M.B. Morais², M. Vaz-Velho¹ and P. Teixeira²

¹Escola Superior de Tecnologia e Gestão – Instituto Politécnico de Viana do Castelo, Viana do Castelo, Portugal;

² Centro de Biotecnologia e Química Fina, Escola Superior de Biotecnologia, Centro Regional Porto da Universidade Católica Portuguesa, Porto, Portugal;

³ Universidade de São Paulo, Faculdade de Ciências Farmacêuticas, São Paulo, Brasil

INTRODUCTION

Traditional smoked and cured meat products are much appreciated and play an important role in traditional Portuguese meals. But modern consumers require products that not only have high appealing sensory attributes but also are safe.



In order to evaluate the influence of antimicrobial agents on the microbiological safety and stability of traditional smoked and cured meat products, it was investigated i) the effect of nisin and chitosan application in controlling *Listeria monocytogenes* growth in “Alheira”; and ii) the organoleptic properties of “Alheira” processed and packed under vacuum or under modified atmosphere (MA: 20 % CO₂ and 80 % N₂) during storage at 4 °C.

MATERIALS AND METHODS

Microbiological Analysis

“Alheiras” from Ponte de Lima were produced at industrial scale. During the operation of mixing ingredients, the following treatments were considered: i) addition of 50 g of chitosan (dissolved in 1.5 L vinegar) per 5 kg; ii) addition of nisin (final concentration 6.3 ppm) and iii) no addition (control). In order to evaluate the antimicrobial effect of nisin and chitosan in “Alheira”, 0.2 ml of a 10⁶ CFU/mL suspension of *L. monocytogenes* (previously isolated from “Alheira”) in Ringer’s solution were inoculated with a syringe into 5 different points of each “Alheira”. *Listeria monocytogenes* was enumerated at 0; 2; 4; 7; 15; 30; 45 and 60 days of storage at 4 °C.

Sensorial Analysis

In order to characterize the sensory profile of “Alheira”, a quantitative descriptive sensory test was performed, involving previous sessions for main descriptors definition, their scale limits as well as verbal anchors by panel consensus. A final sheet with 16 descriptors, each one with a 13-point scale was validated. Then, all treatments of “Alheira”, packed under vacuum or under MA, were evaluated by a semi-trained panel after 5, 40 and 60 days storage at 4 °C.

Statistical analysis

An analysis of variance (one-way ANOVA) was carried out to assess the effects of storage time and antimicrobial addition treatments on panel results using STATISTICA 7 and Microsoft® Office Excel 2007 tools.

RESULTS AND DISCUSSION

Comparing **Control** with **Chitosan Addition** in Fig.1, there was a clear reduction in the initial concentration of *L. monocytogenes*; thus the use of chitosan is an alternative to start cultures and may be used in the preparation of sausages to reduce the growth of pathogens. We did not observe any other bacteria or fungi growth in general medium (TSAYE) in “alheiras” with chitosan addition, confirming the antimicrobial activity of this natural compound against other microorganisms. Despite the positive microbiological results, the use of chitosan did not present good sensory results; at the 5th day the panel considered the product below the threshold of acceptability.

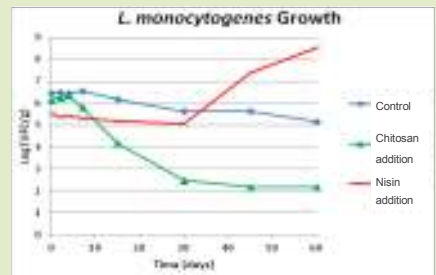


Fig. 1. Behavior of *L. monocytogenes* with chitosan and nisin incorporation. (Control – Pathogen growth in sausage only; Chitosan Addition – Pathogen growth with chitosan addition in sausage; Nisin Addition – Pathogen growth with nisin in sausage).

Comparing **Control** with **Nisin Addition** in Fig.1, this compound did not demonstrate to be a good option for pathogen reduction.

Figure 2 a) shows the sensory profile of the sausage with chitosan addition in the 5th day of storage for both packaging conditions. It is visible an increase in the perception of the attribute “atypical flavor” packed under MAP. The attribute corresponding to “Flavor acid” and “Adhesion” also increases sharply. The acid taste intensified over storage for the nisin-added samples, yet panellists did not find significant differences between them (Fig 2 b) and c)).

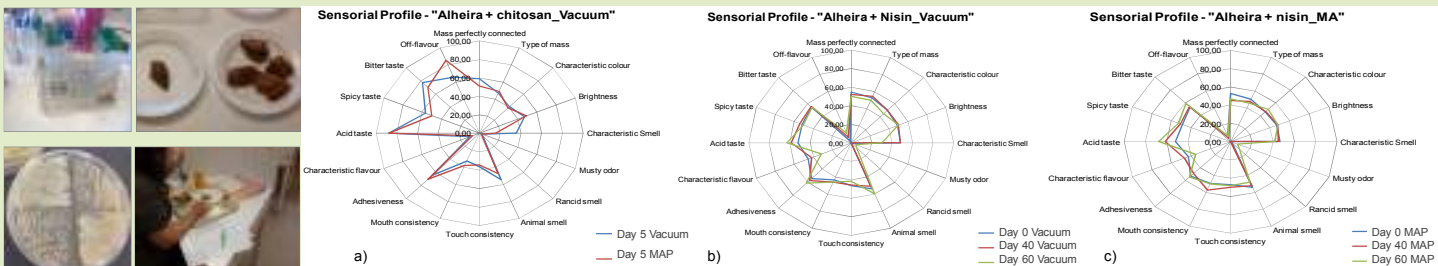


Fig. 2. Sensory profiles of Alheira (a); with chitosan under vacuum packaging (b); with nisin under vacuum packaging (c) with nisin under modified atmosphere packaging.

CONCLUSION

No significant differences were observed in the microbiological quality of “Alheira” packed under vacuum or under modified atmosphere conditions. A significant reduction in the level of *L. monocytogenes* was observed in the presence of chitosan (2 and 3 log cycles reduction during the first 15 and 30 days of storage, respectively). The condition with nisin, despite having had a good acceptability by the panel, the level of microbial reduction was not as effective. Rather, the condition with Chitosan had an excellent performance in terms of bacterial reduction, but did not get good results in sensory analysis. Further studies are importantly required to obtain an effective anti-listerial agent that simultaneously does not affect consumer’s perception and consequently acceptability for these traditional cured meat products.

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