CONTROL OF MICROBIAL STABILITY USING VEGETABLE INGREDIENTS (RADDISH, ONION, GARLIC) IN A PROCESSED MEAT PRODUCT WITH REDUCED SODIUM LEVELS

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I. INTRODUCTION

Sodium chloride or table salt is one of the most important sources of Sodium from diet [1]. Several health problems are associated with the consumption of excessive amounts of Sodium including high blood pressure and cardiovascular disease [2]. The World Health Organization (WHO) is promoting the reformulation of processed food products in order to reduce the levels of NaCl and the consumption of Sodium through diet. Sodium control through reduction of NaCl is complicated as this ingredient is used as a flavoring agent, texture modifier, protein activator and antimicrobial agent. In fact, reduction of NaCl could result in higher rates of microbial replication [3]. Strategies to reduce Sodium may include substitution of NaCl with other antimicrobial compounds. Some ingredients commonly used to formulate meat and poultry products, like spices, can be used in that sense [4]. Several spices have been recognized by their bactericidal and bacteriostatic effect mostly associated with volatile oils present in their composition [5,6,7]. Additionally, some studies have demonstrated that mixture of spices could potentiate the "salty" flavor in some foods [8]. The objective of our research was to experimentally evaluate if the microbial stability of a processed meat product is compromised when NaCl is partially substituted with a mixture of spices (raddish, onion and garlic).

II. MATERIALS AND METHODS

A processed meat product (chorizo) was prepared using pork meat, common meat ingredients (200 ppm of sodium nitrite, 0.3% of phosphates and 600 ppm of sodium erythorbate), different levels of NaCl and several combinations of spices (raddish, onion and garlic), KCl and potassium lactate. The combinations used are as follows:

Table 1: Formulations of chorizo with different levels of NaCl and spices

Treatment	NaCl	Spices	KCl	Potassium lactate
1	1,74%	0%	0%	0%
2	1,34%	0,75%	0%	0%
3	1,34%	0,75%	0,40%	0%
4	1,34%	0,75%	0%	2%

The different chorizo treatments were cooked at 75°C and cooled down in chilled water. The chorizo samples were divided in two groups. Samples from one group were vacuum packaged and stored at 4°C for one month; at different time intervals samples from this group were removed from storage to determine the population of psycrotrophic bacteria and lactic acid bacteria using Tryptic Soy Agar (TSA) and De Man Rogosa Agar (MRS) plates, respectively. Samples from the second group were inoculated with a cocktail of five different strains of *L. monocytogenes* in order to obtain an initial population of 2,0 – 3,0 Log CFU/g; these samples were also vacuum packaged and stored as described before. At different time intervals, the population of *L. monocytogenes* was monitored by count plating on Modified Oxford Agar Media (MOX). Experiments were repeated three times and data (Log CFU/g) were compared using ANOVA; the differences between means was established through Fisher´s least significant difference.

RESULTS AND DISCUSSION

Figure 1 shows the evolution of the *L. monocytogenes* population in the chorizo samples. Maximum *L. monocytogenes* populations were observed after 25 days of storage at 4°C for all the treatments. No significant differences were observed between the control sample (T1) and samples T2 and T3; however, the counts of *L. monocytogenes* of T4 were lower ($p<0.05$) than the other treatments throughout the storage. Maximum populations for samples T1 to T3 were between 7,1 and 7,6 log CFU/g; for sample T4 max population of 5,8 log CFU/g was reported.

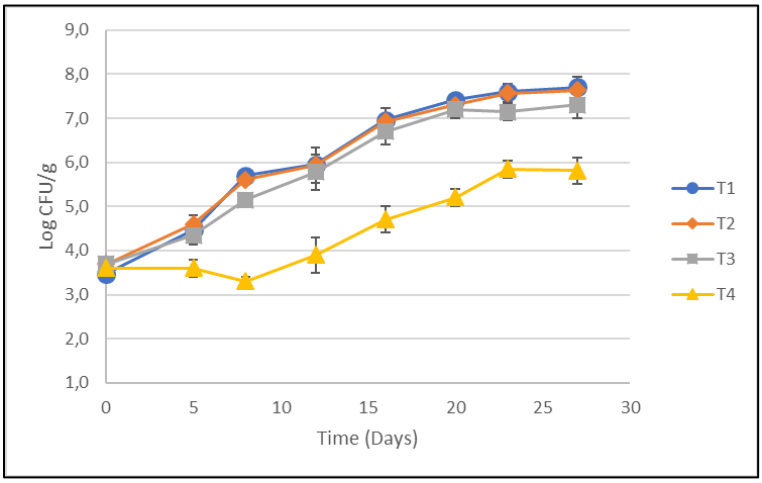

Fig. 1 *L. monocytogenes* population in chorizo samples formulated with different levels of NaCl

Regarding the lactic acid bacteria population in the chorizo samples, maximum populations were observed between days 25 (T3) and 30 (T1, T2 and T4). Higher bacterial populations ($p<0.05$) were observed for samples T2 and T3 between days 10 and 15 of storage compared with the control (T1). No significant differences were observed between samples T1 and T4. The results of our research demonstrate that a mixture of selected spices (garlic, onion and raddish) could compensate for the antimicrobial activity of NaCl in a reduced Sodium meat product. The application of spices allows for a moderate reduction (0.4%) of NaCl without increasing the risk for *L. monocytogenes* growth or the replication of spoilage microorganisms. Our observations agree with previous studies that demonstrated the antimicrobial capacity of garlic, onion [9] and raddish [10] against common pathogenic and spoilage microorganisms associated with meat products. However, to our knowledge this is the first study evaluating the potential role of these substances as salt substitutes in a processed meat product.

III. CONCLUSION

The microbial stability of processed meats with reduced Sodium levels may not be compromised if NaCl is substituted with a combination of garlic, onion and raddish. However, spices and KCl are still not efficient at controlling growth of *L. monocytogenes* in chorizo. The antimicrobial activity of these spices may be enhanced in the presence of other antimicrobials such as salts of organic acids (potassium lactate).

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