MEAT PRESERVATION BY AN ANTIMICROBIAL EDIBLE COATING

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Abstract – Meat is a highly perishable food, in which microorganisms can multiply rapidly, resulting in quality losses and public health problems. It is important, therefore, the development of techniques that help to prevent microbial growth in fresh meat. The objective of this work was to determine the effect of an antimicrobial edible coating on the microbiological characteristics of fresh pork stored under refrigeration. Pork samples inoculated with *Listeria monocytogenes* or *Brochothrix thermosphacta* (10^6 cfu/g) were coated with a filmogenic suspension containing a mixture of antimicrobials (nisin 18.75 µg/mL, lauric arginate 312.5 µg/mL and lactic acid 87.5 mg/mL). Samples were vacuum packed, stored at 4°C for 30 d, determining microbiological parameters. For all microorganisms analyzed, meat treated with the antimicrobial coating showed a lower population related to the control. In the case of *L. monocytogenes*, although the difference from the control was not very large (2.3 log cfu/g), it decreased with treatment while the control maintained the population. In meat inoculated with *Brochothrix*, a reduction from the control (3.1 log cfu/g) was also obtained.

Key Words –antimicrobial edible coating, *Listeria monocytogenes*, meat

I. INTRODUCTION

Meat industry shows a continued interest in developing new technologies to extend shelf life and improving consumer acceptance of animal products by maintaining nutritional quality and ensuring food safety [1]. Edible coatings (EC) added with antimicrobial compounds are one viable option since the contamination of the meat products occurs mainly on its surface [2]. EC can provide an additional stress factor to be applied to the meat preservation, offering another benefits such as prevention of moisture losses during storage of fresh or frozen products, maintaining juiciness of fresh cuts of meat, reducing rancidity index, reducing loss of aromas, absorbing foreign aromas and also helping to reduce both the costs as the amount of traditional packaging used [3]. The aim of this work was to evaluate the effect of antimicrobial EC based on modified starch on the quality of fresh meat during its storage in refrigeration through the determination of microbiological parameters.

II. MATERIALS AND METHODS

Fresh pork loin meat (*Longissimus dorsi*) was cut into portions of approximately 5 cm x 5 cm x 1 cm. *L. monocytogenes* and *B. thermosphacta* (10^6 CFU/g) were inoculated separately on the surface of meat. Meat was allowed to dry for 5 min in laminar flow hood and the procedure was repeated on the other side of the sample. Once inoculated, meat samples were covered with a starch-based antimicrobial EC, placing 50 µL/cm^2 of the sample and allowed to dry for 10 min. The procedure was performed on both sides of the sample. Once dried, meat pieces were vacuum packed in polyethylene bags and stored at 4°C. Samples were evaluated for 30 d for mesophilic aerobic bacteria, lactic acid bacteria (LAB), *Pseudomonas*, *Salmonella*, *Brochothrix* and *Listeria*. As controls, non-inoculated meat coated with antimicrobial film, uncooked meat and uninoculated meat were used [4].

III. RESULTS AND DISCUSSION

For all tested microorganisms, samples treated with the antimicrobial EC, during the whole test had the lowest populations than those samples uncoated or that were treated with the coating elaborated without antimicrobials. The behavior of *Brochothrix* in the first days for all the treatments was very similar, having little growth, observing a considerable increase after 6 days of storage in those samples not treated with the antimicrobial EC. On the contrary,

in samples with antimicrobials, although there was no a complete inhibition of the microorganisms, a difference of about 3 log was observed at the end of the study (Figure 1A). Although it has been reported that the development of *B. thermosphacta* is inhibited in the presence of LAB due to the low pH values, there are also studies, which report that the vacuum condition could allow *Brochothrix* to develop if they are in a high concentration, despite the prevalence of LAB [5].

L. monocytogenes did not show growth, which could be due to the storage conditions in which, the low oxygen concentrations hinder its development, although it was able to survive and maintain the population during the test period. However, samples treated with the antimicrobial EC showed a decrease of the population throughout the test period, achieving a difference of 2.37 Log at the end of the study comparing with the control (Figure 1B). This result was similar to obtained by Hond et al. [6] where a reduction of 2 Log in 10 days was observed using a mixture of grapefruit seed extract and green tea. If we consider that *Listeria* is generally found in low concentrations in foods (around 10^2 cfu/g), this reduction can be an additional barrier to control the presence of this pathogen in meat.

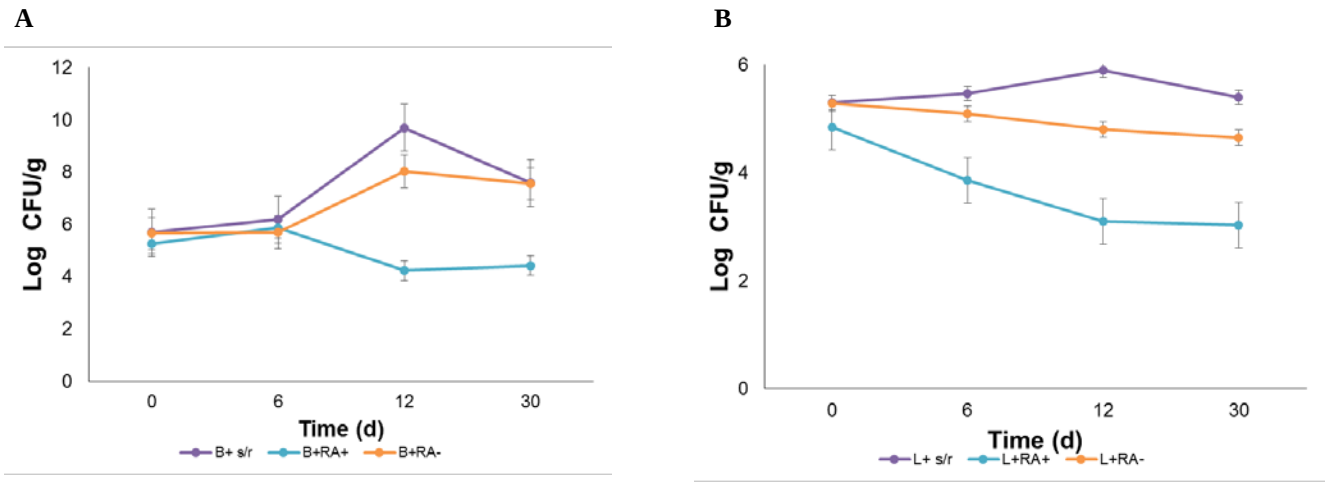

Figure 1. Population of A) *B. thermosphacta* and B) *L. monocytogenes* in pork stored in refrigeration. Samples were incubated for 24 h at 30 ° C. Abbreviations: B+ s/r, meat inoculated with *B. thermosphacta* and uncoated; B+R+, meat inoculated with *B. thermosphacta* and with antimicrobial coating; B+RA- meat inoculated with *B. thermosphacta* and coated with antimicrobial agents. L+ s/r, meat inoculated with *L. monocytogenes* and uncoated; L+R+, meat inoculated with *L. monocytogenes* and with antimicrobial coating; L+RA- meat inoculated with *L. monocytogenes* and coated with antimicrobial agents.

IV. CONCLUSION

Antimicrobial EC controlled the development of the microorganisms analyzed in fresh pork, showing a reduction in the microbial population of 3 Log for *B. thermosphacta* and 2 Log for *L. monocytogenes*, compared to the control, being able to have a potential use as packaging material.

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