Effect of lactic acid, UV-C radiation and vacuum packaging on *Listeria monocytogenes*, *Salmonella* spp., *Pseudomonads* spp. and Lactic acid bacteria growth on raw chicken breasts.

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I. INTRODUCTION

Chicken meat is a very perishable food and a source of pathogenic bacteria such as *Listeria monocytogenes* and *Salmonella*. While packaging in modified atmosphere can extend its shelf life, it will not necessarily assure its safety, since some pathogens are able to grow before spoilage becomes evident [1]. Several research reports have addressed the efficacy of lactic acid (LA) for reducing microbial counts in meat and poultry [2]. More recently UV-C application has been shown to reduce L. monocytogenes and Salmonella on beef and meat products without affecting product quality. UV-C can also be applied after vacuum packaging [3, 4]. However, there are few studies on the combined effect of lactic acid, UV-C and vacuum packaging in chicken meat.
The aim of this work was to evaluate the effectiveness of lactic acid washing to reduce *L. monocytogenes*, *Salmonella enteritidis*, *Pseudomonads* spp. and lactic acid bacteria (LAB) on chicken meat vacuum packaged and stored at 4 °C.

II. MATERIALS AND METHODS

The effect of different doses of UV-C and lactic acid application, on *L. monocytogenes*, *S. enteritidis*, *Pseudomonads* spp. and lactic acid bacteria counts was analyzed in chicken breasts packaged under both aerobic and anaerobic conditions during 21 days.
A 2^2-factorial design with five central points was performed using Design-Expert 13.0 program. The independent variables were LA concentration between 0-5 % (m/v) and UV-C dose between 0-188 mJ/cm^2. The dependent variables were the counts expressed in log CFU/g of *L. monocytogenes*, *Salmonella*, *Pseudomonas* and LAB. For this purpose, 72 pieces of 10 grams were cut from freshly produced chicken breasts and inoculated with a mixed culture of *L. monocytogenes* ATCC 19111 and *Salmonella enteritidis* to reach a level of inoculation for both strains of 5.8 log CFU/g. After 10 minutes, inoculated samples were sprayed with 1.5 ml of LA according to the experimental design and placed in Cryovac T7335B bags. One half of the samples were vacuum sealed. Then, variable doses of UV-C were applied to the packaged meat according to the factorial design. Samples were analyzed at 0, 7, 14 and 21 days from the time of LA and UV-C application. Each piece of chicken breast was homogenized in a stomacher with peptone water and the appropriate dilutions were seeded on PALCAM agar plates with a selective supplement for PALCAM and incubated at 37 ºC for 48 hours for *L. monocytogenes*, on XLD agar and incubated at 37 ºC for 24 hours for *Salmonella*, in *Pseudomonas* Agar Base supplemented with cetrimide, fucidin and cephalosporin at 25 ºC for 48 hours for *Pseudomonas* and for LAB in MRS agar at 25 °C for 72 hours in anaerobiosis.

III. RESULTS AND DISCUSSION

Both lactic acid and UV-C significantly ($p<0.05$) reduce the counts of *L. monocytogenes* and PSE. While for *Salmonella* and LAB only the application of lactic acid was significant ($p<0.05$) to reduce the initial counts. The maximum level of reduction was achieved with 5 % LA and 188 mJ/cm^2 (Figure 1).
The effect of 5 % LA and 188 mJ/cm^2 UV-C on growth inhibition for *Listeria* and *Salmonella* was observed during 21 days for both aerobic and vacuum packaged samples. While *Pseudomonads*

growth inhibition was only observed in vacuum packed samples. LAB counts increased after the 7th day regardless of the treatment (Figure 2)

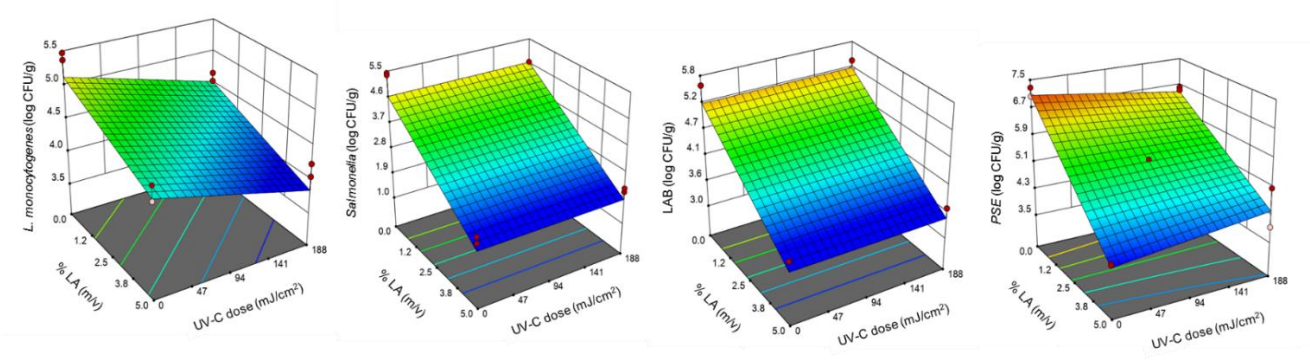

Figure 1. Effect of LA and UV-C on *L. monocytogenes*, *Salmonella*, PSE and LAB initial counts.

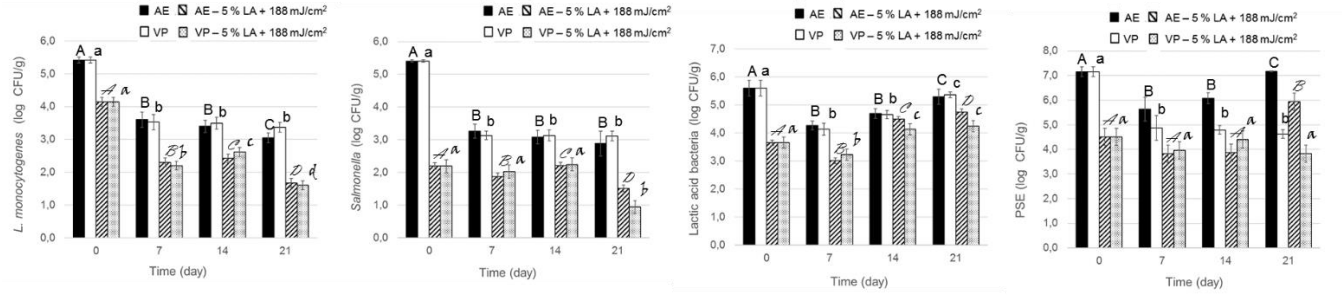

Figure 2. LA+UV-C and VP effect on *L. monocytogenes*, *Salmonella*, PSE and LAB counts for 21 days at 4 ºC.

IV. CONCLUSION

The application of 5 % LA + 188 mJ/cm^2 UV-C is useful to inhibit both *L. monocytogenes* and *Salmonella* spp. growth for 21 days at 4 ºC regardless of the packaging condition. 5 % LA + 188 mJ/cm^2 UV-C + VP is useful to control PSE up to 21 days at 4 ºC and up to 7 days for LAB. This strategy could contribute to improve the safety and extend the shelf life of refrigerated raw chicken breast.

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