

# COMBINATION OF HIGH PRESSURE PROCESSING AND NATURAL ANTIMICROBIALS TO CONTROL *LISTERIA MONOCYTOGENES* IN UNCURED COOKED TURKEY

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## I. INTRODUCTION

*Listeria monocytogenes* is a significant foodborne pathogen causing Listeriosis, especially lethal to children, pregnant woman and immune-compromised population [1]. This non-spore forming, gram positive bacteria can grow in high salt, low temperature and vacuum conditions. Thus, intrinsic hurdles of ready-to-eat (RTE) foods like deli meat are not able to control the outgrowth of *L. monocytogenes* and are linked to outbreaks. Good manufacturing practices, proper cooking along with anti-*Listeria* ingredients such as lactate and acetate salts are traditional methods to control this bacteria [2]. Recently, high pressure processing (HPP) has gained popularity because of the benefit of no labeling and less impacts on sensorial and nutritional quality of foods. In principle, high pressure (100-800 MPa) in HPP causes reversible or permanent damages to microbial structures and intracellular materials, which prevent cells from growing [3]. Applications of HPP in RTE meat have been reported elsewhere and there is concern about the long term anti-*Listeria* effect of HPP during shelf life [4]. The present study was to assess the synergistic combination of HPP with natural antimicrobial ingredients to enable reduction in HPP time while ensuring safety of RTE uncured cooked turkey.

## II. MATERIALS AND METHODS

Uncured cooked turkey slices were formulated with the following treatments: No preservatives, 2.5 and 3.5% Opti.form® PD4, 1.4% and 1.9% natural Verdad® N8, 2.5% and 3.5% Verdad® N64. These dosages have been tested various times in meat applications and are also commercially used levels in meat products. The meat was prepared and vacuum packed at Corbion Innovation Centre, Lenexa, KS, USA before they were sent to a certified lab for HPP and *L. monocytogenes* challenge test. The turkey slices were then surface inoculated with a cocktail of five *L. monocytogenes* strains (ATCC #19111, ATCC #19118, and three internal strains) which had been cold adapted in non-selective media at 10-15°C for 6 days. The inoculation was prepared so that the final concentration was approximately 7.0 Log CFU/g. Inoculated samples were then vacuum sealed in 25g portions, HPP treated at 85,000 psi (586 MPa) for 1.5 or 3 minutes. Samples were incubated at 40°F/4.4°C for a 90-day shelf-life study. Evaluation was done on Day 0 (pre-HPP), Day 1 (pre-HPP and HPP treated), Day 14, 56 and 90 (HPP treated). *L. monocytogenes* was enumerated on Tryptic Soy Agar with Yeast Extract overlaid with Modified Oxford Agar for 48 hours at 35°C.

## III. RESULTS AND DISCUSSION

HPP treatment with and without antimicrobial ingredients provided 4-5 Log CFU/g lethality on *L. monocytogenes* counts on Day 1 (Figure 1-2). As anticipated, longer treatment time (3 min) increased the *L. monocytogenes* reductions, particularly when antimicrobial ingredients were used (Figure 2). However, HPP treatment alone did not provide the continuous inhibition of the surviving *L. monocytogenes* counts post-treatment and the counts quickly increased by 1 Log within 2-4 days of incubation to more than 1 Log CFU/g. The combination of HPP with Opti.form® PD4 or Verdad® N8 or Verdad® N64 inhibited the surviving cells of *L. monocytogenes* post-treatment outgrowth up to 56 days and did not allow more than 2 Log growth till day 90. Similarly, other researchers [5,6] found a good protection of HPP and lactate containing ingredient combination in HPP ham for 63-80 days at 1°C, 6°C incubation.

## IV. CONCLUSION

The present research substantiates that HPP treatment is able to provide initial lethality of *L. monocytogenes* but any surviving cells will have very fast growth (> 1log in 2-4 days) at refrigerated storage. Inclusion of antimicrobial ingredients like Opti.form® PD4 or natural products (Verdad® N8 and Verdad® N64) can provide

>5 log reduction in counts, reduces HPP time from 3 to 1.5 minutes and able to suppress the pathogen outgrowth during shelf life. After opening protection of HPP package against the *L. monocytogenes* outgrowth can be provided by natural antimicrobial inclusion too.

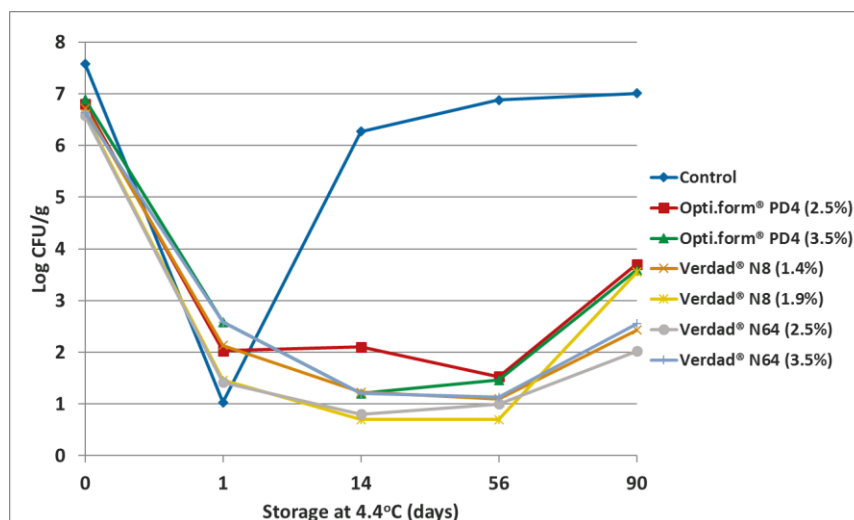


Figure 1. Inhibition of *Listeria monocytogenes* in cooked uncured turkey slices treated by 1.5-minute HPP and different antimicrobial ingredients

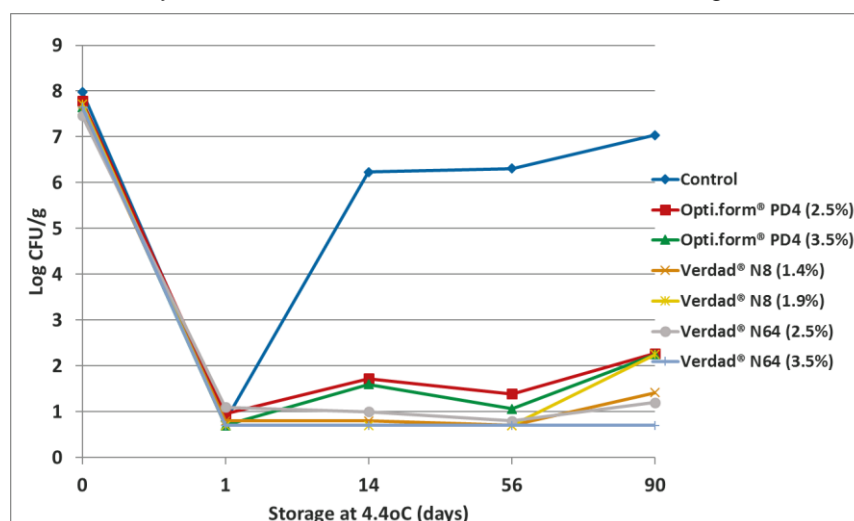


Figure 2. Inhibition of *Listeria monocytogenes* in cooked uncured turkey slices treated by 3-minute HPP and different antimicrobial ingredients

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