

# P2-60 Synergism of Mild Heat, Nisin, and Elevated Hydrostatic Pressure for

Public Health Microbiology Laboratory



## Inactivation of *Listeria monocytogenes*

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### ABSTRACT

Epidemiological evidence derived from CDC's active surveillance data indicate >98% of human Listeriosis cases are foodborne in nature with about 94% and 15.9% hospitalization and death rates, respectively. Current study investigated inactivation of *Listeria monocytogenes* using mild heat, hydrostatic pressure, and nisin in buffered environment. Four-strain mixture of *Listeria monocytogenes* were exposed to 0, 3, 6, and 9 minute of six treatments: A) hydrostatic pressure at 4 °C; B) hydrostatic pressure and nisin at 4 °C; C) nisin at 4 °C; D) heat at 40 °C; E) hydrostatic pressure at 40 °C; F) hydrostatic pressure and nisin at 40 °C. Pressure intensity level of 400 MPa (Hub880 Explorer, Pressure BioScience Inc), and nisin concentration of 5000 IU/ml were used for the experiments of inoculated pathogen in phosphate buffered saline. The unit temperature was precisely controlled and monitored by a stainless steel water jacket surrounding the pressure chamber connected to a refrigerated circulating water bath. Analyses of variance were conducted followed by LSD-based mean separation by OpenEpi software. The six treatments after 9 minutes were all resulted in reductions ( $P < 0.05$ ) of the pathogen. These reductions were 4.5, 4.3, 4.9, 3.1, 5.2, and 4.5 log CFU/ml for treatments of A to F, respectively. Under the condition of this experiment, antimicrobial efficacy of nisin was affected only modestly through synergism with elevated pressure and mild heat. As an examples, counts of samples treated for 6 minutes were similarly ( $P \geq 0.05$ )  $2.9 \pm 0.4$ ,  $3.3 \pm 0.7$ , and  $2.9 \pm 0.5$  for samples treated with nisin alone, nisin and hydrostatic pressure, and nisin and heat, respectively. Results of this study could be incorporated as part of hazard analysis for meeting requirements of FSMA Human Food rule for mitigating the public health burden of foodborne Listeriosis.

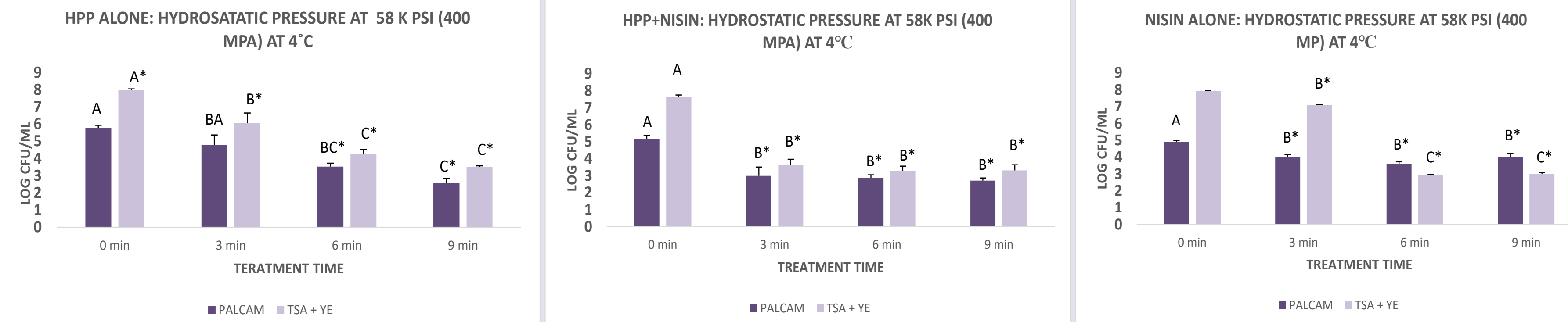
### *Listeria monocytogenes*

- ✓ *Listeria* is one of the leading cause of death from foodborne illness
- ✓ *Listeria* can spread through bloodstream and nervous system
- ✓ Pregnant women are particularly susceptible to *Listeria* infection
- ✓ *Listeria*, unlike other foodborne bacteria, tolerates salty environments and cold temperature
- ✓ *Listeria* causes two (2) forms of diseases
  - ✓ In healthy people, non-invasive gastrointestinal illness
  - ✓ Invasive form, which can cause septicemia and meningitis
- ✓ In vast majority of cases *Listeria monocytogenes* is foodborne in nature
- ✓ In 2011 the CDC reported about 1,591 causes of listeriosis

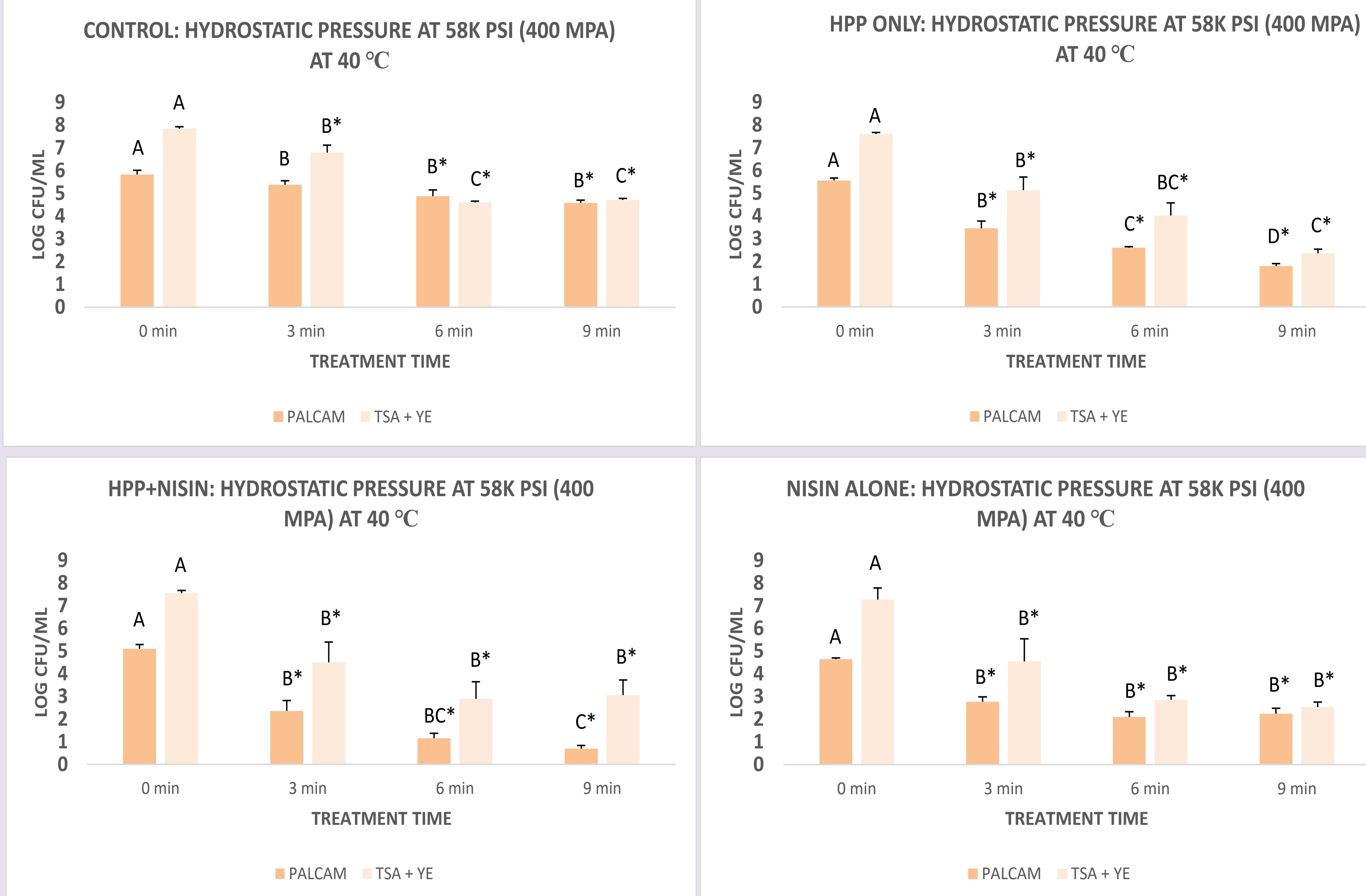
### DESIGN, METHODS, & ANALYSES

- ✓ Two biologically independent repetitions
- ✓ (i.e., two blocking factor).
- ✓ Each block, containing three instrumental replications.
- ✓ Each instrumental replication had two microbiological repetitions.
- ✓ Inoculation, microbiological analyses, and enumeration of the bacteria were based on Bacteriological Analytical Methods (BAM) of the U.S. Food and Drug Administration.
- ✓ Hydrostatic pressure (Barocycler Hub880, Pressure BioScience Inc., South Easton, MA) of 58K PSI (400 MPa) were applied at various time internal for decontamination of the inoculated pathogen.

### Inactivation of *Listeria monocytogenes* at 4 °C



### Inactivation of *Listeria monocytogenes* at 40 °C



### Acknowledgements

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High Pressure Processing Unit equipped with water jacket and circulating water bath for precise application of hydrostatic pressure at controlled temperature. Public Health Microbiology Laboratory, TSU.