

# The Survival of *Listeria monocytogenes* on Dried Gala Apple: Influence of Water Activity, Storage Temperature



WASHINGTON STATE  
UNIVERSITY

Mengqian Hang<sup>1</sup>, Xiaoye Shen<sup>1</sup>, Juming Tang<sup>2</sup>, Mei-Jun Zhu<sup>1\*</sup>

<sup>1</sup> School of Food Science, <sup>2</sup> Biological Systems Engineering, Washington State University, Pullman, WA, United States, 99164

## OBJECTIVE

*Listeria monocytogenes* can endure prolonged periods in dry conditions, yet there is a general lack of understanding about its survival on dried apple products. This study aims to explore the impact of storage conditions, including water activity ( $a_w$ ) and temperature, on the survival of *L. monocytogenes* on dried apples during extended storage.

## SIGNIFICANT FINDING

- *L. monocytogenes* exhibits greater stability in desiccated Gala apple slices compared to Granny Smith apples.
- Resistance of *L. monocytogenes* in dried apples is significantly impacted by  $a_w$ , particularly at ambient temperature.
- In dried Gala apple slices stored at ambient temperature, a ~4 log reduction was observed at  $a_w$  of 0.25 over 48 weeks, compared to a 5.04-7.08 log reduction at  $a_w$  of 0.45.
- At 4°C, *L. monocytogenes* maintained a relatively stable population over 48 weeks of storage, with 1.48-1.76 and 1.76-1.95 log reduction, respectively, suggesting that  $a_w$  has a diminished impact on the survivability of *L. monocytogenes* at lower temperature.

## METHODS

- Dried apple slices were inoculated with ~9 log<sub>10</sub>CFU/g 3-strain *L. monocytogenes* (½ a, ½ b, 4b) cocktail using a dry inoculation method.
- The inoculated apple slices were equilibrated to reach  $a_w$  of ~0.25 and 0.45, respectively, before being stored at 4 °C and ambient temperature.
- Three 1 g dried apple slices were tested at the sampling point for the *L. monocytogenes* detached and enumerated.

## RESULTS

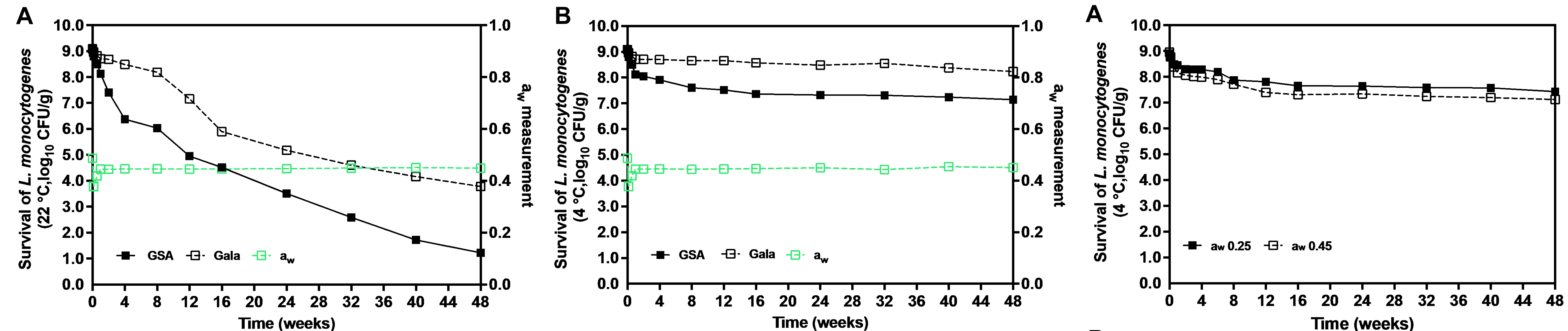


Figure 1. Fate of *Listeria monocytogenes* on dried Granny Smith and Gala apple slices during 48 weeks of storage,  $a_w$  at 0.45. A. 4 °C, B. 22 °C. Mean  $\pm$  SEM, n = 3.

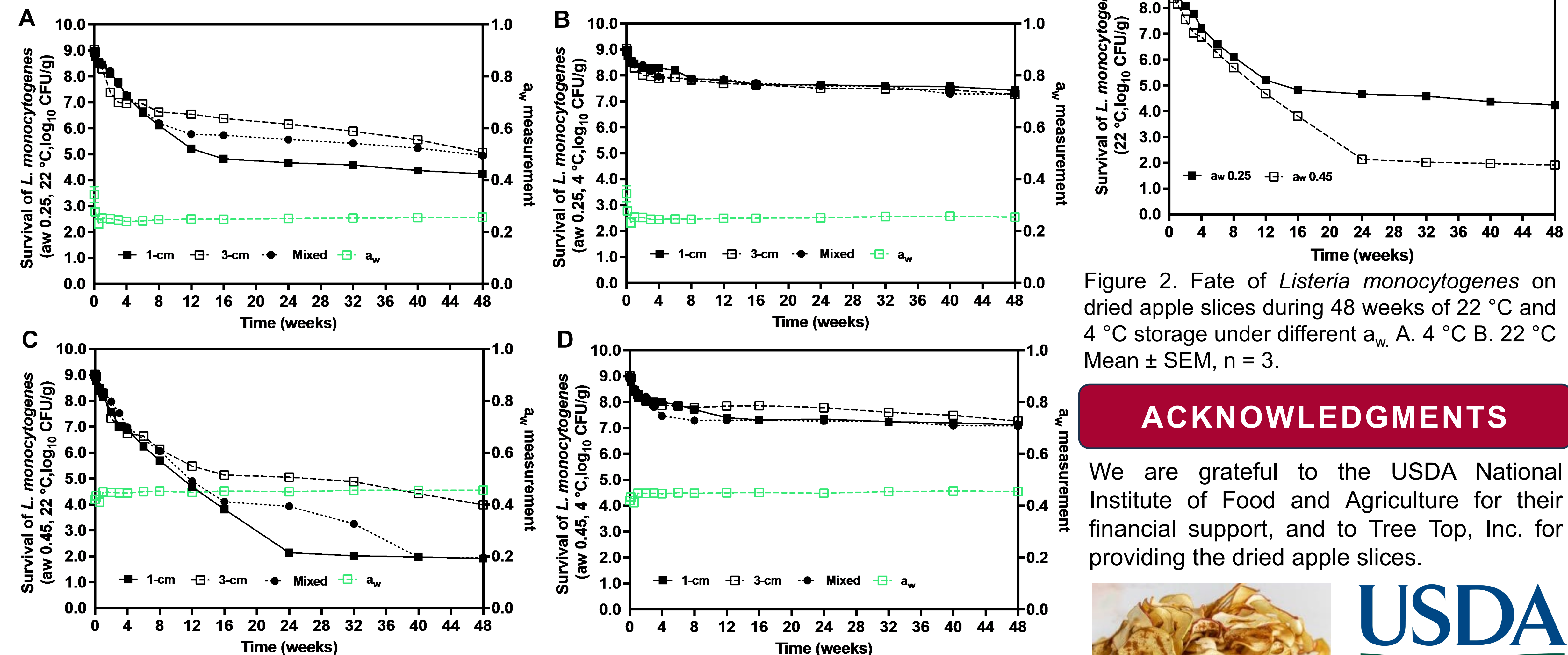


Figure 2. Fate of *Listeria monocytogenes* on dried apple slices during 48 weeks of 22 °C and 4 °C storage under different  $a_w$ . A. 4 °C B. 22 °C Mean  $\pm$  SEM, n = 3.

Figure 3. Fate of *Listeria monocytogenes* on dried apple slices with 1-cm, 3-cm, and mixed-size during 48 weeks of 22 °C and 4 °C storage under different  $a_w$ . A.  $a_w$  0.25, 22°C, B.  $a_w$  0.25, 4°C C.  $a_w$  0.45, 22°C D.  $a_w$  0.45, 4°C . Mean  $\pm$  SEM, n = 3.

## ACKNOWLEDGMENTS

We are grateful to the USDA National Institute of Food and Agriculture for their financial support, and to Tree Top, Inc. for providing the dried apple slices.

