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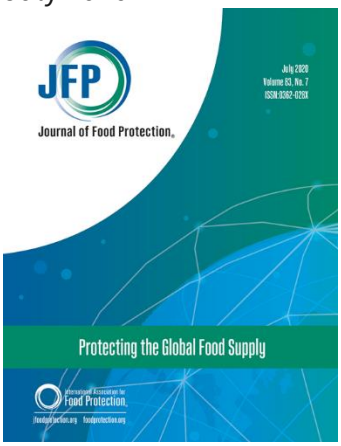

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RESEARCH ARTICLE| FEBRUARY 21 2020

Thermal Resistance of Foodborne Pathogens and *Enterococcus faecium* NRRL B-2354 on Inoculated Pistachios

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ABSTRACT

Process control validations require knowledge of the resistance of the pathogen(s) of concern to the target treatment and, in some cases, the relative resistance of surrogate organisms. Selected strains of *Escherichia coli* O157:H7 (five strains), *Listeria monocytogenes* (five strains), and *Salmonella enterica* (five strains) as well as *Salmonella* Enteritidis phage type (PT) 30 and nonpathogenic *Enterococcus faecium* NRRL B-2354 were inoculated separately (as individual strains) onto inshell pistachios. The thermal tolerance of each strain was compared via treatment of inoculated pistachios to hot oil (121°C) or hot water (80°C) for 1 min. Survivor curves in hot oil or hot water (0.5 to 6 min, $n = 6$ to 15) were determined for one or two of the most resistant strains of each pathogen, as well as *E. faecium* NRRL B-2354 and *Salmonella* Enteritidis PT 30, and the Weibull model was fit to the data. A pilot-scale air-impingement oven was used to compare the thermal tolerance of *E. faecium* NRRL B-2354

and *Salmonella* Enteritidis PT 30 on pistachios with or without a brining pretreatment and at either dry (no steam) or 30% humidity (v/v) oven conditions. No significant difference in the time to a 4-log reduction in hot oil or hot water was predicted for any of the strains evaluated, on the basis of the 95% confidence interval. In the pilot-scale oven, *E. faecium* NRRL B-2354 was more thermally resistant than *Salmonella* in a broad set of differing treatments, treatment times, and temperatures. *Salmonella* is a suitable target pathogen of concern in pistachios for thermal processes because no other pathogen tested was more thermally resistant under the conditions evaluated. *E. faecium* NRRL B-2354 was at least as thermally resistant as *Salmonella* under all conditions evaluated, making it a good potential surrogate for *Salmonella* on pistachios.

HIGHLIGHTS

- *Salmonella* Enteritidis PT 30 is a reasonable target strain for laboratory-based studies.
- *E. coli* O157:H7 or *L. monocytogenes* were less thermally resistant than *Salmonella*.
- *E. faecium* NRRL B-2354 was at least as thermally resistant or more so than *Salmonella*.
- *E. faecium* NRRL B-2354 is a good potential thermal-treatment surrogate for pistachios.