

Title The effects of X-ray radiation on *Escherichia coli* O157:H7, *Listeria monocytogenes*, *Salmonella enterica* and *Shigella flexneri* inoculated on whole Roma tomatoes

Author Barakat S.M. Mahmoud

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Abstract

In the last two decades several foodborne disease outbreaks associated with produce were reported. Tomatoes, in particular, have been associated with several multi-state *Salmonella* outbreaks. Inactivation of inoculated *Escherichia coli* O157:H7, *Listeria monocytogenes*, *Salmonella enterica* and *Shigella flexneri* on whole Roma tomato surfaces by X-ray at 0.1, 0.5, 0.75, 1.0, and 1.5 kGy was studied. The main purpose of this study was to achieve a 5 log reduction in consistent with the recommendations of the National Advisory Committee on Microbiological Criteria for Foods. Moreover, the effect of X-ray on inherent microflora (mesophilic counts, psychrotrophic counts and yeast and mold counts) of untreated and treated Roma tomatoes, during storage at ambient temperature (22 °C) for 20 days was also determined. Mixtures of three or two strains of each tested organism was spot inoculated (100 µl) onto the surface of Roma tomatoes (approximately 7–9 log per tomato), separately, and air-dried, followed by treatment with X-ray doses at 22 °C and 55–60% relative humidity. Surviving bacterial populations on tomato surfaces were evaluated using a nonselective medium (tryptic soy agar) with a selective medium overlay for each bacteria; *E. coli* O157:H7 (CT-SMAC agar), *L. monocytogenes* (MOA), and *S. enterica* and *S. flexneri* (XLD). Treatment with X-ray significantly reduced the population of the tested pathogens on whole Roma tomato surfaces, compared with the control. Approximately 4.2, 2.3, 3.7 and 3.6 log CFU reduction of *E. coli* O157:H7, *L. monocytogenes*, *S. enterica* and *S. flexneri* per tomato were achieved by treatment with 0.75 kGy X-ray, respectively. More than a 5 log CFU reduction per tomato was achieved at 1.0 or 1.5 kGy X-ray for all tested pathogens. Furthermore, treatment with X-ray significantly reduced the inherent microflora on Roma tomatoes. Inherent levels were significantly ($p < 0.05$) lower than the control sample throughout storage for 20 days.